

QUANTITATIVE APTITUDE

CA-FOUNDATION

NEW SYLLABUS

By: CMA ALI NAQVI

(CMA, LL.B, M.COM. B.COM(H), MA(ECO),MBA(F))

"Dear students, many- many thanks for your positive and valuable feed back

Which has truly motivated me?"

..... Wishing you grand success and bright career

OUR GLORIOUS RESULTS

Name of student	Q.A RESU LT
ABDULLAHA	96
VAISHALI SHARMA	95
RAVI KUMAR	90
ISHA SING	88
RACHNA	84
RAJ	81
MOHD SAHIL	78
MANISH RAI	75
MUKESH	75
VIVEK YADAV	72
BARKHA	69
AFROZ PATAN	

And many more

.....

.....

*I am also thankful to the team of professionals, students, family and friends
who have made significant contribution in bringing out this book.*

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While the Author & publisher have taken all reasonable care in preparation of this book to see that there are no Errors ,However, suggestions from students for improvement in future editions are welcome .

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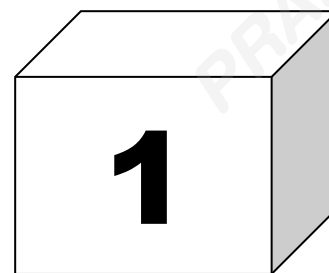
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SR. No.	CHAPTER NAME	
1.	RATIO AND PRPORTION,INDICES AND LOG	01-39
2.	EQUATION	40-67
3.	LINEAR INEQUALITIES	68-88
4.	MATHMEMATICS OF FINANCE	89-127
5.	BASIC CONCEPT OF PERMUTATION AND, COMBINATION	128-154
6.	SEQUENCE AND SERIES	155-183
7.	SETS,RELATION AND FUNCTION, BASIC LIMITS & CONTINUTY	184-204
8.	BASIC APPLICASTION -DIFFRENTION & INTEGRATION	205-245
9.	NUMBER SERIES,CODING & DECODING	246-259
10.	DIRECTION TEST	260-273
11.	SEATING ARRANGMENT	274 -289
12.	BLOOD RELATION	290-310
13.	STATSTICAL REPRESENTATION OF DATA	311-377
14.	MEASURES OF CENTRAL TENDENCY & DISPERSION	378-438
15.	PROBABILITY	439-474

16.	THEORETICAL DISTRIBUTION	475-519
17.	CORRELATION AND REGRESSION	520-554
18.	INDEX NUMBER	555-589
19.	SAMPLING THEORY	590-616



RATIO AND PROPORTION, INDICES, LOGARITHMS

UNIT I: RATIO

RATIO

A ratio is a comparison of the sizes of two or more quantities of the same kind by division.

If a and b are two quantities of the same kind (in same units), then the fraction a/b is called the ratio of a to b . It is written as $a : b$. Thus, the ratio of a to $b = a/b$ or $a : b$. The quantities a and b are called the **terms** of the ratio, a is called the **first term or antecedent** and b is called the **second term or consequent**.

For example, in the ratio $5 : 6$, 5 & 6 are called terms of the ratio. 5 is called first term and 6 is called second term.

- Both terms of a ratio can be multiplied or divided by the same (non-zero) number. Usually a ratio is expressed in lowest terms (or simplest form).
- If a quantity increases or decreases in the ratio $a : b$ then new quantity = b of the original quantity/ a

The fraction by which the original quantity is multiplied to get a new quantity is called the factor multiplying ratio.

Inverse Ratio

One ratio is the inverse of another if their product is 1. Thus $a : b$ is the inverse of $b : a$ and vice-versa.

1. A ratio $a : b$ is said to be of greater inequality if $a > b$ and of less inequality if $a < b$.
2. The ratio compounded of the ratios $a : b$ and $c : d$ is $ac : bd$.
For example compound ratio of $2 : 3$, $5 : 7$ and $4 : 9$ is $40 : 189$.
3. A ratio compounded of itself is called its duplicate ratio.

Thus $a^2 : b^2$ is the duplicate ratio of $a : b$. similarly, the triplicate ratio of $a : b$ is $a^3 : b^3$.

For example, duplicate ratio of $2 : 3$ is $4 : 9$. Triplicate ratio of $2 : 3$ is $8 : 27$.

- 4. The sub-duplicate ratio of $a : b$ is $\sqrt{a} : \sqrt{b}$ and the sub-triplicate ratio of $a : b$ is $\sqrt[3]{a} : \sqrt[3]{b}$**

For example sub-duplicate ratio of $4 : 9$ is $\sqrt{4} : \sqrt{9} = 2 : 3$

And sub-triplicate ratio of $8 : 27$ is $\sqrt[3]{8} : \sqrt[3]{27} = 2 : 3$.

- 5. Continued Ratio is the relation (or compassion) between the magnitudes of three or more quantities of the same kind. The continued ratio of three similar quantities a, b, c is written as $a : b : c$.**

EXERCISE 1(A)

Choose the most appropriate option (a) (b) (c) or (d).

1. The inverse ratio of 11 : 15 is
(a) 15 : 11 (b) $\sqrt{11} : \sqrt{15}$ (c) 121 : 225 (d) None of these
2. The ratio of two quantities is 3 : 4. If the antecedent is 15, the consequent is
(a) 16 (b) 60 (c) 22 (d) 20
3. The ratio of the quantities is 5 : 7. If the consequent of its inverse ratio is 5, the antecedent is
(a) 5 (b) $\sqrt{5}$ (c) 7 (d) None of these
4. The ratio compounded of 2 : 3, 9 : 4, 5 : 6 and 8 : 10 is
(a) 1 : 1 (b) 1 : 5 (c) 3 : 8 (d) None of these
5. The duplicate ratio of 3 : 4 is
(a) $\sqrt{3} : 2$ (b) 4 : 3 (c) 9 : 16 (d) None of these
6. The sub-duplicate ratio of 25 : 36 is
(a) 6 : 5 (b) 36 : 25 (c) 50 : 72 (d) 5 : 6
7. The triplicate ratio of 2 : 3 is
(a) 8 : 27 (b) 6 : 9 (c) 3 : 2 (d) None of these
8. The sub-triplicate ratio of 8 : 27 is
(a) 27 : 8 (b) 24 : 81 (c) 2 : 3 (d) None of these
9. The ratio compounded of 4 : 9 and the duplicate ratio of 3 : 4 is
(a) 1 : 4 (b) 1 : 3 (c) 3 : 1 (d) None of these
10. The ratio compounded of 4 : 9, the duplicate ratio of 3 : 4, the triplicate ratio of 2 : 3 and 9 : 7 is
(a) 2 : 7 (b) 7 : 2 (c) 2 : 21 (d) None of these

11. The ratio compounded of duplicate ratio of 4 : 5, triplicate ratio of 1 : 3, sub duplicate ratio of 81 : 256 and subtriplicate ratio of 125 : 512 is

- (a) 4 : 512 (b) 3 : 32 (c) 1 : 12 (d) None of these

12. If $a : b = 3 : 4$, the value of $(2a + 3b) : (3a + 4b)$ is

- (a) 54 : 25 (b) 8 : 25 (c) 17 : 24 (d) 18 : 25

13. Two numbers are in the ratio 2 : 3. If 4 be subtracted from each, they are in the ratio 3:5. The numbers are

- (a) (16, 24) (b) (4, 6) (c) (2, 3) (d) None of these

14. The angles of a triangle are in ratio 2 : 7 : 11. The angles are

- (a) $(20^\circ, 70^\circ, 90^\circ)$ (b) $(30^\circ, 70^\circ, 80^\circ)$
(c) $(18^\circ, 63^\circ, 99^\circ)$ (d) None of these

15. Division of ₹ 324 between X and Y is in the ratio 11 : 7. X & Y would get Rupees

- (a) (204, 120) (b) (200, 124) (c) (180, 144) (d) None of these

16. Anand earns ₹ 80 in 7 hours and Pramod ₹ 90 in 12 hours. The ratio of their earnings is

- (a) 32 : 21 (b) 23 : 12 (c) 8 : 9 (d) None of these

17. The ratio of two numbers is 7 : 10 and their difference is 105. The numbers are

- (a) (200, 305) (b) (185, 290) (c) (245, 350) (d) None of these

18. P, Q and R are three cities. The ratio of average temperature between P and Q is 11:12 and that between P and R is 9 : 8. The ratio between the average temperature of Q and R is

- (a) 22 : 27 (b) 27 : 22 (c) 32 : 33 (d) None of these

19. If $x : y = 3 : 4$, the value of $x^2y + xy^2 : x^3 + y^3$ is

- (a) 13 : 12 (b) 12 : 13 (c) 21 : 31 (d) None of these

20. If $p : q$ is the sub-duplicate ratio of $p - x^2 : q - x^2$ then x^2 is

- (a) $\frac{p}{p+q}$ (b) $\frac{q}{p+q}$ (c) $\frac{pq}{p+q}$ (d) None of these

21. If $2s : 3t$ is the duplicate ratio of $2s - p : 3t - p$ then

- (a) $p^2 = 6st$ (b) $p = 6st$ (c) $2p = 3st$ (d) None of these

22. If $p : q = 2 : 3$ and $x : y = 4 : 5$, then the value of $5px + 3qy : 10px + 4qy$ is

- (a) $71 : 82$ (b) $27 : 28$ (c) $17 : 28$ (d) None of these

23. The number which when subtracted from each of the terms of the ratio $19 : 31$ reducing it to $1 : 4$ is

- (a) 15 (b) 5 (c) 1 (d) None of these

24. Daily earnings of two persons are in the ratio $4 : 5$ and their daily expenses are in the ratio $7 : 9$. If each saves ₹ 50 per day, their daily earnings in ₹ are

- (a) (40, 50) (b) (50, 40) (c) (400, 500) (d) None of these

25. The ratio between the speeds of two trains is $7 : 8$. If the second train runs 400 kms. in 5 hours, the speed of the first train is

- (a) 10 Km/hr (b) 50 Km/hr (c) 70 Km/hr (d) None of these

ANSWERS

Exercise 1(A)

1. (a) 2. (d) 3. (c) 4. (a) 5. (c) 6. (d) 7. (a) 8. (c)
 9. (a) 10. (c) 11. (d) 12. (d) 13. (a) 14. (c) 15. (d) 16. (a)
 17. (c) 18. (b) 19. (b) 20. (c) 21. (a) 22. (c) 23. (a) 24. (c)
 25. (c)

EXAMPLE AND ILLUSTRATION

- The ratio of the number of boys to the number of girls in a school of 720 students is $3 : 5$. If 18 new girls are admitted in the school, find how many new boys may be admitted so that the ratio of the number of boys to the number of girls may change to $2 : 3$.
- The monthly incomes of two persons are in the ratio $4 : 5$ and their monthly expenditures are in the ratio $7 : 9$. If each saves ₹ 50 per month, find their monthly incomes.

3. The ratio of the prices of two houses was 16 : 23. Two years later when the price of the first has increased by 10% and that of the second by ₹ 447, the ratio of the prices becomes 11 : 20. Find the original prices of the two houses.
4. Find in what ratio will the total wages of the workers of a factory be increased or decreased if there be a reduction in the number of workers in the ratio 15 : 11 and an increment in their wages in the ratio 22 : 25.

UNIT II: PROPORTIONS

PROPORTIONS

n equality of two ratios is called a proportion. Four quantities a, b, c, d are said to be in proportion if $a : b = c : d$ (also written as $a : b :: c : d$) i.e. $a/b = c/d$ i.e. if $ad = bc$.

The quantities a, b, c, d are called terms of the proportion; a, b, c and d are called its first, second, third and fourth terms respectively. First and fourth terms are called extremes (or extreme terms). Second and third terms are called means (or middle terms).

If $a : b = c : d$ then d is called fourth proportional.

If $a : b = c : d$ are in proportion then $a/b = c/d$ i.e. $ad = bc$

i.e. **product of extremes = product of means.**

This is called *cross product rule*.

Three quantities a, b, c of the same kind (in same units) are said to be in continuous proportion if $a : b = b : c$ i.e. $a/b = b/c$ i.e. $b^2 = ac$.

If a, b, c are in continuous proportion, then the middle term b is called the mean proportional between a and c, a is the first proportional and c is the third proportional.

Thus, if b is mean proportional between a and c, then $b^2 = ac$ i.e. $b = \sqrt{ac}$.

Properties of Proportion

1. If $a : b = c : d$, then $ad = bc$

Proof. $\frac{a}{b} = \frac{c}{d}$; $\therefore ad = bc$ (By cross – multiplication)

2. If $a : b = c : d$, then $b : a = d : c$ (Invertendo)

Proof. $\frac{a}{b} = \frac{c}{d}$ or $1/\frac{a}{b} = 1/\frac{c}{d}$, or $\frac{b}{a} = \frac{d}{c}$

Hence, $b : a = d : c$.

3. If $a : b = c : d$, then $a : c = b : d$ (Alternendo)

Proof. $\frac{a}{b} = \frac{c}{d}$ or, $ad = bc$

Dividing both sides by cd , we get

$$\frac{ad}{cd} = \frac{bc}{cd}, \text{ or } \frac{a}{b} = \frac{c}{d}, \text{ i.e. } a : c = b : d.$$

4. If $a : b = c : d$, then $a + b : b = c + d : d$ (Componendo)

Proof. $\frac{a}{b} = \frac{c}{d}$, or, $\frac{a}{b} + 1 = \frac{c}{d} + 1$

Or, $\frac{a+b}{b} = \frac{c+d}{d}$, i.e. $a + b : b = c + d : d$.

5. If $a : b = c : d$, then $a - b : b = c - d : d$ (Dividendo)

Proof. $\frac{a}{b} = \frac{c}{d}$, $\therefore \frac{a}{b} - 1 = \frac{c}{d} - 1$

$$\frac{a-b}{b} = \frac{c-d}{d}, \text{ i.e. } a - b : b = c - d : d.$$

6. If $a : b = c : d$, then $a + b : a - b = c + d : c - d$ (Componendo and Dividendo)

Proof. $\frac{a}{b} = \frac{c}{d}$, or, $\frac{a}{b} + 1 = \frac{c}{d} + 1$, or $\frac{a+b}{b} = \frac{c+d}{d}$ 1

Again $\frac{a}{b} - 1 = \frac{c}{d} - 1$, or $\frac{a-b}{b} = \frac{c-d}{d}$ 2

Dividing (1) by (2) we get

$$\frac{a+b}{a-b} = \frac{c+d}{c-d}, \text{ i.e. } a + b : a - b = c + d : c - d$$

7. If $a : b = c : d = e : f = \dots\dots\dots$, then each of these ratios (Addendo) is equal ($a + c + e + \dots\dots\dots$) : ($b + d + f + \dots\dots\dots$)

Proof. $\frac{a}{b} = \frac{c}{d} = \frac{e}{f} = \dots\dots\dots$ (say) k ,

$\therefore a = bk, c = dk, e = fk, \dots\dots\dots$

Now $a + c + e \dots\dots\dots = k (b + d + f) \dots\dots\dots$ or $\frac{a + c + e \dots\dots\dots}{b + d + f \dots\dots\dots} = k$

Hence, $(a + c + e + \dots\dots\dots) : (b + d + f + \dots\dots\dots)$ is equal to each ratio

EXERCISE 1(B)

Choose the most appropriate option (a) (b) (c) or (d).

1. The fourth proportional to 4, 6, 8 is
(a) 12 (b) 32 (c) 48 (d) None of these
2. The third proportional to 12, 18 is
(a) 24 (b) 27 (c) 36 (d) None of these
3. The mean proportional between 25, 81 is
(a) 40 (b) 50 (c) 45 (d) None of these
4. The number which has the same ratio to 26 that 6 has to 13 is
(a) 11 (b) 10 (c) 21 (d) None of these
5. The fourth proportional to $2a$, a^2 , c is
(a) $Ac/2$ (b) Ac (c) $2/ac$ (d) None of these
6. If four numbers $1/2$, $1/3$, $1/5$, $1/x$ are proportional then x is
(a) $6/5$ (b) $5/6$ (c) $15/2$ (d) None of these
7. The mean proportional between $12x^2$ and $27y^2$ is
(a) $18xy$ (b) $81xy$ (c) $8xy$ (d) None of these
(Hint: Let z be the mean proportional and $z = \sqrt{12x^2 \times 27y^2}$)
8. If $A = B/2 = C/5$, then $A : B : C$ is
(a) $3 : 5 : 2$ (b) $2 : 5 : 3$ (c) $1 : 2 : 5$ (d) None of these
9. If $a/3 = b/4 = c/7$, then $a + b + c/c$ is

- (a) 1 (b) 3 (c) 2 (d) None of these
10. If $p/q = r/s = 2.5/1.5$, the value of $ps : qr$ is
 (a) $3/5$ (b) $1 : 1$ (c) $5/3$ (d) None of these
11. If $x : y = z : w = 2.5 : 1.5$, the value of $(x + z) / (y + w)$ is
 (a) 1 (b) $3/5$ (c) $5/3$ (d) None of these
12. If $(5x - 3y) / (5y - 3x) = 3/4$, the value of $x : y$ is
 (a) $2 : 9$ (b) $7 : 2$ (c) $7 : 9$ (d) None of these
13. If $A : B = 3 : 2$ and $B : C = 3 : 5$, then $A : B : C$ is
 (a) $9 : 6 : 10$ (b) $6 : 9 : 10$ (c) $10 : 9 : 6$ (d) None of these
14. If $x/2 = y/3 = z/7$, then the value of $(2x - 5y + 4z) / 2y$ is
 (a) $6/23$ (b) $23/6$ (c) $3/2$ (d) $17/6$
15. If $x : y = 2 : 3$, $y : z = 4 : 3$ then $x : y : z$ is
 (a) $2 : 3 : 4$ (b) $4 : 3 : 2$ (c) $3 : 2 : 4$ (d) None of these
16. Division of ₹ 750 into 3 parts in the ratio $4 : 5 : 6$ is
 (a) (200, 250, 300) (b) (250, 250, 250)
 (c) (350, 250, 150) (d) $8 : 12 : 9$
17. The sum of the ages of 3 persons is 150 years. 10 years ago their ages were in the ratio $7 : 8 : 9$. Their present ages are
 (a) (45, 50, 55) (b) (40, 60, 50) (c) (35, 45, 70) (d) None of these
18. The numbers 14, 16, 35, 42 are not in the proportion. The fourth term for which they will be in proportion is
 (a) 45 (b) 40 (c) 32 (d) None of these
19. If $x/y = z/w$, implies $y/x = w/z$, then the process is called
 (a) Dividendo (b) Componendo (c) Alternendo (d) None of these
20. If $p/q = r/s = p - r/q - s$, the process is called
 (a) Subtahendo (b) Addendo (c) Invertendo (d) None of these

these

21. If $a/b = c/d$, implies $(a + b)/(a - b) = (c + d)/(c - d)$, the process is called

- (a) Componendo (b) Dividendo
(c) Componendo and Dividendo (d) None of these

22. If $u/v = w/p$, then $(u - v)/(u + v) = (w - p)/(w + p)$. The process is called

- (a) Invertendo (b) Alternendo
(c) Addendo (d) None of these

23. 12, 16, *, 20 are in proportion. Then * is

- (a) 25 (b) 14 (c) 15 (d) None of these

24. 4, *, 9, $13\frac{1}{2}$ are in proportion. Then * is

- (a) 6 (b) 8 (c) 9 (d) None of these

25. The mean proportional between 1.4 gms and 5.6 gms is

- (a) 28 gms (b) 2.8 gms (c) 3.2 gms (d) None of these

26. If $\frac{a}{4} = \frac{b}{5} = \frac{c}{9}$ then $\frac{a+b+c}{c}$ is

- (a) 4 (b) 2 (c) 7 (d) None of these

27. Two numbers are in the ratio 3 : 4; if 6 be added to each terms of the ratio, then the new ratio will be 4 : 5, then the numbers are

- (a) 14, 20 (b) 17, 19 (c) 18 and 24 (d) None of these

28. If $\frac{a}{4} = \frac{b}{5}$ then

- (a) $\frac{a+4}{a-4} = \frac{b-5}{b+5}$ (b) $\frac{a+4}{a-4} = \frac{b+5}{b-5}$
(c) $\frac{a-4}{a+4} = \frac{b+5}{b-5}$ (d) None of these

29. If $a:b=4:1$ then $\sqrt{\frac{a}{b}} + \sqrt{\frac{b}{a}}$ is

- (a) $5/2$ (b) 4 (c) 5 (d) None of these

30. If $\frac{x}{b+c-a} = \frac{y}{c+a-b} = \frac{z}{a+b-c}$ then

$(b-c)x + (c-a)y + (a-b)z$ is

- (e) $5/2$ (f) 4 (g) 5 (h) None of these

Exercise 1(B)

1. (a) 2. (b) 3. (c) 4. (d) 5. (a) 6. (c)
9. (c) 10. (b) 11. (c) 12. (d) 13. (a) 14. (d)
17. (a) 18. (b) 19. (d) 20. (a) 21. (c) 22. (d)
25. (b) 26. (b) 27. (c) 28. (b) 29. (a) 30. (b)

EXAMPLE AND ILLUSTRATION

A dealer mixes tea costing ₹ 6.92 per kg. with tea costing ₹ 7.77 per kg. and sells the mixture at ₹ 8.80 per kg. and earns a profit of $17\frac{1}{2}\%$ on his sale price. In what proportion does he mix them?

UNIT III: INDICES

EXERCISE 1(C)

Choose the most appropriate option (a) (b) (c) or (d).

1. $4x^{-1/4}$ is expressed as
(a) $-4x^{1/4}$ (b) x^{-1} (c) $4/x^{1/4}$ (d) None of these
2. The value of $8^{1/3}$ is
(a) $3\sqrt{2}$ (b) 4 (c) 2 (d) None of these
3. The value of $2 \times (32)^{1/5}$ is
(a) 2 (b) 10 (c) 4 (d) None of these
4. The value of $4 \times (32)^{1/5}$ is
(a) 8 (b) 2 (c) 4 (d) None of these
5. The value of $(8 \times 27)^{1/3}$ is
(a) $2/3$ (b) $3/2$ (c) $2/9$ (d) None of these
6. The value of $2(256)^{-1/8}$ is
(a) 1 (b) 2 (c) $1/2$ (d) None of these
7. $2^{1/2} \cdot 4^{3/4}$ is equal to
(a) a fraction (b) a positive integer (c) a negative integer (d) None of these
8. $\left(\frac{81x^4}{y^{-8}}\right)^{1/4}$ has simplified value equal to
(a) xy^2 (b) x^2y (c) $9xy^2$ (d) None of these
9. $x^{a-b} \times x^{b-c} \times x^{c-a}$ is equal to
(a) x (b) 1 (c) 0 (d) None of these

10. The value of $\left(\frac{2p^2q^3}{3xy}\right)^0$ where $p, q, x, y \neq 0$ is equal to
 (a) 0 (b) $2/3$ (c) 1 (d) None of these
11. $\left\{(3^3)^2 \times (4^2)^3 \times (5^3)^2\right\} / \left\{(3^2)^3 \times (4^3)^2 \times (5^2)^3\right\}$ is
 (a) $3/4$ (b) $4/5$ (c) $4/7$ (d) 1
12. Which is True?
 (a) $2^0 > (1/2)^0$ (b) $2^0 < (1/2)^0$ (c) $2^0 = (1/2)^0$ (d) none of these
13. If $x^{1/p} = y^{1/q} = z^{1/r}$ and $xyz = 1$, then the value of $p + q + r$ is
 (a) 1 (b) 0 (c) $1/2$ (d) none of these
14. The value of $y^{a-b} \times y^{b-c} \times y^{c-a} \times y^{a-b}$
 (a) y^{a+b} (b) y (c) 1 (d) $1/y^{a+b}$
15. The True option is
 (a) $x^{2/3} = \sqrt[3]{x^2}$ (b) $x^{2/3} = \sqrt{x^3}$ (c) $x^{2/3} > 3\sqrt{x^2}$ (d) $x^{2/3} < 3\sqrt{x^2}$
16. The simplified value of $16x^{-3}y^2 \times 8^{-1}x^3y^{-2}$ is
 (a) $2xy$ (b) $xy/2$ (c) 2 (d) none of these
17. The value of $(8/27)^{-1/3} \times (32/243)^{-1/5}$ is
 (a) $9/4$ (b) $4/9$ (c) $2/3$ (d) none of these
18. The value of $\left\{(x+y)^{2/3} (x-y)^{3/2} / \sqrt{x+y} \times (x-y)^3\right\}^6$ is
 (a) $(x+y)^2$ (b) $(x-y)$ (c) $x+y$ (d) none of these
19. Simplified value of $(125)^{2/3} \times \sqrt{25} \times 3\sqrt{5^3} \times 5^{1/2}$ is
 (a) 5 (b) $1/5$ (c) 1 (d) none of these
20. $\left[\left\{(2)^{1/2} \cdot (4)^{3/4} \cdot (8)^{5/6} \cdot (16)^{7/8} \cdot (32)^{9/10}\right\}^4\right]^{3/25}$ is
 (a) A fraction (b) an integer (c) 1 (d) none of these
21. $\left[1 - \left\{1 - (1-x^2)^{-1}\right\}^{-1}\right]^{-1/2}$ is equal to
 (a) x (b) $1/x$ (c) 1 (d) none of these
22. $\left[\left(x^n\right)^{n-\frac{1}{n}}\right]^{\frac{1}{n+1}}$ is equal to

- (a) x^n (b) x^{n+1} (c) x^{n-1} (d) none of these

23. If $a^3 - b^3 = (a-b)(a^2 + ab + b^2)$, then the simplified form of

$$\left[\frac{x^l}{x^m}\right]^{l2+lm+m^2} \times \left[\frac{x^m}{x^n}\right]^{m2+mn+n^2} \times \left[\frac{x^n}{x^l}\right]^{l2+lm+n^2}$$

- (a) 0 (b) 1 (c) x (d) none of these

24. Using $(a-b)^3 = a^3 - b^3 - 3ab(a-b)$ tick the correct of these when

$$x = p^{1/3} - p^{-1/3}$$

- (a) $x^3 + 3x = p + 1/p$ (b) $x^3 + 3x = p - 1/p$ (c) $x^3 + 3x = p + 1$ (d) none of these

25. On simplification $1/(1+a^{m-n}+a^{m-p}) \cdot 1/(1+a^{n-m}+a^{n-p}) + 1/(1+a^{p-m}+a^{p-n})$ is equal to

- (a) 0 (b) a (c) 1 (d) $1/a$

26. The value of $\left(\frac{x^a}{x^b}\right)^{a+b} \times \left(\frac{x^b}{x^c}\right)^{b+c} \times \left(\frac{x^c}{x^a}\right)^{c+a}$

- (a) 1 (b) 0 (c) 2 (d) none of these

27. If $x = 3^{\frac{1}{3}} + 3^{\frac{1}{3}}$, then $3x^3 - 9x$ is

- (a) 15 (b) 10 (c) 12 (d) none of these

28. If $a^x = b, b^y = c, c^z = a$, then xyz is

- (a) 1 (b) 2 (c) 3 (d) none of these

29. The value of $\left(\frac{x^a}{x^b}\right)^{(a^2+ab+b^2)} \times \left(\frac{x^b}{x^c}\right)^{(b^2+bc+c^2)} \times \left(\frac{x^c}{x^a}\right)^{(c^2+ca+a^2)}$

- (a) 1 (b) 0 (c) -1 (d) none of these

30. If $2^x = 3^y = 6^{-z}$, $\frac{1}{x} + \frac{1}{y} + \frac{1}{z}$, is

- (a) 1 (b) 0 (c) 2 (d) none of these

Exercise 1 (C)

1. (c) 2. (c) 3. (c) 4. (b) 5. (a) 6. (a)
 9. (b) 10. (c) 11. (d) 12. (c) 13. (b) 14. (d)
 17. (a) 18. (c) 19. (d) 20. (b) 21. (a) 22. (c)
 25. (c) 26. (a) 27. (b) 28. (a) 29. (a) 30. (b)

EXAMPLE AND ILLUSTRATION

Example 1: Simplify $2x^{1/2}3x^{-1}$ if $x = 4$

Example 2: Simplify $6ab^2c^3 \times 4b^{-2}c^{-3}d$.

Example 3: Find the value of $\frac{4x^{-1}}{x^{-1/3}}$

Example 4: Simplify $\frac{2a^{\frac{1}{2}} \times a^{\frac{2}{3}} \times 6a^{\frac{-7}{3}}}{9a^{\frac{-5}{3}} \times a^{\frac{3}{2}}}$ if $a = 4$

Example 5: Simplify $(x^a \cdot y^{-b})^3 \cdot (x^3 \cdot y^2)^{-a}$

Example 6: $\sqrt[6]{a^{4b}x^6} \cdot (a^{2/3}x^{-1})^{-b}$

Example 7: Find x, if $x\sqrt{x} = (x\sqrt{x})^x$

Example 8: Find the value of k from $(\sqrt{9})^{-7} \times (\sqrt{3})^{-5} = 3^k$

UNIT IV: LOGARITHM

LOGONITHMS:

The logarithm of a number to a given base is the index or the power to which the base must be

raised to produce the number, i.e. to make it equal to the given number. If there are three quantities indicated by say a, x and n, they are related as follows:

If $a^x = n$, where $n > 0, a > 0$ and $a \neq 1$

then x is said to be the logarithm of the number n to the base 'a' symbolically it can be expressed as follows:

$$\log_a n = x$$

i.e. the logarithm of n to the base 'a' is x. We give some illustrations below:

(i) $2^4 = 16 \Rightarrow \log_2 16 = 4$

i.e. the logarithm of 16 to the base 2 is equal to 4

(ii) $10^3 = 1000 \Rightarrow \log_{10} 1000 = 3$

i.e. the logarithm of 1000 to the base 10 is 3

(iii) $5^{-3} = \frac{1}{125} \Rightarrow \log_5 \left(\frac{1}{125} \right) = -3$

i.e. the logarithm of $\frac{1}{125}$ to the base 5 is -3

(iv) $2^3 = 8 \Rightarrow \log_2 8 = 3$

i.e. the logarithm of 8 to the base 2 is 3

1. The two equations $a^x = n$ and $x = \log_a n$ are only transformations of each other and should be remembered to change one form of the relation into the other.
2. The logarithm of 1 to any base is zero. This is because any number raised to the power zero is one.

since $a^0 = 1, x = \log_a 1 = 0$

3. The logarithm of any quantity to the same base is unity. This is because any quantity raised to the power 1 is that quantity only.

Since $a^1 = a, \log_a a = 1$

PROPERTIES OF LOG

- I. **Logarithm of the product of two numbers is equal to the sum of the logarithms of the numbers to the same base, i.e.**

$$\log_a mn = \log_a m + \log_a n$$

1. $\log_a \frac{m}{n} = \log_a m - \log_a n$

3. **Logarithm of the number raised to the power is equal to the index of the power multiplied by the logarithm of the number to the same base i.e.**

$$\log_a m^n = n \log_a m$$

Change of Base

If the logarithm of a number to any base is given, then the logarithm of the same number to any other base can be determined from the following relation.

$$\log_a m = \log_b m \cdot \log_a b \Rightarrow \log_b m = \frac{\log_a m}{\log_a b}$$

Logarithm Tables:

The logarithm of a number consists of two parts, the whole part or the integral part is called the characteristic and the decimal part is called the mantissa where the former can be known by mere inspection, the latter has to be obtained from the logarithm tables.

Characteristic:

The characteristic of the logarithm of any number greater than 1 is positive and is one less than the number of digits to the left of the decimal point in the given number. The characteristic of the logarithm of any number less than one (1) is negative and numerically one more than the number of zeros to the right of the decimal point. If there is no zero then obviously it will be -1. The following table will illustrate it.

Number

37	1
4623	3
6.21	0

Number

.8	-1
.07	-2
.00507	-3
.000670	-4

Characteristic

[One less than the number of digits to the left of the decimal point]

Characteristic

[One more than the number of zeros on the right immediately after the decimal point.]

Zero on positive characteristic when the number under consideration is greater than unity:
Since

$$10^0 = 1$$

$$, \log 1 = 0$$

$$10^1 = 10$$

$$, \log 10 = 1$$

$$10^2 = 100$$

$$, \log 100 = 2$$

$$10^3 = 1000$$

$$, \log 1000 = 3$$

All numbers lying between 1 and 10 i.e. numbers with 1 digit in the integral part have their logarithms lying between 0 and 1. Therefore, their integral parts are zero only.

All numbers lying between 10 and 100 have two digits in their integral parts. Their logarithms lie between 1 and 2. Therefore, numbers with two digits have integral parts with 1 as characteristic.

In general, the logarithm of a number containing n digits only in its integral parts is $(n - 1) +$ a decimal. For example, the characteristics of $\log 75$, $\log 79326$, $\log 1.76$ are 1, 4 and 0 respectively.

Negative characteristics

$$\text{Since } 10^{-1} = \frac{1}{10} = 0.1 \rightarrow \log 0.1 = -1$$

$$10^{-2} = \frac{1}{100} = 0.01 \rightarrow \log 0.01 = -2$$

All numbers lying between 1 and 0.1 have logarithms lying between 0 and -1, i.e. greater than -1 and less than 0. Since the decimal part is always written positive, the characteristic is -1.

All numbers lying between 0.1 and 0.01 have their logarithms lying between -1 and -2 as characteristic of their logarithms.

In general, the logarithm of a number having n zeros just after the decimal point is - $(n + 1) +$ a decimal.

Hence, we deduce that the characteristic of the logarithm of a number less than unity is one more than the number of zeros just after the decimal point and is negative.

Mantissa

The mantissa is the fractional part of the logarithm of a given number.

Number	Mantissa	Logarithm
$\log 4594$	$= (\dots\dots 6623)$	$= 3.6623$
$\log 459.4$	$= (\dots\dots 6623)$	$= 2.6623$
$\log 45.94$	$= (\dots\dots 6623)$	$= 1.6623$
$\log 4.594$	$= (\dots\dots 6623)$	$= 0.6623$
$\log .4594$	$= (\dots\dots 6623)$	$= \bar{1}.6623$

Thus with the same figures there will be difference in the characteristic only. It should be remembered, that the mantissa is always a positive quantity. The other way to indicate this is

$$\log .004594 = -3 + .6623 = -3.6623.$$

Negative mantissa must be converted into a positive mantissa before reference to a logarithm table. For example

$$-3.6872 = -4 + (1 - 3.6872) = \bar{4} + 0.3128 = \bar{4}.3128$$

It may be noted that $\bar{4}.3128$ is different from -4.3128 as -4.3128 is a negative number whereas, in $\bar{4}.3128$, 4 is negative while .3128 is positive.

$$\log_a mn = \log_a m + \log_a n$$

$$\text{Ex. } \log (2 \times 3) = \log 2 + \log 3$$

$$\log_a (m / n) = \log_a m - \log_a n$$

$$\text{Ex. } \log (3/2) = \log 3 - \log 2$$

$$\log_a m^n = n \log_a m$$

$$\text{Ex. } \log 2^3 = 3 \log 2$$

$$\log_a 1 = 0$$

$$\text{Ex. } \log_2 1 = 0, \log_{10} 1 = 0 \text{ etc.}$$

$$\log_b a \times \log_a b = 1$$

$$\text{Ex. } \log_3 2 \times \log_2 3 = 1$$

$$\log_b a \times \log_c b = \log_c a$$

$$\text{Ex. } \log_3 2 \times \log_5 3 = \log_5 2$$

$$\log_b a = \log a / \log b$$

$$\text{Ex. } \log_3 2 = \log 2 / \log 3$$

$$\log_b a = 1 / \log_a b$$

$$a^{\log_a x} = x \text{ (Inverse logarithm Property)}$$

- The two equations $ax = n$ and $x = \log a$ are only transformations of each other and should be remembered to change one form of the relation into the other.

$$\text{Since } a_1 = a, \log_a a = 1$$

Notes :

(A) If base is understood, base is taken as 10

(B) This $\log 10 = 1$, $\log 1 = 0$

(C) Logarithm using base 10 is called Common logarithm and logarithm using base e is called Natural logarithm {e = 2.33 (approx..) called exponential number}.

EXERCISE 1(D)

Choose the most appropriate option. (a) (b) (c) or (d).

1. $\log 6 + \log 5$ is expressed as
(a) $\log 11$ (b) $\log 30$ (c) $\log 5/6$ (d) none of these
2. $\log_2 8$ is equal to
(a) 2 (b) 8 (c) 2^3 (d) none of these
3. $\log 32/4$ is equal to
(a) $\log 32/\log 4$ (b) $\log 32 - \log 4$ (c) $\log 5/6$ (d) none of these
4. $\log (1 \times 2 \times 3)$ is equal to
(a) $\log 1 + \log 2 + \log 3$ (b) $\log 3$ (c) $\log 2$ (d) none of these

5. The value of $\log 0.0001$ to the base 0.1 is
(a) -4 (b) 4 (c) $1/4$ (d) none of these
6. If $2 \log x = 4 \log 3$, the x is equal to
(a) 3 (b) 9 (c) 2 (d) none of these
7. $\log_{\sqrt{2}} 64$ is equal to
(a) 12 (b) 6 (c) 1 (d) none of these
8. $\log_{2\sqrt{3}} 1728$ is equal to
(a) $2\sqrt{3}$ (b) 2 (c) 6 (d) none of these
9. $\log (1/81)$ to the base 9 is equal to
(a) 2 (b) $1/2$ (c) -2 (d) none of these
10. $\log 0.0625$ to the base 2 is equal to
(a) 4 (b) 5 (c) 1 (d) none of these
11. Given $\log_2 = 0.3010$ and $\log_3 = 0.4771$ the value of $\log 6$ is
(a) 0.9030 (b) 0.9542 (c) 0.7781 (d) none of these
12. The value of $\log_2 \log_2 \log_2 16$
(a) 0 (b) 2 (c) 1 (d) none of these
13. The value of $\log \frac{1}{3}$ to the base 9 is
(a) $-1/2$ (b) $1/2$ (c) 1 (d) none of these
14. If $\log x + \log y = \log (x + y)$, y can be expressed as
(a) $x - 1$ (b) x (c) $x/x - 1$ (d) none of these
15. The value of $\log_2 [\log_2 \{ \log_3 (\log_3 27^3) \}]$ is equal to
(a) 1 (b) 2 (c) 0 (d) none of these

16. $\log_2 x + \log_4 x + \log_{16} x = 21/4$, these x is equal to
 (a) 8 (b) 4 (c) 16 (d) none of these
17. Given that $\log_{10} 2 = x, \log_{10} 3 = y$ the value of $\log_{10} 60$ is expressed as
 (a) $x - y + 1$ (b) $x + y + 1$ (c) $x - y - 1$ (d) none of these
18. Given that $\log_{10} 2 = x, \log_{10} 3 = y$, then $\log_{10} 1.2$ is expressed in terms of x and y as
 (a) $x + 2y - 1$ (b) $x + y - 1$ (c) $2x + y - 1$ (d) none of these
19. Given that $\log x = m + n$ and $\log y = m - n$, the value of $\log 10x/y^2$ is expressed in terms of m and n as
 (a) $1 - m + 3n$ (b) $m - 1 + 3n$ (c) $m + 3n + 1$ (d) none of these
20. The simplified value of $2 \log_{10} 5 + \log_{10} 8 - \frac{1}{2} \log_{10} 4$ is
 (a) $\frac{1}{2}$ (b) 4 (c) 2 (d) none of these
21. $\log [1 - \{1 - (1 - x^2)^{-1}\}^{-1}]^{-1/2}$ can be written as
 (a) $\log x^2$ (b) $\log x$ (c) $\log 1/x$ (d) none of these
22. The simplified value of $\log \sqrt[4]{729 \sqrt[3]{9^{-1} \cdot 27^{-4/3}}}$ is
 (a) $\log 3$ (b) $\log 2$ (c) $\log \frac{1}{2}$ (d) none of these
23. The value of $(\log_b a \times \log_c b \times \log_a c)^3$ is equal to
 (a) 3 (b) 0 (c) 1 (d) none of these
24. The logarithm of 64 to the base $\sqrt[3]{2}$ is
 (a) 2 (b) $\sqrt{2}$ (c) $\frac{1}{2}$ (d) none of these
25. The value of $\log_8 25$ given $\log 2 = 0.3010$ is
 (a) 1 (b) 2 (c) 1.5482 (d) none of these

Exercise 1 (D)

1. (b) 2. (c) 3. (b) 4. (a) 5. (b) 6. (b) 7. (a) 8. (c)
 9. (c) 10. (d) 11. (c) 12. (c) 13. (a) 14. (c) 15. (c) 16. (a)
 17. (b) 18. (c) 19. (a) 20. (c) 21. (b) 22. (a) 23. (c) 24. (d)
 25. (c)

EXAMPLE AND ILLUSTRATION

1. Find the logarithm of 1728 to the base $2\sqrt{3}$

2. Prove that $\frac{\log_3 8}{\log_9 16 \log_4 10} = 3 \log_{10} 2$

3. Find the logarithm of 64 to the base $2\sqrt{2}$

4. If $\log_a bc = x, \log_b ca = y, \log_c ab = z$, prove that

$$\frac{1}{x+1} + \frac{1}{y+1} + \frac{1}{z+1} = 1$$

5. If $a = \log_{24} 12, b = \log_{36} 24$, and $c = \log_{48} 36$ then prove that
 $1 + abc = 2bc$

ADDITIONAL QUESTION BANK

1. The value of $\left(\frac{6^{-1}7^2}{6^27^{-4}}\right)^{7/2} \times \left(\frac{6^{-2}7^3}{6^37^{-5}}\right)^{-5/2}$ is

- (a) 0 (b) 252 (c) 250 (d) 248

2. The value of $\frac{x^{2/7}}{z^{-1/2}} \times \frac{x^{2/5}}{z^{2/3}} \times \frac{x^{-9/7}}{z^{2/3}} \times \frac{x^{5/6}}{z^{-3/5}}$ is

- (a) 1 (b) -1 (c) 0 (d) None

3. On simplification $\frac{2^{x+3} \times 3^{2x-y} \times 5^{x+y+3} \times 6^{y+1}}{6^{x+1} \times 10^{y+3} \times 15^x}$ reduces to

(a) -1

(b) 0

(c) 1

(d) 10

4. If $\frac{9^y \cdot 3^2 \cdot (3^{-y})^{-1} - 27^y}{3^{3x} \cdot 2^3} = \frac{1}{27}$ then $x - y$ is given by

(a) -1

(b) 1

(c) 0

(d) None

5. Show that $\left(x^{\frac{1}{a-b}}\right)^{\frac{1}{a-c}} \times \left(x^{\frac{1}{b-c}}\right)^{\frac{1}{b-a}} \times \left(x^{\frac{1}{c-a}}\right)^{\frac{1}{c-b}}$ is given by

(a) 1

(b) -1

(c) 3

(d) 0

6. Show that $\frac{16(32)^x - 2^{3x-2} \cdot 4^{x+1}}{15(2)^{x-1}(16)^x} - \frac{5(5)^{x-1}}{\sqrt{5^{2x}}}$ is given by

(a) 1

(b) -1

(c) 4

(d) 0

7. Show that $\left(\frac{x^a}{x^b}\right)^{a+b} \times \left(\frac{x^b}{x^c}\right)^{b+c} \times \left(\frac{x^c}{x^a}\right)^{c+a}$ is given by

(a) 0

(b) -1

(c) 3

(d) 1

8. Show that $(a+b)\sqrt{\frac{x^{a^2}}{x^{b^2}}} \times (b+c)\sqrt{\frac{x^{b^2}}{x^{c^2}}} \times (c+a)\sqrt{\frac{x^{c^2}}{x^{a^2}}}$ reduces to

(a) 1

(b) 0

(c) -1

(d) None

9. Show that $\left(\frac{x^{b+c}}{x^{c-a}}\right)^{\frac{1}{a-b}} \times \left(\frac{x^{c+a}}{x^{a-b}}\right)^{\frac{1}{b-c}} \times \left(\frac{x^{a+b}}{x^{b-c}}\right)^{\frac{1}{c-a}}$ reduces to

(a) 1

(b) 3

(c) -1

(d) None

10. Show that $\left(\frac{x^b}{x^c}\right)^a \times \left(\frac{x^c}{x^a}\right)^b \times \left(\frac{x^a}{x^b}\right)^c$ reduces to

(a) 1

(b) 3

(c) 0

(d) 2

11. Show that $\left(\frac{x^b}{x^c}\right)^{\frac{1}{bc}} \times \left(\frac{x^c}{x^a}\right)^{\frac{1}{ca}} \times \left(\frac{x^a}{x^b}\right)^{\frac{1}{ab}}$ reduces to

(a) -1

(b) 0

(c) 1

(d) None

12. Show that $\left(\frac{x^a}{x^b}\right)^{(a^2+ab+b^2)} \times \left(\frac{x^b}{x^c}\right)^{(b^2+bc+c^2)} \times \left(\frac{x^c}{x^a}\right)^{(c^2+ca+a^2)}$ is given by

- (a) 1 (b) -1 (c) 0 (d) 3

13. Show that $\left(\frac{1}{x^{a-b}}\right)^{\frac{1}{a-c}} \times \left(\frac{1}{x^{b-c}}\right)^{\frac{1}{b-a}} \times \left(\frac{1}{x^{c-a}}\right)^{\frac{1}{c-b}}$ is given by

- (a) 0 (b) 1 (c) -1 (d) None

14. Show that $\left(\frac{x^b}{x^c}\right)^{b+c-a} \times \left(\frac{x^c}{x^a}\right)^{c+a-b} \times \left(\frac{x^a}{x^b}\right)^{a+b-c}$ is given by

- (a) 1 (b) 0 (c) -1 (d) None

15. Show that $\left(\frac{x^a}{x^{-b}}\right)^{(a^2-ab+b^2)} \times \left(\frac{x^b}{x^{-c}}\right)^{(b^2-bc+c^2)} \times \left(\frac{x^c}{x^{-a}}\right)^{(c^2-ca+a^2)}$ reduces to

- (a) 1 (b) $x^{-2(a^2+b^2+c^2)}$ (c) $x^{2(a^3+b^3+c^3)}$ (d) $x^{-2(a^3+b^3+c^3)}$

16. $x^{a^2b^{-1}c^{-1}} \cdot x^{b^2c^{-1}a^{-1}} \cdot x^{c^2a^{-1}b^{-1}} - x^3$ would reduce to zero if $a + b + c$ is given by

- (a) 1 (b) -1 (c) 0 (d) None

17. The value of z is given by the following if $z^{z\sqrt{z}} = (z\sqrt{z})^z$

- (a) 2 (b) 3/2 (c) -3/2 (d) 9/4

18. $\frac{1}{x^b x^{-c} + 1} + \frac{1}{x^c x^{-a} + 1} + \frac{1}{x^a x^{-b} + 1}$ would reduce to one if $a + b + c$ is given by

- (a) 1 (b) 0 (c) -1 (d) None

19. $\frac{1}{1 + z^{a-b} z^{a-c}} + \frac{1}{1 + z^{b-c} z^{b-a}} + \frac{1}{1 + z^{c-a} z^{c-b}}$ would reduce to

- (a) $\frac{1}{z^{2(a+b+c)}}$ (b) $\frac{1}{z^{(a+b+c)}}$ (c) 1 (d) 0

20. If $(5.678)^x = (0.5678)^y = 10^z$ then

(a) $\frac{1}{x} - \frac{1}{y} + \frac{1}{z} = 1$ (b) $\frac{1}{x} - \frac{1}{y} - \frac{1}{z} = 0$ (c) $\frac{1}{x} - \frac{1}{y} + \frac{1}{z} = -1$ (d) None

21. If $x = 4^{\frac{1}{3}} + 4^{-\frac{1}{3}}$ prove that $4x^3 - 12x$ is given by

(a) 12 (b) 13 (c) 15 (d) 17

22. If $x = 5^{\frac{1}{3}} + 5^{-\frac{1}{3}}$ prove that $5x^3 - 15x$ is given by

(a) 25 (b) 26 (c) 27 (d) 30

23. If $ax^{\frac{2}{3}} + bx^{\frac{1}{3}} + c = 0$ then the value of $a^3x^2 + b^3x + c^3$ is given by

(a) $3abcx$ (b) $-3abcx$ (c) $3abc$ (d) $-3abc$

24. If $a^p = b, b^q = c, c^r = a$ then the value of pqr is given by

(a) 0 (b) 1 (c) -1 (d) None

25. If $a^p = b^q = c^r$ and $b^2 = ac$ the value of $q(p + r)/pr$ is given by

(a) 1 (b) -1 (c) 2 (d) None

26. On simplification $\left[\frac{x^{\frac{a}{a-b}}}{x^{\frac{a}{a+b}}} \div \frac{x^{\frac{b}{b-a}}}{x^{\frac{b}{b+a}}} \right]^{a+b}$ reduced to

(a) 1 (b) -1 (c) 0 (d) None

27. On simplification $\left[\frac{x^{ab}}{x^{a^2+b^2}} \right]^{a+b} \times \left[\frac{x^{b^2+c^2}}{x^{bc}} \right]^{b+c} \times \left[\frac{x^{ca}}{x^{c^2+a^2}} \right]^{c+a}$ reduces to

(a) x^{-2a^3} (b) x^{2a^3} (c) $x^{-2(a^3+b^3+c^3)}$ (d) $x^{2(a^3+b^3+c^3)}$

28. On simplification $\left[\frac{x^{ab}}{x^{a^2+b^2}} \right]^{a+b} \times \left[\frac{x^{bc}}{x^{b^2+c^2}} \right]^{b+c} \times \left[\frac{x^{ca}}{x^{c^2+a^2}} \right]^{c+a}$ reduces to

(a) x^{-2a^3} (b) x^{2a^3} (c) $x^{-2(a^3+b^3+c^3)}$ (d) $x^{2(a^3+b^3+c^3)}$

29. On simplification $\left(\frac{m^x}{m^y}\right)^{x+y} \times \left(\frac{m^y}{m^z}\right)^{y+z} \div 3(m^x m^z)^{x-z}$, m reduces to

- (a) 3 (b) -3 (c) -1/3 (d) 1/3

30. The value of $\frac{1}{1+a^{y-x}} + \frac{1}{1+a^{x-y}}$ is given by

- (a) -1 (b) 0 (c) 1 (d) None

31. If $xyz = 1$ then the value of $\frac{1}{1+x+y^{-1}} + \frac{1}{1+y+z^{-1}} + \frac{1}{1+z+x^{-1}}$ is

- (a) 1 (b) 0 (c) 2 (d) None

32. If $2^a = 3^b = (12)^c$, then $\frac{1}{c} - \frac{1}{b} - \frac{2}{a}$ reduces to

- (a) 1 (b) 0 (c) 2 (d) None

33. If $2^a = 3^b = 6^{-c}$ then the value of $\frac{1}{a} + \frac{1}{b} + \frac{1}{c}$ reduce to

- (a) 0 (b) 2 (c) 3 (d) 1

34. If $3^a = 5^b = (75)^c$, then the value of $ab - c(2a+b)$ reduces to

- (a) 1 (b) 0 (c) 3 (d) 5

35. $2^a = 3^b = (12)^c$, then the value of $ab - c(a+2b)$ reduces to

- (a) 0 (b) 1 (c) 2 (d) 3

36. If $2^a = 4^b = 8^c$ and $abc=288$ then the value of $\frac{1}{2a} + \frac{1}{4b} + \frac{1}{8c}$ is given by

- (a) 1/8 (b) -1/8 (c) 11/96 (d) -11/96

37. If $a^p = b^q = c^r = d^s$ and $ab = cd$ then the value of $\frac{1}{p} + \frac{1}{q} - \frac{1}{r} - \frac{1}{s}$ reduces to

- (a) 1/a (b) 1/b (c) 0 (d) 1

38. If $a^b = b^a$, then the value of $\left(\frac{a}{b}\right)^{\frac{a}{b}} - a^{\frac{a}{b}-1}$ reduces to

- (a) a (b) b (c) 0 (d) None

39. If $m = b^x, n = b^y$ and $(m^y n^x) = b^2$ the value of xy is given by

- (a) -1 (b) 0 (c) 1 (d) None

40. If $a = xy^{m-1}, b = xy^{n-1}, c = xy^{p-1}$ then the value of $a^{n-p} \times b^{p-m} \times c^{m-n}$ reduces to

- (a) 1 (b) -1 (c) 0 (d) None

41. If $a = x^{n+p}y^m, b = x^{p+m}y^n, c = x^{m+n}y^p$ then the value of $a^{n-p} \times b^{p-m} \times c^{m-n}$ reduces to

- (a) 0 (b) 1 (c) -1 (d) None

42. If $a = \sqrt[3]{\sqrt{2} + 1} - \sqrt[3]{\sqrt{2} - 1}$ then the value of $a^3 + 3a - 2$ is

- (a) 3 (b) 0 (c) 2 (d) 1

43. If $a = x^{\frac{1}{3}} + x^{-\frac{1}{3}}$ then $a^3 - 3a$ is

- (a) $x + x^{-1}$ (b) $x - x^{-1}$
(c) $2x$ (d) 0

44. If $a = 3^{\frac{1}{4}} + 3^{-\frac{1}{4}}$ and $b = 3^{\frac{1}{4}} - 3^{-\frac{1}{4}}$ then the value of $3(a^2 + b^2)^2$ is

- (a) 67 (b) 65 (c) 64 (d) 62

45. If $x = \sqrt{3} + \frac{1}{\sqrt{3}}$ and $y = \sqrt{3} - \frac{1}{\sqrt{3}}$ then $x^2 - y^2$ is

- (a) 5 (b) $\sqrt{3}$ (c) $\frac{1}{\sqrt{3}}$ (d) 4

46. If $a = \frac{4\sqrt{6}}{\sqrt{2} + \sqrt{3}}$ then the value of $\frac{a + 2\sqrt{2}}{a - 2\sqrt{2}} + \frac{a + 2\sqrt{3}}{a - 2\sqrt{3}}$ is given by

- (a) 1 (b) -1 (c) 2 (d) -2

47. If $P + \sqrt{3}Q + \sqrt{5}R + \sqrt{15}S = \frac{1}{1 + \sqrt{3} + \sqrt{5}}$ then the value of P is

- (a) 7/11 (b) 3/11 (c) -1/11 (d) -2/11

48. If $a = 3 + 2\sqrt{2}$ then the value of $a^{\frac{1}{2}} + a^{-\frac{1}{2}}$ is

- (a) $\sqrt{2}$ (b) $-\sqrt{2}$ (c) $2\sqrt{2}$ (d) $-2\sqrt{2}$

49. If $a = 3 + 2\sqrt{2}$ then the value of $a^{\frac{1}{2}} - a^{-\frac{1}{2}}$ is

- (a) $2\sqrt{2}$ (b) 2 (c) $2\sqrt{2}$ (d) $-2\sqrt{2}$

50. If $a = \frac{1}{2}(5 - \sqrt{21})$ then the value of $a^3 + a^{-3} - 5a^2 - 5a^{-2} + a + a^{-1}$ is
 (a) 0 (b) 1 (c) 5 (d) -1

51. If $a = \sqrt{\frac{7+4\sqrt{3}}{7-4\sqrt{3}}}$ then the value of $[a(a-14)]^2$ is
 (a) 14 (b) 7 (c) 2 (d) 1

52. If $a = 3 - \sqrt{5}$ then the value of $a^4 - a^3 - 20a^2 - 16a + 24$ is
 (a) 10 (b) 14 (c) 0 (d) 15

53. If $a = \frac{\sqrt{3} + \sqrt{2}}{\sqrt{3} - \sqrt{2}}$ then the value of $2a^4 - 21a^3 + 12a^2 - a + 1$ is
 (a) 21 (b) 1 (c) 12 (d) None

54. The square root of $3 + \sqrt{5}$
 (a) $\sqrt{\frac{5}{2}} + \sqrt{\frac{1}{2}}$ (b) $-\left(\sqrt{\frac{5}{2}} + \sqrt{\frac{1}{2}}\right)$ (c) Both the above (d) None

55. If $x = \sqrt{2 - \sqrt{2 - \sqrt{2}}} \dots \infty$ the value of x is given by
 (a) -2 (b) 1 (c) 2 (d) 0

56. If $a = \frac{\sqrt{3} + \sqrt{2}}{\sqrt{3} - \sqrt{2}}$, $b = \frac{\sqrt{3} - \sqrt{2}}{\sqrt{3} + \sqrt{2}}$ then the value of $a + b$ is
 (a) 10 (b) 100 (c) 98 (d) 99

57. If $a = \frac{\sqrt{3} + \sqrt{2}}{\sqrt{3} - \sqrt{2}}$, $b = \frac{\sqrt{3} - \sqrt{2}}{\sqrt{3} + \sqrt{2}}$ then the value of $a^2 + b^2$ is
 (a) 10 (b) 100 (c) 98 (d) 99

58. If $a = \frac{\sqrt{3} + \sqrt{2}}{\sqrt{3} - \sqrt{2}}$, $b = \frac{\sqrt{3} - \sqrt{2}}{\sqrt{3} + \sqrt{2}}$ then the value of $\frac{1}{a^2} + \frac{1}{b^2}$ is
 (a) 10 (b) 100 (c) 98 (d) 99

59. The square root of $x + \sqrt{x^2 - y^2}$ is given by
 (a) $\frac{1}{2}[\sqrt{x+y} + \sqrt{x-y}]$ (b) $\frac{1}{2}[\sqrt{x+y} - \sqrt{x-y}]$
 (c) $[\sqrt{x+y} + \sqrt{x-y}]$ (d) $[\sqrt{x+y} - \sqrt{x-y}]$

60. The square root of $11 - \sqrt{120}$ is given by

(a) $\sqrt{6} + \sqrt{5}$

(b) $\sqrt{6} - \sqrt{5}$

(c) $2\sqrt{3} - 3\sqrt{2}$

(d) $2\sqrt{3} + 3\sqrt{2}$

61. $\log(1 + 2 + 3)$ is exactly equal to

(a) $\log 1 + \log 2 + \log 3$

(b) $\log(1 \times 2 \times 3)$

(c) Both the above

(d) None

62. The logarithm of 21952 to the base of $2\sqrt{7}$ and 19683 to the base of $3\sqrt{3}$ are

(a) Equal

(b) Not equal

(c) Have a difference of 2269

(d) None

63. The value of $4 \log \frac{8}{25} - 3 \log \frac{16}{125} - \log 5$ is

(a) 0

(b) 1

(c) 2

(d) -1

64. $a^{\log b - \log c} \times b^{\log c - \log a} \times c^{\log a - \log b}$ has a value of

(a) 1

(b) 0

(c) -1

(d) None

65. $\frac{1}{\log_{ab}(abc)} + \frac{1}{\log_{bc}(abc)} + \frac{1}{\log_{ca}(abc)}$ is equal to

(a) 0

(b) 1

(c) 2

(d) -1

66. $\frac{1}{1 + \log_a(bc)} + \frac{1}{1 + \log_b(ca)} + \frac{1}{1 + \log_c(ab)}$ is equal to

(a) 0

(b) 1

(c) 3

(d) -1

67. $\frac{1}{\log_{a/b}(x)} + \frac{1}{\log_{b/c}(x)} + \frac{1}{\log_{c/a}(x)}$ is equal to

(a) 0

(b) 1

(c) 3

(d) -1

68. $\log_b(a) \cdot \log_c(b) \cdot \log_a(c)$ is equal to

(a) 0

(b) 1

(c) -1

(d) None

69. $\log_b\left(a^{\frac{1}{2}}\right) \cdot \log_c(b^3) \cdot \log_a\left(c^{\frac{2}{3}}\right)$ is equal to

(a) 0

(b) 1

(c) -1

(d) None

70. The value of $a^{\log b/c} \cdot b^{\log c/a} \cdot c^{\log a/b}$ is

(a) 0

(b) 1

(c) -1

(d) None

71. The value of $(bc)^{\log b/c} \cdot (ca)^{\log c/a} \cdot (ab)^{\log a/b}$ is

(a) 0

(b) 1

(c) -1

(d) None

72. The value of $\log \frac{a^n}{b^n} + \log \frac{b^n}{c^n} + \log \frac{c^n}{a^n}$ is
 (a) 0 (b) 1 (c) -1 (d) None

73. The value of $\log \frac{a^2}{bc} + \log \frac{b^2}{ca} + \log \frac{c^2}{ab}$ is
 (a) 0 (b) 1 (c) -1 (d) None

74. $\log(a^9) + \log a = 10$ if the value of a is given by
 (a) 0 (b) 10 (c) -1 (d) None

75. $\frac{\log a}{y-z} = \frac{\log b}{z-x} = \frac{\log c}{x-y}$ the value of abc is
 (a) 0 (b) 1 (c) -1 (d) None

76. $\frac{\log a}{y-z} = \frac{\log b}{z-x} = \frac{\log c}{x-y}$ the value of $a^{y+z} \cdot b^{z+x} \cdot c^{x+y}$ is given by
 (a) 0 (b) 1 (c) -1 (d) None

77. If $\log a = \frac{1}{2} \log b = \frac{1}{5} \log c$ the value of $a^4 b^3 c^{-2}$ is
 (a) 0 (b) 1 (c) -1 (d) None

78. If $\frac{1}{2} \log a = \frac{1}{3} \log b = \frac{1}{5} \log c$ the value of $a^4 - bc$ is
 (a) 0 (b) 1 (c) -1 (d) None

79. If $\frac{1}{4} \log_2 a = \frac{1}{6} \log_2 b = -\frac{1}{24} \log_2 c$ the value of $a^3 b^2 c$ is
 (a) 0 (b) 1 (c) -1 (d) None

80. The value of $\frac{1}{\log_a(ab)} + \frac{1}{\log_b(ab)}$ is
 (a) 0 (b) 1 (c) -1 (d) None

81. If $\frac{1}{\log_a t} + \frac{1}{\log_b t} + \frac{1}{\log_c t} = \frac{1}{\log_z t}$ then the value of z is given by
 (a) abc (b) a + b + c (c) a(b + c) (d) (a + b)c

82. If $l = 1 + \log_a bc$, $m = 1 + \log_b ca$, $n = 1 + \log_c ab$ then the value of $\frac{1}{l} + \frac{1}{m} + \frac{1}{n} - 1$ is
 (a) 0 (b) 1 (c) -1 (d) 3

83. If $a = b^2 = c^3 = d^4$ then the value of $\log_a (abcd)$ is

- (a) $1 + \frac{1}{2} + \frac{1}{3} + \frac{1}{4}$ (b) $1 + \frac{1}{2!} + \frac{1}{3!} + \frac{1}{4!}$
(c) $1 + 2 + 3 + 4$ (d) None

84. The sum of the series $\log_a b + \log_{a^2} b^2 + \log_{a^3} b^3 + \dots \log_{a^n} b^n$ is given by

- (a) $\log_a b^n$ (b) $\log_{a^n} b$ (c) $\log_{a^n} b^n$ (d) None

85. $\frac{1}{a^{\log_b a}}$ has a value of

- (a) a (b) b (c) (a + b) (d) None

86. The value of the following expression $a^{\log_a b \cdot \log_b c \cdot \log_c d \cdot \log_d t}$ is given by

- (a) t (b) abcdt (c) (a + b + c + d + t) (d) None

87. For any three consecutive integers x y z the equation $\log (1+xz) - 2\log y = 0$ is

- (a) True
(b) False
(c) Sometimes true
(d) Cannot be determined in the cases of variables with cyclic order.

88. If $\log \frac{a+b}{3} = \frac{1}{2} (\log a + \log b)$ then the value of $\frac{a}{b} + \frac{b}{a}$ is

- (a) 2 (b) 5 (c) 7 (d) 3

89. If $a^2 + b^2 = 7ab$ then the value of $\log \frac{a+b}{3} - \frac{\log a}{2} - \frac{\log b}{2}$ is

- (a) 0 (b) 1 (c) -1 (d) 7

90. If $a^3 + b^3 = 0$ then the value of $\log(a+b) - \frac{1}{2}(\log a + \log b + \log 3)$ is equal to

- (a) 0 (b) 1 (c) -1 (d) 3

91. If $x = \log_a bc$; $y = \log_b ca$; $z = \log_c ab$ then the value of $xyz - x - y - z$ is

- (a) 0 (b) 1 (c) -1 (d) 2

92. On solving the equation $\log t + \log(t-3) = 1$ we get the value of t as

- (a) 5 (b) 2 (c) 3 (d) 0

93. On solving the equation $\log_3 [\log_2 (\log_3 t)] = 1$ we get the value of t as

- (a) 8 (b) 18 (c) 81 (d) 6561

94. On solving the equation $\log_{\frac{1}{2}} [\log_t (\log_4 32)] = 2$ we get the value of t as

- (a) $\frac{5}{2}$ (b) $\frac{25}{4}$ (c) $\frac{625}{16}$ (d) None

95. If $(4.8)^x = (0.48)^y = 1,000$ then the value of $\frac{1}{x} - \frac{1}{y}$ is

- (a) 3 (b) -3 (c) $\frac{1}{3}$ (d) $-\frac{1}{3}$

96. If $x^{2a-3}y^{2a} = x^{6-a}y^{5a}$ then the value of $\text{alog}\left(\frac{x}{y}\right)$ is

- (a) $3 \log x$ (b) $\log x$ (c) $6 \log x$ (d) $5 \log x$

97. If $x = \frac{e^n - e^{-n}}{e^n + e^{-n}}$ then the value of n is

- (a) $\frac{1}{2} \log_e \frac{1+x}{1-x}$ (b) $\log_e \frac{1+x}{1-x}$
(c) $\log_e \frac{1-x}{1+x}$ (d) $\frac{1}{2} \log_e \frac{1-x}{1+x}$

ANSWERS: -

1.	(b)	26.	(d)	51.	(d)	76.	(b)
2.	(a)	27.	(a)	52.	(c)	77.	(b)
3.	(c)	28.	(c)	53.	(b)	78.	(a)

4.	(b)	29.	(d)	54.	(c)	79.	(b)
5.	(a)	30.	(c)	55.	(a)	80.	(b)
6.	(a)	31.	(a)	56.	(a)	81.	(a)
7.	(d)	32.	(b)	57.	(c)	82.	(a)
8.	(a)	33.	(a)	58.	(c)	83.	(a)
9.	(a)	34.	(b)	59.	(a)	84.	(a), (c)
10.	(a)	35.	(a)	60.	(b)	85.	(b)
11.	(c)	36.	(c)	61.	(c)	86.	(a)
12.	(a)	37.	(c)	62.	(a)	87.	(a)
13.	(b)	38.	(c)	63.	(b)	88.	(c)
14.	(a)	39.	(c)	64.	(a)	89.	(a)
15.	(a)	40.	(a)	65.	(c)	90.	(a)
16.	(c)	41.	(b)	66.	(b)	91.	(d)
17.	(d)	42.	(b)	67.	(a)	92.	(a)
18.	(b)	43.	(a)	68.	(b)	93.	(d)
19.	(c)	44.	(c)	69.	(b)	94.	(c)
20.	(b)	45.	(d)	70.	(b)	95.	(c)
21.	(d)	46.	(c)	71.	(b)	96.	(a)
22.	(b)	47.	(a)	72.	(a)	97.	(a)
23.	(a)	48.	(c)	73.	(a)		
24.	(b)	49.	(b)	74.	(b)		
25.	(c)	50.	(a)	75.	(b)		

PREVIOUS YEARS QUESTION

2014 - JUNE

1. If $x : y = 2:3$, then $(5x+2y):(3x-y) =$ _____.
(a) 19:3 (b) **16 : 3** (c) 7 : 2 (d) 7 : 3
2. If $(25)^{150} = (25x)^{50}$; then the value of x will be :
(a) 5^3 (b) **5^4** (c) 5^2 (d) 5
3. The value of $\left(\frac{y^a}{y^b}\right)^{a^2+ab+b^2} \times \left(\frac{y^b}{y^c}\right)^{b^2+bc+c^2} \times \left(\frac{y^c}{y^a}\right)^{c^2+ac+a^2}$ is equal to _____.
(a) y (b) -1 (c) **1** (d) None of these
4. If the salary of P is 25% lower than that of Q and the salary of R is 20% higher than that of Q, the ratio of the salary of R and P will be:
(a) 5: 8 (b) **8 : 5** (c) 5:3 (d) 3 : 5
5. If $x^2 + y^2 = 7xy$, then $\log \frac{1}{3}(x+y) =$ _____.
(a) $(\log x + \log y)$ (b) **$\frac{1}{2} (\log x + \log y)$**
(c) $\frac{1}{3} (\log x / \log y)$ (d) $\frac{1}{3} (\log x + \log y)$ (1 mark)
6. A person has assets worth Rs. 1,48,200. He wish to divide it amongst his wife, son and daughter in the ratio 3:2:1 respectively. From this assets, the share of his son will be:
(a) Rs. 24,700 (b) **Rs. 49,400** (c) Rs. 74,100 (d) Rs. 37,050
7. If $x = \log_{24} 12$, $y = \log_{36} 24$ and $z = \log_{48} 36$, then $xyz + 1 =$ _____.
(a) $2xy$ (b) $2xz$ (c) **$2yz$** (d) 2

2014 - DECEMBER

8. If $\log x = a + b$, $\log y = a - b$ then the value of $\log \frac{10x}{y^2} =$ _____.
(a) **$1 - a + 3b$** (b) $a - 1 + 3b$ (c) $a + 3b + 1$ (d) $1 - b + 3a$
9. If $x = 1 + \log_p qr$, $y = 1 + \log_q rp$ and $z = 1 + \log_r pq$ then the value of $\frac{1}{x} + \frac{1}{y} + \frac{2}{z} =$ _____.
(a) 0 (b) **1.** (c) -1 (d) 3
10. For three months, the salary of a person are in the ratio 2 : 4 : 5. If the difference between the product of salaries of the first two months and last two months is Rs. 4,80,00,000; then the salary of the person for the second month will be:
(a) Rs. 4,000 (b) Rs. 6,000 (c) **Rs. 8,000** (d) Rs. 12,000

2015 - JUNE

11. A dealer mixes rice costing Rs. 13.84 per Kg. with rice costing Rs. 15.54 and sells the mixture at Rs. 17.60 per Kg. So, he earns a profit of 14.6% on his sale price. The proportion in which he mixes the two qualities of rice is:

- (a) 3 : 7 (b) 5 : 7 (c) 7 : 9 (d) 9 : 11
12. If $p^x = q$, $q^y = r$ and $r^z = p^6$, then the value of xyz will be:
 (a) 0 (b) 1 (c) 3 (d) 6
13. If $\log x = m + n$ and $\log y = m - n$, then $\log (10x/y^2) =$
 (a) **3n - m + 1** (b) $3m - n + 1$ (c) $3n + n + 1$ (d) $3m + n + 1$
14. If $15(2p^2 - q^2) = 7pq$, where p and q are positive, then $p : q$ will be:
 (a) **5 : 6** (b) 5 : 7 (c) 3 : 5 (d) 8 : 3

2015 - DECEMBER

15. The ratio of third proportion of 12, 30 to the mean proportion of 9, 25 is:
 (a) 2:1 (b) **5:1** (c) 7:15 (d) 3:5
16. The value of $\log_5 3 \times \log_3 4 \times \log_2 5$.
 (a) 0 (b) 1 (c) **2 (d)** $\frac{1}{2}$
17. What number must be added to each of the numbers 10, 18, 22, 38 to make the numbers in proportion?
 (a) **2** (b) 4 (c) 8 (d) None of these.
18. The value of $\frac{2^n + 2^{n-1}}{2^{n+1} - 2^n}$ is :
 (a) $\frac{1}{2}$ (b) $\frac{3}{2}$ (c) $\frac{2}{3}$ (d) 2

2016 - JUNE

19. The integral part of a logarithm is called _____ and the decimal part of a logarithm is called _____.
 (a) Mantissa, Characteristic (b) **Characteristic, Mantissa**
 (c) Whole, Decimal (d) None of these.
20. The value of $\left[\frac{x^2 - (y-z)^2}{(x+z)^2 - y^2} + \frac{y^2 - (x-z)^2}{(x+y)^2 - z^2} + \frac{z^2 - (x-y)^2}{(y+z)^2 - x^2} \right]$ is
 (a) 0 (b) **1** (c) -1 (d) ∞
21. X, Y, Z together start a business. If X invests 3 times as much as Y invests and Y invests two-thirds of what Z invests, then the ratio of capitals of X, Y, Z is:
 (a) 3:9:2 (b) 6:3:2 (c) 3:6:2 (d) **6:2:3**
22. If $\log_4(x^2 + x) - \log_4(x+1) = 2$, then the value of X is:
 (a) 2 (b) **3 (c)** (d) 8
23. Value of $\frac{1}{\log_3 60} + \frac{1}{\log_4 80} + \frac{1}{\log_5 60}$ is:
 (a) 0 (b) **1** (c) 5 (d) 60

2016 - DECEMBER

24. If $3^x = 5^y = 75^z$, then

- (a) $x+y-z=0$ (b) $\frac{2}{x} + \frac{1}{y} - \frac{1}{z}$ (c) $\frac{1}{x} + \frac{2}{y} = \frac{1}{z}$ (d) $\frac{2}{x} + \frac{1}{z} = \frac{1}{y}$

25. If $\log 2 = 0.3010$ and $\log 3 = 0.4771$, then the value of $\log 24$ is:

- (a) 1.0791 (b) 1.7323 (c) **1.3801** (d) 1.8301

26. If $abc = 2$, then the value of $\frac{1}{1+a+2b^{-1}} + \frac{1}{1+\frac{1}{2}b+c^{-1}} + \frac{1}{1+c+a^{-1}}$ is:

- (a) **1** (b) 2 (c) 3 (d) $\frac{1}{2}$

27. There are total 23 coins of Rs. 1, Rs. 2 and Rs. 5 in a bag. If their value is Rs. 43 and the ratio of coins of Rs. 1 and Rs. 2 is 3:2. Then the number of coins of Rs. 1 is:

- (a) **12** (b) 5 (c) 10 (d) 14

2017-JUNE

28. If $a : b = 2 : 3$, $b : c = 4 : 5$ and $c : d = 6 : 7$, then $a : d$ is:

- (a) 24 : 35 (b) 8 : 15 (c) **16:35** (d) 7:15

29. The value of $\log (1^3 + 2^3 + 3^3 + \dots + n^3)$ is equal to:

- (a) $3 \log 1 + 3 \log 2 + \dots + 3 \log n$
(b) **$2 \log n + 2 \log (n+1) - 2 \log 2$**
(c) $\log n + \log (n+1) + \log (2n+1) - \log 6$ (1 mark)
(d) 1

30. If $a = \frac{\sqrt{6}+\sqrt{5}}{\sqrt{6}-\sqrt{5}}$ and $b = \frac{\sqrt{6}-\sqrt{5}}{\sqrt{6}+\sqrt{5}}$ then the value of $\frac{1}{a^2} + \frac{1}{b^2}$ is equal to:

- (a) 480 (b) **482** (c) 484 (d) 486

2017 - DECEMBER

31. The ratio of the number of Rs. 5 coins and Rs. 10 coins is 8 : 15. If the value of Rs. 5 coins is Rs. 360, then the number of Rs. 10 coins will be:

- (a) 72 (b) 120 (c) **135** (d) 185

32. If $\log_3 [\log_4 (\log_2 x)] = 0$, then the value of 'x' will be:

- (a) 4 (b) 8 (c) **16** (d) 32

33. If $\log \left(\frac{x-y}{2} \right) = \frac{1}{2} (\log x + \log y)$, then the value of $x^2 + y^2 =$

- (a) 2xy (b) 4xy (c) $2x^2y^2$ (d) **6xy**

34. If $\frac{1}{2}, \frac{1}{3}, \frac{1}{5}$ and $\frac{1}{x}$ are in proportion, then the value of 'x' will be:

- (a) $\frac{15}{2}$ (b) $\frac{6}{5}$ (c) $\frac{10}{3}$ (d) $\frac{5}{6}$

2018-MAY

35. If $p : q$ is the sub-duplicate ratio of $p - x^2 : q - x^2$, then x^2 is :

- (a) $\frac{p}{p+q}$ (b) $\frac{q}{p+q}$ (c) $\frac{qp}{p+q}$ (d) **None.**

36. The value of the expression :

$${}_a \log_a b \cdot \log_b^c \cdot \log_c^d \cdot \log_d t$$

- (a) t (b) abcdt (c) (a + b + c + d + t) (d) None

37. The mean proportional between 24 and 54 is:

- (a) 33 (b) 34 (c) 35 (d) 36

38. The value of $\log_4 9 \cdot \log_3 2$ is:

- (a) 3 (b) 2 (c) 9 (d) 1

39. $\frac{2^n + 2^{n-1}}{2^{n-1} - 2^n}$

- (a) $\frac{1}{2}$ (b) $\frac{3}{2}$ (c) $\frac{2}{3}$ (d) $\frac{1}{3}$

2018 - NOVEMBER

40. $\frac{3x-2}{5x+6}$ is the duplicate ratio of $\frac{2}{3}$ then find the value of x:

- (a) 2 (b) 6 (c) 5 (d) 9

41. $\frac{2^{m+1} \times 3^{2m+n+8} \times 5^{n-m+4} \times 6^{2n+m}}{6^{2m+n} \times 10^{n+1} \times 15^{m+8}}$

- (a) 3^{2m+2n} (b) 3^{2n-2m} (c) 1 (d) None of the above

42. If x:y:z = 7:4:11 then $\frac{x+y+z}{z}$ is:

- (a) 2 (b) 3 (c) 4 (d) 5

43. $\log_2 \log_2 \log_2 16 = ?$

- (a) 0 (b) 3 (c) 1 (d) 2

2019 - JUNE

44. If the ratio of two numbers is 7 : 11. If 7 is added to each number then the new ratio will be 2 : 3 then the numbers are.

- (a) 49, 77 (b) 42, 45 (c) 43, 42 (d) 39, 40

45. If $2^{x^2} = 3^{y^2} = 12^{z^2}$ then

- (a) $\frac{1}{x^2} + \frac{1}{y^2} = \frac{1}{z^2}$ (b) $\frac{1}{x^2} + \frac{2}{y^2} = \frac{1}{z^2}$ (c) $\frac{2}{x^2} + \frac{1}{y^2} = \frac{1}{z^2}$ (d) None

46. The value of

$$\log_5 \left(1 + \frac{1}{5} \right) + \log_5 \left(1 + \frac{1}{6} \right) + \dots + \log_5 \left(1 + \frac{1}{624} \right)$$

- (a) 2 (b) 3 (c) 5 (d) 0

47. $\log_{2\sqrt{2}} (512) : \log_{3\sqrt{2}} 324 =$

- (a) 128:81 (b) 2 : 3 (c) 3:2 (d) None

48. If $P = x^{1/3} + x^{-1/3}$ then $P^3 - 3P =$

- (a) 3 (b) $\frac{1}{2} \left(x + \frac{1}{x} \right)$ (c) $\left(x + \frac{1}{x} \right)$ (d) $2 \left(x + \frac{1}{x} \right)$

2019 - NOVEMBER

49. The ratio of two numbers are 3 : 4. The difference of their squares is 28 Greater no is:
(a)8 (b)12 (c)24 (d)64.
50. The price of scooter and moped are in the ratio 7 : 9. The price of moped is Rs. 1,600 more than that of scooter. Then the price of moped is:
(a)Rs. 7,2000 (b)Rs. 5.600 (c)Rs. 800 (d)Rs. 700
51. $\log_{0.01} 10,000 = ?$
(a)2 (b)-2 (c)4 (d) -4
52. Value of $\left[9^{n+\frac{1}{4}} \cdot \frac{\sqrt{3} \cdot 3^n}{3 \cdot \sqrt{3-n}} \right]^{\frac{1}{n}}$
(a) 9 (b)27 (c) 81 (d)3
53. If $x = \sqrt{3} + \frac{1}{\sqrt{3}}$ then $\left(x - \frac{\sqrt{126}}{\sqrt{42}} \right) \left(x - \frac{1}{x - \frac{2\sqrt{3}}{3}} \right) = ?$
(a)5/6 (b)6/5 (c)2/3 (d)- 3/5

2020 - NOVEMBER

54. If $a : b = 3 : 7$, then $3a + 2b : 4a + 5b = ?$
(a)23:47 (b)27:43 (c)24 : 51 (d)29 : 53
55. If $\log_a \sqrt{3} = \frac{1}{6}$, find the value of Q:
(a)9 (b) 81 (c)27 (d) 3
56. $\log 9 + \log 5$ is expressed as:
(a) $\log 4$ (b) $\log 9/5$ (c) $\log 5/9$ (d) **$\log 45$**
57. If $a : b = 9 : 4$, then $\sqrt{\frac{a}{b}} + \sqrt{\frac{b}{a}} = ?$
(a) 3/2 (b) 2/3 (c)6/13 (d)**13/6**
58. The ratio of number of boys and the number of girls in a school is found to be 15 : 32. How many boys and equal number of girls should be added to bring the ratio to 2/3?
(a)19 (b)20 (c)23 (d)27
59. Find the value of a from the following:
 $\sqrt{(9)}^{-5} \times \sqrt{(3)}^{-7} - \sqrt{(3)}^{-a}$
(a)11 (b)13 (c)15 (d)**17**

2021 - JANUARY

60. Find the value of $\frac{3t^{-1}}{t^{-1/5}}$

(a) $\frac{3}{t^{2/3}}$ (b) $\frac{3}{t^{3/2}}$ (c) $\frac{3}{t^{1/3}}$ (d) $\frac{3}{t^{1/2}}$

61. If $\log_a(ab) = x$, then $\log_b(ab)$ is

(a) $1/x$ (b) $\frac{x}{1+x}$ (c) $\frac{x}{x-1}$ (d) None of these

62. In a certain business A and B received profit in a certain ratio B and C received profits in the same ratio. If A gets Rs. 1600 and C gets Rs. 2500 then how much does B get?

(a) Rs. 2,000 (b) Rs. 2,500 (c) Rs. 1,000 (d) Rs. 1,500

63. The ratio of two quantities is 15 : 17. If the consequent of its inverse ratio is 15, then the antecedent is;

(a) 15 (b) $\sqrt{15}$ (c) 17 (d) 14

64. The salaries of A, B and C are in the ratio 2 : 3 : 5. If increments of 15%, 10% and 20% are allowed respectively to their salary, then what will be the new ratio of their salaries?

(a) 3:3:10 (b) 10:11: 20 (c) 23:33: 60 (d) Cannot be determined

2021 - JULY

65. The salaries of A, B, and C are in the ratio 2 : 3 : 5. if increments of 15%, 10% and 20% are allowed respectively to their salary, then what will be the new ratio of their salaries?

(a) 23 : 33 : 60 (b) 33:23:60 (c) 23:60:33 (d) 33:60: 23

66. if $A : B = 5 : 3$, $B : C = 6 : 7$ and $C : D = 14 : 9$ then the value of $A : B : C : D$ is:

(a) 20 : 14 : 12 : 9 (b) 20 : 9 : 12 : 14 (c) 20 : 9 : 14 : 12 (d) 20:12:14:9

67. A vessel contained a solution of acid and water in which water was 64%. Four litres of the solution were taken out of the vessel and the same quantity of water was added. If the resulting solution contains 30% acid, the quantity (in litres) of the solution, in the beginning in the vessel, was

(a) 12 (b) 36 (c) 24 (d) 2

68. If $xy + yz + zx = -1$ then the value of $\left(\frac{x+y}{1+xy} + \frac{z+y}{1+2y} + \frac{x+z}{1+zx}\right)$ is:

(a) xyz (b) $\frac{-1}{yz}$ (c) $\frac{1}{xyz}$ (d) $\frac{1}{x+y+z}$

(a) 64 (b) 4 (c) 16 (d) 2

2021 - DECEMBER

69. Let $a = (\sqrt{5} + \sqrt{3})/(\sqrt{5} - \sqrt{3})$ and $b = (\sqrt{5} - \sqrt{3})/(\sqrt{5} + \sqrt{3})$. What is the value of $a^2 + b^2$?

(a) 64 (b) 62 (c) 60 (d) 254

70. Incomes of R and S are in the ratio 7 : 9 and their expenditures are in the ratio 4:5. Their total expenditure is equal to income of R. What is the ratio of their savings?

(a) 23 : 36 (b) 28:41 (c) 31 : 43 (d) 35 : 46

Answer:

71. A bag contains 105 coins containing some 50 paise, and 25 paise coins. The ratio of the number of these coins is 4:3. The total value (in Rs.) in the bag is
(a)43.25 (b)**41.25** (c)39.25 (d)35.25
72. If $\log_{10} 3 = x$ and $\log_{10} 4 = y$, then the value of $\log_{10} 120$ can be expressed as
(a) $x - y + 1$ (b) **$x + y + 1$** (c) $x + y - 1$ (d) $2x + y - 1$
73. Find the value of $\log(x^6)$, if $\log(x) + 2 \log(x^2) + 3 \log(x^3) = 14$,
(a)3 (b)4 (c)5 (d)**6**
74. The value of $\frac{6^{n+4} 3^{n+8} \times 2^{n+8}}{5 \times 6^n + 6^n}$ is:
(a)232 (b)242 (c)**252** (d)262
75. In a department, the number of males and females are in the ratio 3 : 2. If 2 males and 5 females join the department, then the ratio becomes 1:1. Initially, the number of females in the department is
(a)9 (b)**6** (c) 3 (d) 8
76. If, $\left(\frac{3a}{2b}\right)^{2x-4} = \left(\frac{2b}{3a}\right)^{2x-4}$, for some a and b, then the value of x is
(a)8 (b)6 (c)4 (d)**2**
77. The value of $\left(1 - \sqrt[3]{0.027} \left(\frac{5}{6}\right) \left(\frac{1}{2}\right)^2\right)$ is:
(a)11/16 (b)13/16 (c)**15/16** (d)1

JUNE 2022

78. $\log \sqrt{3} = 6$ base a, the a will be
A.27 B.36 C.15 D.1
79. $\log \frac{p^2}{qr} + \log \frac{q^2}{pr} + \log \frac{r^2}{qr}$ is
A.pqr B.0 C.1 D.none
80. A Box contain 25 paise coins and 10 paise coins and 5 paise coins in the Ratio 3:2:1 and total money is Rs 40. how many 5 paise coins are there
A. 65 B.**55** C.40 D.50
81. If $X:Y = 4:6$ and $Z:X = 4:16$ find Y ?
B. 4 B.6 C.16 D.1
82. If $(\sqrt{3}^{18}) = \sqrt{9^x}$ find X
A.18 B.8 C**9** D.19

DEC 2022

83. If the cost of 3 bags and 4 pens is Rs. 257 whereas the cost of 4 bags and 3 Rs. 324, then the cost of one bag is:
A. 8 B. 24 C. 32 D. 75
84. If $\log_{10} 2 = y$ and $\log_{10} 3 = x$, then the value of $\log_{10} 15$ is:
A. $x - y + 1$ B. $x + y + 1$ C. $x - y - 1$ D. $y - x + 1$

85. $\log_7 4 \cdot \log_4 5 \cdot \log_5 6 \cdot \log_6 7 \cdot \log_7 8 \cdot \log_8 9$ equals to:

- A. 3 B. 2 C. 1 D. 0

86. A sum of money is to be distributed among A, B, C, D in the proportion of 5:2:4:3. If C gets Rs. 1000 more than D, what is B's share?

- A. 2000 B. 1500 C. 2300 D. 1000

87. By simplifying $(2a^3b^4)^4 / ((4a^3b)^2 \times (a^3b^3))$, the answer will be

- A. $4a^3b^3$ B. $4a^3b^{23}$ C. $4a^{23}b^{23}$ D. $4a^{18}b^{13}$

88. A group of 400 soldiers posted at border area had a provision for 31 days. After 28 days 280 soldiers from this group were called back. Find the number of days for which the remaining ration will be sufficient?

- A. 3 B. 6 C. 8 D. 10

JUNE 2023

89. If $\sqrt[3]{a} + 3\sqrt{b} + 3\sqrt{c}$ then the value of $\left(\frac{a+b+c}{3}\right)^3 = 0$

- (a) abc (b) $9abc$ (c) $\frac{1}{abc}$ (d) $\frac{1}{9abc}$

90. The value of $[\log_{10} (5 \log_{10} 100)]^2 = ?$

- (a) 1 (b) 2 (c) 10 (d) 25

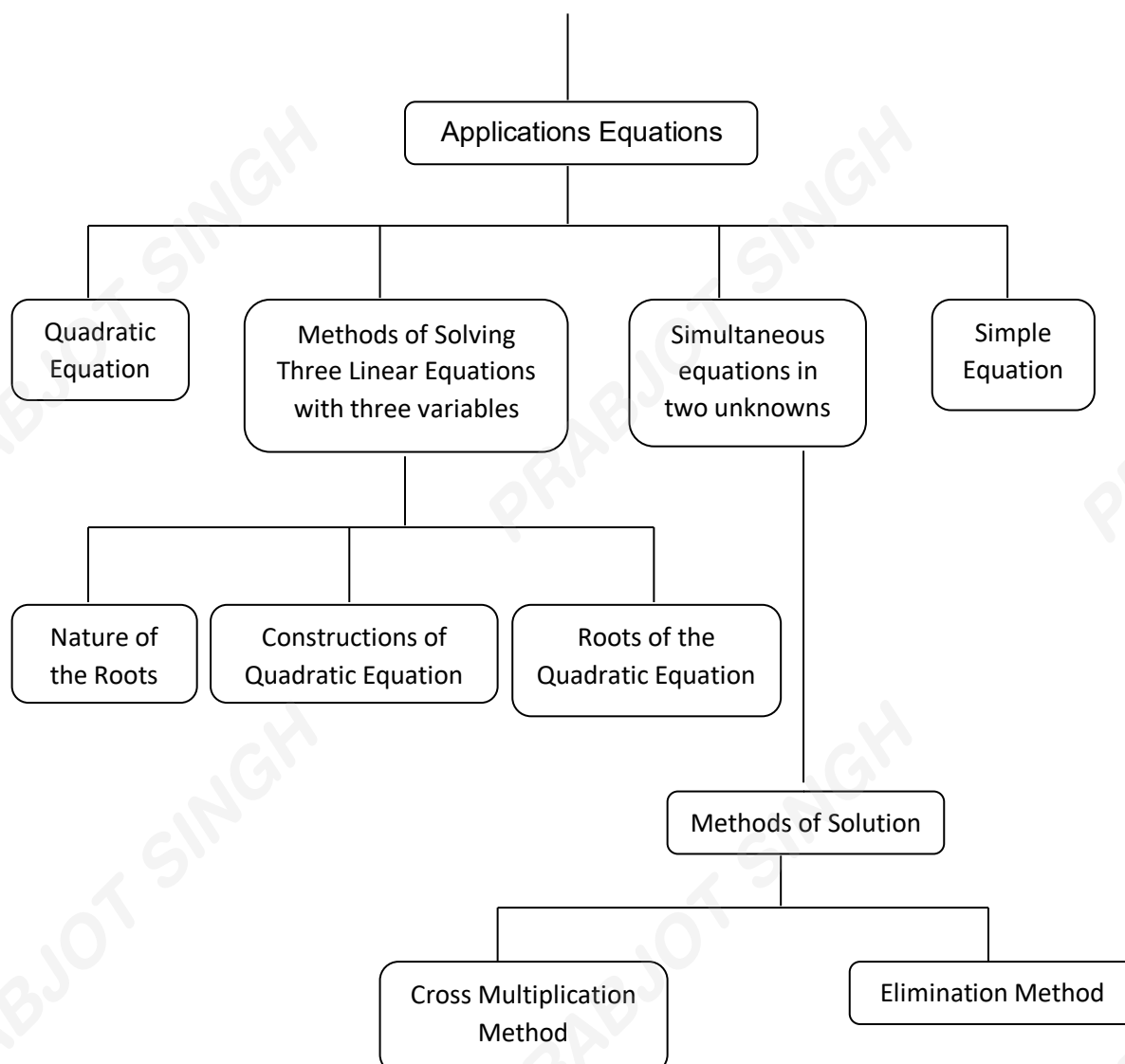
91. If $\log x = m + n$ and $\log y = m - n$, then $\log (100x/y^2) =$

- (a) $3n - m + 1$ (b) $3n + m - 1$ (c) $m^2 - n^2$ (d) $3m + n + 1$

EQUATION

UNIT -1

OVERVIEW



Equation: is defined to be a mathematical statement of equality. If the equality is true for certain value of the variable involved, the equation is often called a conditional equation and equality sign '=' is used; while if the equality is true for all values of the variable involved, the equation is called an identity.

EXERCISE (A)

Choose the most appropriate option (a) (b) (c) or (d).

1. The equation $-7x+1=5-3x$ will be satisfied for x equal to:
a) 2 b) -1 c) 1 d) none of these
2. The root of the equation $\frac{x+4}{4} + \frac{x-5}{3} = 11$ is
a) 20 b) 10 c) 2 d) none of these
3. Pick up the correct value of x for $\frac{x}{30} = \frac{2}{45}$
a) $x=5$ b) $x=7$ c) $x=1\frac{1}{3}$ d) none of these
4. The solution of the equation $\frac{x+24}{5} = 4 + \frac{x}{4}$
a) 6 b) 10 c) 16 d) none of these
5. 8 is the solution of the equation
a) $\frac{x+4}{4} + \frac{x-5}{3} = 11$ b) $\frac{x+4}{2} + \frac{x+10}{9} = 8$
c) $\frac{x+24}{5} = 4 + \frac{x}{4}$ d) $\frac{x-15}{10} + \frac{x+5}{5} = 4$
6. The value of y that satisfies the equation $\frac{y+11}{6} - \frac{y+1}{9} = \frac{y+7}{4}$ is
a) -1 b) 7 c) 1 d) $-\frac{1}{7}$
7. The solution of the equation $(p+2)(p-3) + (p+3)(p-4) = p(2p-5)$ is
a) 6 b) 7 c) 5 d) none of these
8. The equation $\frac{12x+1}{4} - \frac{15x-1}{5} + \frac{2x-5}{3x-1}$ is true for
a) $x=1$ b) $x=2$ c) $x=5$ d) $x=7$
9. Pick up the correct value x for which $\frac{x}{0.5} - \frac{1}{0.05} + \frac{x}{0.005} - \frac{1}{0.0005} = 0$
a) $x=0$ b) $x=1$ c) $x=10$ d) none of these

ANSWERS

Exercise (A)

1. (b) 2. (a) 3. (c) 4. (c) 5. (b) 6. (d) 7. (a) 8. (d)
9. (c)

EXAMPLE AND ILUUSTRATION:

1. The denominator of a fraction exceeds the numerator by 5 and if 3 be added to both the fraction becomes $\frac{3}{4}$. Find the fraction.
2. If thrice of A's age 6 years ago be subtracted from twice his present age, the result would be equal to his present age. Find A's present age.
3. A number consists of two digits the digit in the ten's place is twice the digit in the unit's place. If 18 be subtracted from the number the digits are reversed. Find the number.
4. For a certain commodity the demand equation giving demand 'd' in kg, for a price 'p' in rupees per kg. is $d = 100(10 - p)$. The supply equation giving the supply in kg. for a price p in rupees per kg. is $s = 75(p - 3)$. The market price is such at which demand equals supply. Find the market price and quantity that will be bought and sold.

UNIT -2

Choose the most appropriate option (a) (b) (c) or (d).

1. The sum of two numbers is 52 and their difference is 2. The numbers are
a) 17 and 15 b) 12 and 10 c) 27 and 25 d) none of these
2. The diagonal of a rectangle is 5 cm and one of its sides is 4 cm. Its area is
a) 20 sq.cm. b) 12 sq.cm. c) 10 sq.cm. d) none of these
3. Divide 56 into two parts such that three times the first part exceeds one third of the second by 48. The parts are.
a) (20, 36) b) (25, 31) c) (24, 32) d) none of these
4. The sum of the digits of a two digit number is 10. If 18 be subtracted from it the digits in the resulting number will be equal. The number is
a) 37 b) 73 c) 75 d) none of these

5. The fourth part of a number exceeds the sixth part by 4. The number is
a) 84 b) 44 c) 48 d) none of these
6. Ten years ago the age of a father was four times of his son. Ten years hence the age of the father will be twice that of his son. The present ages of the father and the son are.
a) (50, 20) b) (60, 20) c) (55, 25) d) none of these
7. The product of two numbers is 3200 and the quotient when the larger number is divided by the smaller is 2. The numbers are
a) (16, 200) b) (160, 20) c) (60, 30) d) (80, 40)
8. The denominator of a fraction exceeds the numerator by 2. If 5 be added to the numerator the fraction increases by unity. The fraction is.
a) $\frac{5}{7}$ b) $\frac{1}{3}$ c) $\frac{7}{9}$ d) $\frac{3}{5}$
9. Three persons Mr. Roy, Mr. Paul and Mr. Singh together have ₹ 51. Mr. Paul has ₹ 4 less than Mr. Roy and Mr. Singh has got ₹ 5 less than Mr. Roy. They have the money as.
a) (₹ 20, ₹16, ₹ 15) b) (₹ 15, ₹20, ₹ 16)
c) (₹ 25, ₹11, ₹ 15) d) none of these
10. A number consists of two digits. The digits in the ten's place is 3 times the digit in the unit's place. If 54 is subtracted from the number the digits are reversed. The number is
a) 39 b) 92 c) 93 d) 94
11. One student is asked to divide a half of a number by 6 and other half by 4 and then to add the two quantities. Instead of doing so the student divides the given number by 5. If the answer is 4 short of the correct answer then the number was
a) 320 b) 400 c) 480 d) none of these.
12. If a number of which the half is greater than $\frac{1}{5}$ th of the number by 15 then the number is
a) 50 b) 40 c) 80 d) none of these.

ANSWERS

Exercise (B)

1. (c) 2. (b) 3. (a) 4. (b) 5. (c) 6. (a) 7. (d) 8. (d)
9. (a) 10. (c) 11. (c) 12. (a)

UNIT -3

SIMULTANEOUS LINEAR EQUATIONS IN TWO AND THREE UNKNOWNNS

EXERCISE (C)

Choose the most appropriate option (a), (b), (c) or (d).

1. The solution of the set of equations $3x + 4y = 7, 4x - y = 3$ is

- a) $(1, -1)$ b) $(1, 1)$ c) $(2, 1)$ d) $(1, -2)$

2. The values of x and y satisfying the equations $\frac{x}{2} + \frac{y}{3} = 2, x + 2y = 8$ are given by the pair.

- a) $(3, 2)$ b) $(-2, -3)$ c) $(2, 3)$ d) none of these

3. $\frac{x}{p} + \frac{y}{q} = 2, x + y = p + q$ are satisfied by the values given by the pair.

- a) $(x = p, y = q)$ b) $(x = q, y = p)$ c) $(x = 1, y = 1)$ d) none of these

4. The solution for the pair of equations

$\frac{1}{16x} + \frac{1}{15y} = \frac{9}{20}, \frac{1}{20x} - \frac{1}{27y} = \frac{4}{45}$ is given by

- a) $\left(\frac{1}{4}, \frac{1}{3}\right)$ b) $\left(\frac{1}{3}, \frac{1}{4}\right)$ c) $(3, 4)$ d) $(4, 3)$

5. Solve for x and y: $\frac{4}{x} - \frac{5}{y} = \frac{x+y}{xy} + \frac{3}{10}$ and $3xy = 10(y-x)$.

- a) $(5, 2)$ b) $(-2, -5)$ c) $(2, -5)$ d) $(2, 5)$

6. The pair satisfying the equations $x + 5y = 36, \frac{x+y}{x-y} = \frac{5}{3}$ is given by

- a) $(16, 4)$ b) $(4, 16)$ c) $(4, 8)$ d) none of these

7. Solve for x and y: $x - 3y = 0, x + 2y = 20$.

- a) $x = 4, y = 12$ b) $x = 12, y = 4$ c) $x = 5, y = 4$ d) none of these

8. The simultaneous equations $7x - 3y = 31, 9x - 5y = 41$ have solutions given by

- a) $(-4, -1)$ b) $(-1, 4)$ c) $(4, -1)$ d) $(3, 7)$

9. $1.5x + 2.4y = 1.8, 2.5(x+1) = 7y$ have solutions as

- a) $(0.5, 0.4)$ b) $(0.4, 0.5)$ c) $\left(\frac{1}{2}, \frac{2}{5}\right)$ d) $(2, 5)$

10. The values of x and y satisfying the equations

$$\frac{3}{x+y} + \frac{2}{x-y} = 3, \quad \frac{2}{x+y} + \frac{3}{x-y} = 3\frac{2}{3} \text{ are given by}$$

- a) (1,2) b) (-1,-2) c) $\left(1, \frac{1}{2}\right)$ d) (2,1)

ANSWERS

Exercise (C)

1. (b) 2. (c) 3. (a) 4. (a) 5. (d) 6. (a) 7. (b) 8. (c)
9. (b) 10. (d)

UNIT -4

EXERCISE (D)

1. $1.5x + 3.6y = 2.1, 2.5(x+1) = 6y$

- a) (0.2, 0.5) b) (0.5, 0.2) c) (2, 5) d) (-2, -5)

2. $\frac{x}{5} + \frac{y}{6} + 1 = \frac{x}{6} + \frac{y}{5} = 28$

- a) (6, 9) b) (9, 6) c) (60, 90) d) (90, 60)

3. $\frac{x}{4} = \frac{y}{3} = \frac{z}{2}; \quad 7x + 8y + 5z = 62$

- a) (4, 3, 2) b) (2, 3, 4) c) (3, 4, 2) d) (4, 2, 3)

4. $\frac{xy}{x+y} = 20, \quad \frac{yz}{y+z} = 40, \quad \frac{zx}{z+x} = 24$

- a) (120, 60, 30) b) (60, 30, 120) c) (30, 120, 160) d) (30, 60, 120)

5. $2x + 3y + 4z = 0, x + 2y - 5z = 0, 10x + 16y - 6z = 0$

- a) (0, 0, 0) b) (1, -1, 1) c) (3, 2, -1) d) (1, 0, 2)

6. $\frac{1}{3}(x+y) + 2z = 21, 3x - \frac{1}{2}(y+z) = 65, x + \frac{1}{2}(x+y-z) = 38$

- a) (4, 9, 5) b) (2, 9, 5) c) (24, 9, 5) d) (5, 24, 9)

7. $\frac{4}{x} - \frac{5}{y} = \frac{x+y}{xy} + \frac{3}{10} \quad 3xy = 10(y-x)$

- a) (2,5) b) (5,2) c) (2,7) d) (3,4)

8. $\frac{x}{0.01} + \frac{y+0.03}{0.05} = \frac{y}{0.02} + \frac{x+0.03}{0.04} = 2$

- a) (1,2) b) (0.1,0.2) c) (0.01,0.02) d) (0.02,0.01)

9. $\frac{xy}{y-x} = 110, \quad \frac{yz}{z-y} = 132, \quad \frac{zx}{z+x} = \frac{60}{11}$

- a) (12,11,10) b) (10,11,12) c) (11,10,12) d) (12,10,11)

10. $3x - 4y + 70z = 0, \quad 2x + 3y - 10z = 0, \quad x + 2y + 3z = 13$

- a) (1,3,7) b) (1,7,3) c) (2,4,3) d) (-10,10,1)

ANSWERS

Exercise (D)

1. (a) 2. (c) 3. (a) 4. (d) 5. (a) 6. (c) 7. (a) 8. (c)
9. (b) 10. (d)

UNIT -5

EXERCISE (E)

Choose the most appropriate option (a), (b), (c) or (d).

- Monthly incomes of two persons are in the ratio 4 : 5 and their monthly expenses are in the ratio 7 : 9. If each saves ₹ 50 per month find their monthly incomes.
a) (500,400) b) (400,500) c) (300,600) d) (350,550)
- Find the fraction which is equal to $\frac{1}{2}$ when both its numerator and denominator are increased by 2. It is equal to $\frac{3}{4}$ when both are increased by 12.
a) $\frac{3}{8}$ b) $\frac{5}{8}$ c) $\frac{2}{8}$ d) $\frac{2}{3}$
- The age of a person is twice the sum of the ages of his two sons and five years ago his age was thrice the sum of their ages. Find his present age.
a) 60 years b) 52 years c) 51 years d) 50 years
- A number between 10 and 100 is five times the sum of its digits. If 9 be added to it the digits are reversed find the number.
a) 54 b) 53 c) 45 d) 55
- The wages of 8 men and 6 boys amount to ₹33. If 4 men earn ₹4.50 more than 5 boys determine the wages of each man and boy.
a) (₹ 1.50, ₹3) b) (₹ 3, ₹ 1.50)
c) (₹ 2.50, ₹ 2) d) (₹ 2, ₹ 2.50)
- A number consisting of two digits is four times the sum of its digits and if 27 be added to it the digits are reversed. The number is
a) 63 b) 35 c) 36 d) 60

7. Of two numbers, $\frac{1}{5}$ th of the greater is equal to $\frac{1}{3}$ rd of the smaller and their sum is 16. The numbers are:
a) (6,10) b) (9,7) c) (12,4) d) (11,5)
8. y is older than x by 7 years 15 years back x's age was $\frac{3}{4}$ of y's age. Their present ages are:
a) ($x = 36, y = 43$) b) ($x = 50, y = 43$)
c) ($x = 43, y = 50$) d) ($x = 40, y = 47$)
9. The sum of the digits in a three digit number is 12. If the digits are reversed the number is increased by 495 but reversing only of the ten's and unit digits increases the number by 36. The number is
a) 327 b) 372 c) 237 d) 273
10. Two numbers are such that twice the greater number exceeds twice the smaller one by 18 and $\frac{1}{3}$ rd of the smaller and $\frac{1}{5}$ th of the greater number are together 21. The numbers are:
a) (36,45) b) (45,36) c) (50,41) d) (55,46)
11. The demand and supply equations for a certain commodity are $4q + 7p = 17$ and $p = \frac{q}{3} + \frac{7}{4}$. respectively where p is the market price and q is the quantity then the equilibrium price and quantity are:
a) $2, \frac{3}{4}$ b) $3, \frac{1}{2}$ c) $5, \frac{3}{5}$ d) None of these

ANSWERS

Exercise (E)

1. (b) 2. (a) 3. (d) 4. (c) 5. (b) 6. (c) 7. (a) 8. (a)
9. (c) 10. (b) 11. (a)

EXAMPLE AND ILLUSTRATION

1. If the numerator of a fraction is increased by 2 and the denominator by 1 it becomes 1. Again if the numerator is decreased by 4 and the denominator by 2 it becomes $\frac{1}{2}$. Find the fraction.
2. The age of a man is three times the sum of the ages of his two sons and 5 years hence his age will be double the sum of their ages. Find the present age of the man?
3. A number consist of three digit of which the middle one is zero and the sum of the other digits is 9. The number formed by interchanging the first and third digits is more than the original number by 297 find the number.

UNIT -6

QUADRATIC EQUATION

QUADRATIC EQUATION:

An equation of the form $ax^2 + bx + c = 0$ where x is a variable and a, b, c are constants with $a \neq 0$ is called a quadratic equation or equation of the second degree.

When $b = 0$ the equation is called a pure quadratic equation; when $b \neq 0$ the equation is called an affected quadratic.

Examples:

i) $2x^2 + 3x + 5 = 0$

ii) $x^2 - x = 0$

iii) $5x^2 - 6x - 3 = 0$

The value of the variable say x is called the root of the equation. A quadratic equation has got two roots.

Sum and Product of the Roots:

Let one root be α and the other root be β

$$\text{Now } \alpha + \beta = \frac{-b + \sqrt{b^2 - 4ac}}{2a} + \frac{-b - \sqrt{b^2 - 4ac}}{2a} = \frac{-b + \sqrt{b^2 - 4ac} - b - \sqrt{b^2 - 4ac}}{2a}$$

$$= \frac{-2b}{2a} = \frac{-b}{a}$$

Thus sum of roots $= -\frac{b}{a} = -\frac{\text{coefficient of } x}{\text{coefficient of } x^2}$

$$\text{Net } \alpha\beta = \left(\frac{-b + \sqrt{b^2 - 4ac}}{2a} \right) \left(\frac{-b - \sqrt{b^2 - 4ac}}{2a} \right) = \frac{c}{a}$$

So the product of the roots $= \frac{c}{a} = \frac{\text{constant term}}{\text{coefficient of } x^2}$

HOW TO CONSTRUCT A QUADRATIC EQUATION

For the equation $ax^2 + bx + c = 0$ **we have**

$$\text{or } x^2 + \frac{b}{a}x + \frac{c}{a} = 0$$

$$\text{or } x^2 - \left(-\frac{b}{a} \right)x + \frac{c}{a} = 0$$

$$\text{or } x^2 - (\text{Sum of the roots})x + \text{Product of the roots} = 0$$

NATURE OF THE ROOTS

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

- i) If $b^2 - 4ac = 0$ the roots are real and equal;
 - ii) If $b^2 - 4ac > 0$ then the roots are real and unequal (or distinct);
 - iii) If $b^2 - 4ac < 0$ then the roots are imaginary;
 - iv) If $b^2 - 4ac$ perfect square ($\neq 0$) the roots are real, rational and unequal (distinct);
 - v) If $b^2 - 4ac > 0$ but not a perfect square the roots are real, irrational and unequal.
- Since $b^2 - 4ac > 0$ discriminates the roots $b^2 - 4ac$ is called the discriminant in the equation $ax^2 + bx + c = 0$ as it actually discriminates between the roots.

Note: (a) Irrational roots occur in conjugate pairs that is if $(m + \sqrt{n})$ is a root

then $(m - \sqrt{n})$ is the other root of the same equation.

(b) If one root is reciprocal to the other root then their product is 1 and so

$$\frac{c}{a} = 1 \text{ i.e. } c = a$$

(c) If one root is equal to other root but opposite in sign then.

their sum = 0 and so $\frac{b}{a} = 0$ i.e. $b = 0$.

UNIT -6

EXERCISE (F)

Choose the most appropriate option (a) (b) (c) or (d).

1. If the roots of the equation $2x^2 + 8x - m^3 = 0$ are equal then value of m is
a) -3 b) -1 c) 1 d) -2

2. If $2^{2x+3} - 3^2 \cdot 2^x + 1 = 0$ then values of x are
a) 0,1 b) 1,2 c) 0,3 d) 0,-3

3. The values of $4 + \frac{1}{4 + \frac{1}{4 + \frac{1}{4 + \dots \infty}}}$

a) $1 \pm \sqrt{2}$ b) $2 + \sqrt{5}$ c) $2 \pm \sqrt{5}$ d) none of these

4. If $\alpha\beta$ be the roots of the equation $2x^2 - 4x - 3 = 0$ the value of $\alpha^2 + \beta^2$ is
a) 5 b) 7 c) 3 d) -4

5. If the sum of the roots of the quadratic equation $ax^2 + bx + c = 0$ is equal to the sum of the squares of their reciprocals then $\frac{a^2}{ac} + \frac{bc}{a^2}$ is equal to
a) 2 b) -2 c) 1 d) -1

6. The equation $x^2 - (p+4)x + 2p+5 = 0$ has equal roots the values of p will be.
a) ± 1 b) 2 c) ± 2 d) -2

7. The roots of the equation $x^2 + (2p-1)x + p^2 = 0$ are real if.
a) $p \geq 1$ b) $p \leq 4$ c) $p \geq 1/4$ d) $p \leq 1/4$

8. If $x = m$ is one of the solutions of the equation $2x^2 + 5x - m = 0$ the possible values of m are
a) (0,2) b) (0,-2) c) (0,1) d) (1,-1)

9. If p and q are the roots of $x^2 + 2x + 1 = 0$ then the values of $p^3 + q^3$ becomes
a) 2 b) -2 c) 4 d) -4

10. If $L + M + N = 0$ and L, M, N are rationals the roots of the equation $(M+N-L)x^2 + (N+L-M)x + (L+M-N)$ are
a) real and irrational b) real and rational
c) imaginary and equal d) real and equal

11. If α and β are the roots of $x^2 = x + 1$ then value of $\frac{\alpha^2}{\beta} - \frac{\beta^2}{\alpha}$ is

- a) $2\sqrt{5}$ b) $\sqrt{5}$ c) $3\sqrt{5}$ d) $-2\sqrt{5}$

12. If $p \neq q$ and $p^2 = 5p - 3$ and $q^2 = 5q - 3$ the equation having roots as $\frac{p}{q}$ and $\frac{q}{p}$ is

- a) $x^2 - 19x + 3 = 0$ b) $3x^2 - 19x - 3 = 0$
c) $3x^2 - 19x + 3 = 0$ d) $3x^2 + 19x + 3 = 0$

13. If one root of $5^2x + 13x + p = 0$ be reciprocal of the other then the value of p is

- a) -5 b) 5 c) $1/5$ d) $-1/5$

Exercise (F)

1. (d) 2. (d) 3. (b) 4. (b) 5. (a) 6. (c) 7. (d) 8. (b)
9. (a) 10. (b) 11. (d) 12. (c) 13. (d)

EXAMPLE AND ILLUSTRATION:

1. Examine the nature of the roots of the following equations.

- i) $x^2 - 8x + 16 = 0$ ii) $3x^2 - 8x + 4 = 0$
iii) $5x^2 - 4x + 2 = 0$ iv) $2x^2 - 6x - 3 = 0$

2. If α and β be the roots of $x^2 + 7x + 12 = 0$ find the equation whose roots are $(\alpha + \beta)^2$ and $(\alpha - \beta)^2$.

2. If α, β be the roots of $2x^2 - 4x - 1 = 0$ find the value of $\frac{\alpha^2}{\beta} + \frac{\beta^2}{\alpha}$

3. Solve $x: 4^x - 3 \cdot 2^{x+2} + 2^5 = 0$

4. Solve $\left(x - \frac{1}{x}\right)^2 + 2\left(x + \frac{1}{x}\right) = 7\frac{1}{4}$

5. Solve i.e. $2^{x-2} + 2^{3-x} = 3$

6. If one root of the equation is $2 - \sqrt{3}$ from the equation given that the roots are irrational

7. If $\alpha \beta$ are the two of the equation $x^2 - px + q = 0$ from the equation

whose roots are $\frac{\alpha}{\beta}$ and $\frac{\beta}{\alpha}$.

8. If the roots of the equation $p(q-r)x^2 + q(r-p)x + (p-q) = 0$

are equal show that $\frac{2}{q} = \frac{1}{p} + \frac{1}{r}$.

UNIT -7

EXERCISE (G)

Choose the most appropriate option (a) (b) (c) or (d).

1. A solution of the quadratic equation $(a+b-2c)x^2 + (2a-b-c)x + (c+a-2b) = 0$ is

- a) $x=1$ b) $x=-1$ c) $x=2$ d) $x=-2$

2. If the root of the equation $x^2 - 8x + m = 0$ exceeds the other by 4 then the value of m is

- a) $m=10$ b) $m=11$ c) $m=9$ d) $m=12$

3. The values of x in the equation

$$7(x+2p)^2 + 5p^2 = 35xp + 117p^2 \text{ are}$$

- a) $(4p, -3p)$ b) $(4p, 3p)$ c) $(-4p, 3p)$ d) $(-4p, -3p)$

4. The solutions of the equation $\frac{6x}{x+1} + \frac{6(x+1)}{x} = 13$ are

- a) $(2, 3)$ b) $(3, -2)$ c) $(-2, -3)$ d) $(2, -3)$

5. The satisfying values of x for the equation

$$\frac{1}{x+p+q} = \frac{1}{x} + \frac{1}{p} + \frac{1}{q} \text{ are}$$

- a) (p, q) b) $(-p, -q)$ c) $(p, -q)$ d) $(-p, q)$

6. The values of x for the equation $x^2 + 9x + 18 = 6 - 4x$ are

- a) $(1, 12)$ b) $(-1, -12)$ c) $(1, -12)$ d) $(-1, 12)$

7. The values of x satisfying the equation $\sqrt{(2x^2 + 5x - 2)} - \sqrt{(2x^2 + 5x - 9)} = 1$ are

- a) $(2, -9/2)$ b) $(4, -9)$ c) $(2, 9/2)$ d) $(2, 9/2)$

8. The solution of the equation $3x^2 - 17x + 24 = 0$ are

- a) $(2,3)$ b) $\left(2, 3\frac{2}{3}\right)$ c) $\left(3, 2\frac{2}{3}\right)$ d) $\left(3, \frac{2}{3}\right)$

9. The equation $\frac{3(3x^2+15)}{6} + 2x^2 + 9 = \frac{2x^2+96}{7} + 6$

has got the solution as

- a) $(1,1)$ b) $(1/2, -1)$ c) $(1, -1)$ d) $(2, -1)$

10. The equation $\left(\frac{l-m}{2}\right)x^2 - \left(\frac{l+m}{2}\right)x + m = 0$ has got two values of x to satisfy the equation given as

- a) $\left(1, \frac{2m}{l-m}\right)$ b) $\left(1, \frac{m}{l-m}\right)$ c) $\left(1, \frac{2l}{l-m}\right)$ d) $\left(1, \frac{1}{l-m}\right)$

Exercise (G)

1. (b) 2. (d) 3. (a) 4. (d) 5. (b) 6. (b) 7. (a) 8. (c)
9. (c) 10. (a)

UNIT -8

EXERCISE (H)

Choose the most appropriate option (a) (b) (c) or (d).

- The sum of two numbers is 8 and the sum of their squares is 34. Taking one number as x form an equation in x and hence find the numbers. The numbers are
a) $(7,10)$ b) $(4,4)$ c) $(3,5)$ d) $(2,6)$
- The difference of two positive integers is 3 and the sum of their squares is 89. Taking the smaller integer as x form a quadratic equation and solve it to find the integers. The integers are.
a) $(7,4)$ b) $(5,8)$ c) $(3,6)$ d) $(2,5)$
- Five times of a positive whole number is 3 less than twice the square of the number. The number is
a) 3 b) 4 c) -3 d) 2
- The area of a rectangular field is 2000 sq.m and its perimeter is 180m. Form a

quadratic equation by taking the length of the field as x and solve it to find the length and breadth of the field. The length and breadth are

a) $(205m, 80m)$ b) $(50m, 40m)$ c) $(60m, 50m)$ d) none

5. Two squares have sides p cm and $(p+5)$ cms. The sum of their squares is 625 sq. cm. The sides of the squares are
a) $(10cm, 30cm)$ b) $(12cm, 25cm)$
c) $15cm, 20cm$ d) none of these
6. Divide 50 into two parts such that the sum of their reciprocals is $1/12$. The numbers are
a) $(24, 26)$ b) $(28, 22)$ c) $(27, 23)$ d) $(20, 30)$
7. There are two consecutive numbers such that the difference of their reciprocals is $1/240$. The numbers are
a) $(15, 16)$ b) $(17, 18)$ c) $(13, 14)$ d) $(12, 13)$
8. The hypotenuse of a right-angled triangle is 20cm. The difference between its other two sides be 4cm. The sides are
a) $(11cm, 15cm)$ b) $(12cm, 16cm)$ c) $(20cm, 24cm)$ d) none of these
9. The sum of two numbers is 45 and the mean proportional between them is 18. The numbers are
a) $(15, 30)$ b) $(32, 13)$ c) $(36, 9)$ d) $(25, 20)$
10. The sides of an equilateral triangle are shortened by 12 units 13 units and 14 units respectively and a right angle triangle is formed. The side of the equilateral triangle is
a) 17 units b) 16 units c) 15 units d) 18 units
11. A distributor of apple Juice has 5000 bottle in the store that it wishes to distribute in a month. From experience it is known that demand D (in number of bottles) is given by $D = -2000p^2 + 2000p + 17000$. The price per bottle that will result zero inventory is
a) ₹ 3 b) ₹ 5 c) ₹ 2 d) none of these
12. The sum of two irrational numbers multiplied by the larger one is 70 and their difference is multiplied by the smaller one is 12; the two numbers are
a) $3\sqrt{2}, 2\sqrt{3}$ b) $5\sqrt{2}, 3\sqrt{5}$ c) $2\sqrt{2}, 5\sqrt{2}$ d) none of these

EXAMPLE AND ILLUSTRATION :

1. Difference between a number and its positive square root is 12; find the numbers?
2. A piece of iron rod costs ₹ 60. If the rod was 2 metre shorter and each metre costs ₹ 1.00 more, the cost would remain unchanged. What is the length of the rod?

3. Divide 25 into two parts so that sum of their reciprocals is $1/6$.

Exercise (H)

1. (c) 2. (b) 3. (a) 4. (b) 5. (c) 6. (d) 7. (a) 8. (b)
9. (c) 10. (a) 11. (a) 12. (c)

UNIT -9

EXERCISE (I)

Choose the most appropriate option (a), (b), (c) or (d)

1. The solution of the cubic equation $x^3 - 6x^2 + 11x - 6 = 0$ is given by the triplet:

- a) $(-1, 1, -2)$ b) $(1, 2, 3)$ c) $(-2, 2, 3)$ d) $(0, 4, -5)$

2. The cubic equation $x^3 + 2x^2 - x - 2 = 0$ has 3 roots namely.

- a) $(-1, 1, -2)$ b) $(-1, 1, 2)$ c) $(-1, 2, -2)$ d) $(1, 2, 2)$

3. $x, x-4, x+5$ are the factors of the left-hand side of the equation

- a) $x^3 + 2x^2 - x - 2 = 0$ b) $x^3 + x^2 - 20x = 0$
c) $x^3 - 3x^2 - 4x + 12 = 0$ d) $x^3 - 6x^2 + 11x - 6 = 0$

4. The equation $3x^3 + 5x^2 = 3x + 5$ has got 3 roots and hence the factors of the left-hand side of the equation $3x^3 + 5x^2 - 3x - 5 = 0$ are

- a) $x-1, x-2, x-5/3$ b) $x-1, x+1, 3x+5$
c) $x+1, x-1, 3x-5$ d) $x-1, x+1, x-2$

5. The roots of the equation $x^3 + 7x^2 - 21x = 0$ are

- a) $(-3, -9, -1)$ b) $(3, -9, -1)$
c) $(3, 9, 1)$ d) $(-3, 9, 1)$

6. The roots of $x^3 + 7x^2 - 21x = 0$ are

- a) $(-1, -1, 1)$ b) $(1, 1, -1)$ c) $(-1, -1, -1)$ d) $(1, 1, 1)$

7. The satisfying value of $x^3 + x^2 - 20x = 0$ are

- a) $(1, 4, -5)$ b) $(2, 4, -5)$ c) $(0, -4, -5)$ d) $(0, 4, -5)$

8. The roots of the cubic equation $x^3 + 7x^2 - 21x - 27 = 0$ are

- a) $(-3, -9, -1)$ b) $(3, -9, -1)$ c) $(3, 9, 1)$ d) $(-3, 9, 1)$

9. If $4x^3 + 8x^2 - x - 2 = 0$ then value of $(2x+3)$ is given by
 a) 4, -1, 2 b) -4, 2, 1 c) 2, -4, -1 d) none of these

10. The rational root of the equation $2x^3 - x^2 - 4x + 2 = 0$ is
 a) $\frac{1}{2}$ b) $-\frac{1}{2}$ c) 2 d) -2.

Exercise (I)

1. (c) 2. (b) 3. (b) 4. (b) 5. (b) 6. (a) 7. (d) 8. (b)
 9. (a) 10. (c)

ADDITIONAL QUESTION BANK

1. Solving equation $x^2 - (a+b)x + ab = 0$ are, value(s) of x
 (a) a, b b) a c) b d) None
2. Solving equation $x^2 - 24x + 135 = 0$ are, value(s) of x
 a) 9, 6 b) 9, 15 c) 15, 6 d) None
3. If $\frac{x}{b} + \frac{b}{x} = \frac{a}{b} + \frac{b}{a}$ the roots of the equation are
 a) $a, b^2/a$ b) $a^2, b/a^2$ c) $a^2, b^2/a$ d) a, b^2
4. Solving equation $\frac{6x+2}{4} + \frac{2x^2-1}{2x^2+2} = \frac{10x-1}{4x}$ we get roots as
 a) ± 1 b) +1 c) -1 d) 0
5. Solving equation $3x^2 - 14x + 16 = 0$ we get roots as
 a) ± 1 b) 2 and $\frac{8}{3}$ c) 0 d) None
6. Solving equation $3x^2 - 14x + 8 = 0$ we get roots as
 a) ± 4 b) ± 2 c) $4\frac{2}{3}$ d) None
7. Solving equation $(b-c)x^2(c-a)x + (a-b) = 0$ following roots are obtained
 a) $\frac{a-b}{b-c}, 1$ b) $(a-b)(a-c), 1$ c) $\frac{b-c}{a-b}, 1$ d) None
8. Solving equation $7\sqrt{\frac{x}{1-x}} + 8\sqrt{\frac{1-x}{x}} = 15$ following roots are obtained
 a) $\frac{64}{113}, \frac{1}{2}$ b) $\frac{1}{50}, \frac{1}{65}$ c) $\frac{49}{50}, \frac{1}{65}$ d) $\frac{1}{50}, \frac{64}{65}$

9. Solving equation $6\left[\sqrt{\frac{x}{1-x}} + \sqrt{\frac{1-x}{x}}\right] = 13$ following roots are obtained

- a) $\frac{4}{13}, \frac{9}{13}$ b) $\frac{-4}{13}, \frac{-9}{13}$ c) $\frac{4}{13}, \frac{5}{13}$ d) $\frac{6}{13}, \frac{7}{13}$

10. Solving equation $z^2 - 6z + 9 = 4\sqrt{z^2 - 6z + 6}$ following roots are obtained

- a) $3 + 2\sqrt{3}, 3 - 2\sqrt{3}$ b) 5, 1 c) all of above d) None

11. Solving equation $\frac{x + \sqrt{12p - x}}{x - \sqrt{12p - x}} = \frac{\sqrt{p+1}}{\sqrt{p-1}}$ following roots are obtained

- a) $3p$ b) both $3p$ and $-4p$ c) only $-4p$ d) $-3p4p$

12. Solving equation $(1+x)^{2/3} + (1-x)^{2/3} = 4(1-x^2)^{1/3}$ are, values of x

- a) $\frac{5}{\sqrt{3}}$ b) $-\frac{5}{\sqrt{3}}$ c) $\pm \frac{5}{3\sqrt{3}}$ d) $\pm \frac{15}{\sqrt{3}}$

13. Solving equation $(2x+1) + (2x+3)(x-1)(x-2) = 150$ the roots available are

- a) $\frac{1 \pm \sqrt{129}}{4}$ b) $\frac{7}{2}, -3$ c) $-\frac{7}{2}, 3$ d) None

14. Solving equation $(2x+3) + (2x+5)(x-1)(x-2) = 30$ the roots available are

- a) $0, \frac{1}{2}, \frac{11}{4}, \frac{9}{4}$ b) $0, -\frac{1}{2}, \frac{-1 \pm \sqrt{105}}{4}$ c) $0, -\frac{1}{2}, -\frac{11}{4}, \frac{9}{4}$ d) None

15. Solving equation $z + \sqrt{z} = \frac{6}{25}$ the value of z works out to

- a) $\frac{1}{5}$ b) $\frac{2}{5}$ c) $\frac{1}{25}$ d) $\frac{2}{25}$

16. Solving equation $z^{10} - 33z^5 + 32 = 0$ the following value of z are obtained

- a) 1, 2 b) 2, 3 c) 2, 4 d) 1, 2, 3

17. When $\sqrt{2z+1} + \sqrt{3z+4} = 7$ the value of z is given by

- a) 1 b) 2 c) 3 d) 4

18. Solving equation $\sqrt{x^2 - 9x + 18} + \sqrt{x^2 + 2x - 15} = \sqrt{x^2 - 4x + 3}$ following roots are obtained

- a) $3, \frac{2 \pm \sqrt{94}}{3}$ b) $\frac{2 \pm \sqrt{94}}{3}$ c) $4, -\frac{8}{3}$ d) $3, 4 - \frac{8}{3}$

19. Solving equation $\sqrt{y^2 + 4y - 21} + \sqrt{y^2 - y - 6} = \sqrt{6y^2 - 5y - 39}$ following roots are obtained

- a) 2, 3, 5/3 b) 2, 3, -5/3 c) -2, -3, 5/3 d) -2, -3, -5/3

20. Solving equation $6x^4 + 11x^3 - 9x^2 - 11x + 6 = 0$ following roots are obtained

- a) $\frac{1}{2}, -2, \frac{-1 \pm \sqrt{37}}{6}$ b) $-\frac{1}{2}, 2, \frac{-1 \pm \sqrt{37}}{6}$ c) $\frac{1}{2}, -2, \frac{5}{6}, \frac{-7}{6}$ d) None

21. If $\frac{x-bc}{d+c} + \frac{x-ca}{c+a} + \frac{x-ab}{a+b} = a+b+c$ the value of x is

- a) $a^2 + b^2 + c^2$ b) $a + (a+b+c)$ c) $(a+b)(b+c)$ d) $ab+bc+ca$

22. If $\frac{x+2}{x-2} - \frac{x-2}{x+2} = \frac{x-1}{x+3} - \frac{x+3}{x-3}$ then the value of x are

- a) $0, \pm\sqrt{6}$ b) $0, \pm\sqrt{3}$ c) $0, \pm 2\sqrt{3}$ d) None

23. If $\frac{x-a}{b} + \frac{x-b}{a} = \frac{b}{x-a} + \frac{a}{x-b}$ then the value of x are

- a) $0, (a+b)(a-b)$ b) $0, (a+b), \frac{a^2+b^2}{a+b}$ c) $0, (a-b), \frac{a^2+b^2}{a+b}$ d) $\frac{a^2+b^2}{a+b}$

24. If $\frac{x-a^2b^2}{c^2} + \frac{c^2}{x-a^2-b^2} = 2$ the value of is

- a) $a^2 + b^2 + c^2$ b) $-a^2 - b^2 - c^2$ c) $\frac{1}{a^2+b^2+c^2}$ d) $-\frac{1}{a^2+b^2+c^2}$

25. Solving equation $\left(x - \frac{1}{x}\right)^2 - 6\left(x + \frac{1}{x}\right) + 12 = 0$ we get roots as follows

- a) 0 b) 1 c) -1 d) None

26. Solving equation $\left(x - \frac{1}{x}\right)^2 - 10\left(x - \frac{1}{x}\right) + 24 = 0$ we get roots as follows

- a) 0 b) 1 c) -1 d) $(2 \pm \sqrt{5}), (3 \pm \sqrt{10})$

27. Solving equation $2\left(x - \frac{1}{x}\right)^2 - 5\left(x + \frac{1}{x} + 2\right) + 18 = 0$ we get roots as under

- a) 0 b) 1 c) -1 d) $-2 \pm \sqrt{3}$

28. If α, β are the roots of equation $x^2 - 5x + 6 = 0$ and $\alpha > \beta$ then the equation with roots $(\alpha - \beta)$ is

- a) $x^2 - 6x + 5 = 0$ b) $2x^2 - 6x + 5 = 0$ c) $2x^2 - 5x + 6 = 0$ d) $x^2 - 5x + 6 = 0$

29. If α, β are the roots of equation $x^2 - 5x + 6 = 0$ and $\alpha > \beta$ then the equation with roots $(\alpha^2 + \beta)$ and $(\alpha + \beta^2)$ is

- a) $x^2 - 9x + 99 = 0$ b) $x^2 - 18x + 90 = 0$ c) $x^2 - 18x + 77 = 0$ d) None

30. If α, β are the roots of equation $x^2 - 5x + 6 = 0$ and $\alpha > \beta$ then the equation with

roots $(\alpha\beta + \alpha + \beta)$ and $(\alpha\beta - \alpha - \beta)$ is

- a) $x^2 - 12x + 11 = 0$ b) $2x^2 - 6x + 12 = 0$ c) $x^2 - 12x + 12 = 0$ d) None

31. The condition that one of $ax^2 + bx + c = 0$ the roots of is twice the other is

- a) $b^2 = 4ca$ b) $2b^2 = 9(c+a)$ c) $2x^2 = 9ca$ d) $2b^2 = 9(c-a)$

32. The condition that one of $ax^2 + bx + c = 0$ the roots of is thrice the other is

- a) $3b^2 = 16ca$ b) $b^2 = 9ca$ c) $3b^2 = -16ca$ d) $b^2 = -9ca$

33. If the roots of $ax^2 + bx + c = 0$ are in the ratio $\frac{p}{q}$ then the value of $\frac{b^2}{(ca)}$ is

- a) $\frac{(p+q)^2}{(pq)}$ b) $\frac{(p+q)}{(pq)}$ c) $\frac{(p-q)^2}{(pq)}$ d) $\frac{(p-q)}{(pq)}$

34. Solving $6x + 5y - 16 = 0$ and $3x - y - 1 = 0$ we get values of x and y as

- a) 1,1 b) 1,2 c) -1,2 d) 0,2

35. Solving $x^2 + y^2 - 25 = 0$ and $x - y - 1 = 0$ we get the roots as under

- a) $\pm 3 \pm 4$ b) $\pm 2 \pm 3$ c) 0, 3, 4 d) 0, -3, -4

36. Solving $\sqrt{\frac{x}{y}} + \sqrt{\frac{y}{x}} - \frac{5}{2} = 0$ and $x + y - 5 = 0$ we get the roots as under

- a) 1,4 b) 1,2 c) 1,3 d) 1,5

37. Solving $\frac{1}{x^2} + \frac{1}{y^2} - 13 = 0$ and $\frac{1}{x} + \frac{1}{y} - 5 = 0$ we get the roots as under

- a) $\frac{1}{8}, \frac{1}{5}$ b) $\frac{1}{2}, \frac{1}{3}$ c) $\frac{1}{13}, \frac{1}{5}$ d) $\frac{1}{4}, \frac{1}{5}$

38. Solving $x^2 + xy - 21 = 0$ and $xy - 2y^2 + 20 = 0$ we get the roots as under

- a) $\pm 1, \pm 2$ b) $\pm 2, \pm 3$ c) $\pm 3, \pm 4$ d) None

39. Solving $x^2 + xy + y^2 = 37$ and $3xy + 2y^2 = 68$ we get the following roots

- a) $\pm 3, \pm 4$ b) $\pm 4, \pm 5$ c) $\pm 2, \pm 3$ d) None

40. Solving $4^x \cdot 2^y = 128$ and $3^{3x+2y} = 9^{xy}$ we get the following roots

- a) $\frac{7}{4}, \frac{7}{2}$ b) 2,3 c) 1,2 d) 1,3

41. Solving $9^x = 3^y$ and $5^{x+y+1} = 25^{xy}$ we get the following roots

- a) 1,2 b) 0,1 c) 0,3 d) 1,3

42. Solving $9x + 3y - 4z = 3, x + y = 0$ and $2x - 5y - 4z = 0$ following roots are obtained

- a) 2,3,4 b) 1,3,4 c) 1,2,3 d) None

43. Solving $x + 2y + 2z = 0$, $3x - 4y + z = 0$ and $x^2 + 3y^2 + z^2 = 11$ following roots are obtained

- a) 2, 1, -2 and -2, -1, 2 b) 2, 1, 2 and -2, -1, -2
c) only 2, 1, -2 d) only -2, -1, 2

44. Solving $x^3 - 6x^2 + 11x - 6 = 0$ get the following roots

- a) -1, -2, 3 b) 1, 2, -3 c) 1, 2, 3 d) -1, -2, -3

45. Solving $x^3 + 9x^2 - x - 9 = 0$ get the following roots

- a) $\pm 1, -9$ b) $\pm 1, \pm 9$ c) $\pm 1, 9$ d) None

46. It is being given that one of the roots is half the sum of the other two solving

$x^3 - 12x^2 + 47x - 60 = 0$ get the following roots :

- a) 1, 2, 3 b) 3, 4, 5 c) 2, 3, 4 d) -3, -4, -5

47. Solve $x^3 + 3x^2 - x - 3 = 0$ given that the roots are in arithmetical progression

- a) -1, 1, 3 b) 1, 2, 3 c) -3, -1, 1 d) -3, -2, -1

48. Solve $x^3 - 7x^2 + 14x - 8 = 0$ given that the roots are in geometrical progression

- a) $\frac{1}{2}, 1, 2$ b) 1, 2, 4 c) $\frac{1}{2}, -1, 2$ d) -1, 2, -4

49. Solve $x^3 - 6x^2 + 5x + 12 = 0$ given that the product of the two roots is 12

- a) 1, 3, 4 b) -1, 3, 4 c) 1, 6, 2 d) 1, -6, -2

50. Solve $x^3 - 5x^2 - 2x + 24 = 0$ given that two of its roots being in the ratio of 3:4

- a) -2, 4, 3 b) -1, 4, 3 c) 2, 4, 3 d) -2, -4, -3

ANSWERS

1.	(a)	18.	(a)	35.	(a)
2.	(b)	19.	(b)	36.	(a)
3.	(a)	20.	(a)	37.	(b)
4.	(b)	21.	(d)	38.	(c)
5.	(b)	22.	(d)	39.	(a)
6.	(c)	23.	(d)	40.	(a), (b)
7.	(a)	24.	(a)	41.	(a)
8.	(a)	25.	(b)	42.	(c)

9.	(a)	26.	(d)	43.	(a)
10.	(c)	27.	(d)	44.	(c)
11.	(a)	28.	(a)	45.	(a)
12.	(c)	29.	(c)	46.	(b)
13.	(a)	30.	(a)	47.	(c)
14.	(b)	31.	(c)	48.	(b)
15.	(c)	32.	(a)	49.	(b)
16.	(a)	33.	(a)	50.	(a)
17.	(d)	34.	(b)		

PREVIOUS YEAR QUESTION:

2015 - June

92. The number of students in each section of a school is 36. After admitting 12 new students, four new sections were started. If total number of students in each section now is 30, than the number of sections initially were.
- (a) 6 (b) 10 (c) 14 (d) 18
93. If α and β be the roots of the quadratic equation $2x^2 - 4x = 1$, the value of $\frac{\alpha^2}{\beta} + \frac{\beta^2}{\alpha}$ is _____.
- (a) -11 (b) 22 (c) -22 (d) 11

94. A person on a tour has Rs. 9,600 for his expenses. If his tour is extended by 16 days, he has to cut down his daily expenses by Rs. 20, his original duration of tour had been.

- (a) 48 days (b) 64 days (c) **80 days** (d) 96 days

95. The present age of a man is 8 years more than thrice the sum of the ages of his two grandsons who are twins. After 8 years, his age will be 10 years more than twice the sum of the ages of his grandsons. The age of a man when his grandsons were born was:

- (a) 86 years (b) **73 years** (c) 68 years (d) 63 years

96. The roots of the cubic equation $x^3 - 7x + 6 = 0$ are:

- (a) 1, 2 and 3 (b) 1, -2 and 3 (c) **1, 2 and -3** (d) 1, -2 and -3

2015 - December

97. If the roots of the equation $4x^2 - 12x + k = 0$ are equal, then the value of k is:

- (a) -3 (b) 3 (c) -9 (d) **9**

98. If $\alpha + \beta = -2$ and $\alpha\beta = -3$, then α, β are the roots of the equation, which is:

- (a) $x^2 - 2x - 3 = 0$ (b) **$x^2 + 2x - 3 = 0$**
(c) $x^2 + 2x + 3 = 0$ (d) $x^2 - 2x + 3 = 0$

2016 - June

99. Let E_1 and E_2 are two linear equations in two variables x and y. (0, 1) is a solution of both equations E_1 and E_2 . (2, -1) is a solution of equation E_1 only and (-2, -1) is solution of E_2 only then E_1 and E_2 are _____.

- (a) $X = 0, y = 1$ (b) $2x - y = -1, 4x + y = 1$
(c) **$x + y = 1, x - y = -1$** (d) $x + 2y = 2, x + y = 1$

100. If difference between the roots of the equation $x^2 - kx + 8 = 0$ is 4, then the value of K is:

- (a) 0 (b) ± 4 (c) $\pm 8\sqrt{3}$ (d) **$\pm 4\sqrt{3}$**

101. If, $2^{x+y} = 2^{2x-y} = \sqrt{8}$ then the respective values of X and Y are —.

- (a) **$1, \frac{1}{2}$** (b) $\frac{1}{2}, 1$ (c) $\frac{1}{2}, \frac{1}{2}$ (d) None of these.

2016 - December

102. A cottage industry produces a certain number of pottery articles in a day. It was observed on a particular day that the cost of each article (in Rs.) was 2 more than thrice the number of articles produced on that day. if the total cost of production on that day was Rs. 800, the number of articles produced was

- (a) 14 (b) **16** (c) 12 (d) 18

2017-June

103. If the sides of an equilateral triangle are shortened by 3 units, 4 units and 5 units respectively and a right triangle is formed, then the side of an equilateral triangle is:

- (a) 6 units (b) 7 units (c) **8 units** (d) 10 units.

104. If α, β are the roots of the equation $x^2 + x + 5 = 0$ then $\frac{\alpha^2}{\beta} + \frac{\beta^2}{\alpha}$ is equal to

- (a) $\frac{16}{5}$ (b) 2 (c) 3 (d) $\frac{14}{5}$

105. If $\frac{3}{x+y} + \frac{2}{x-y} = -1$ and $\frac{1}{x+y} - \frac{1}{x-y} = \frac{4}{3}$ then (x, y) is :

- (a) (2,1) (b) **(1,2)** (c) (-1,2) (d) (-2,1)

2017 - December

106. The roots of the cubic equation $x^3 + 7x^2 - 21x - 27 = 0$ are

- (a) -1, 3, 9 (b) 1, -3, 9 (c) **-1, 3, -9** (d) -1, -- 3, 9

107. The difference between the roots of the equation $x^2 - 7x - 9 = 0$ is :

- (a) 7 (b) $\sqrt{85}$ (c) 9 (d) $2\sqrt{85}$

108. If the sum of two numbers is 13 and the sum of their squares is 85, then the numbers will be;

- (a) 3, 10 (b) 5, 8 (c) 4, 9 (d) **6, 7**

109. If $u^{5x} = v^{5y} = w^{5z}$ and $u^2 = vw$, then the value of $xy + xz - 2yz$ will be:

- (a) 5 (b) 2 (c) 1 (d) **0**

2018 - May

110. If $\alpha + \beta = -2$ and $\alpha\beta = -3$, then α, β are the roots of the equation, which is;

- (a) $x^2 - 2x - 3 = 0$ (b) **$x^2 + 2x - 3 = 0$**

- (c) $x^2 + 2x + 3 = 0$ (d) $x^2 - 2x + 3 = 0$

111. If $2^{x+y} = 2^{2x-y} = \sqrt{8}$, then the respective values of x and y are _____

- (a) **$1, \frac{1}{2}$** (b) $\frac{1}{2}, 1$ (c) $\frac{1}{2}, \frac{1}{2}$ (d) None of these

112. If $\frac{3}{x+y} + \frac{2}{x-y} = -1$ and $\frac{1}{x+y} - \frac{1}{x-y} = \frac{4}{3}$ then (x, y) is:

- (a) (2,1) (b) **(1,2)**

- (c) (-1,2) (d) (-2,1)

113. If the sides of an equilateral triangle are shortened by 3 units, 4 units and 5 units respectively and a right triangle is formed then the sides of an equilateral triangle is:

- (a) 6 units (b) 7 units (c) **8 units** (d) 10 units

114. If α, β are the roots of the equation $x^2 + x + 5 = 0$ then $\frac{\alpha^2}{\beta} + \frac{\beta^2}{\alpha}$ is equal to

- (a) $\frac{16}{5}$ (b) 2 (c) 3 (d) $\frac{14}{5}$

2018 - November

115. Let α and β be the roots of $x^2 + 7x + 12 = 0$. Then the value of $\left(\frac{\alpha^2}{\beta} + \frac{\beta^2}{\alpha}\right)$ will be:

- (a) $\frac{7}{12} + \frac{12}{7}$ (b) $\frac{49}{144} + \frac{144}{49}$ (c) $-\frac{91}{12}$ (d) None of the above,

116. When two roots of quadratic equation are $\alpha, \frac{1}{\alpha}$ then what will be the quadratic equation:

- (a) $\alpha x^2 - (\alpha^2 + 1)x + \alpha = 0$
(b) $\alpha x^2 - \alpha^2 x + 1 = 0$
(c) $\alpha x^2 - (\alpha^2 + 1)x + 1 = 0$
(d) None of these

2019 - June

117. A number consists of two digits such that the digit in one's place is thrice the digit in ten's place. If 36 be added then the digits are reversed. Find the number _____.

- (a) 62
(b) 26
(c) 39
(d) None of these

118. Find the condition that one root is double the other of $ax^2 + bx + c = 0$

- (a) $2b^2 = 3ac$
(b) $b^2 = 3ac$
(c) $2b^2 = 9ac$
(d) $2b^2 > 9ac$

2019 - November

119. Roots of the equation $x^3 + 9x^2 - x - 9 = 0$.

- (a) 1, 2, 3
(b) 1, -1, -9
(c) 2, 3, -9
(d) 1, -3, 9

120. $\frac{2x+5}{10} + \frac{3x+10}{15} = 5$

- (a) 10.58
(b) 9.58
(c) 9.5
(d) None

121. Find value of $x^2 - 10x + 1$ if $x = \frac{1}{5-2\sqrt{6}}$

(a)25

(b)1

(c)0

(d)49

122. Find the value, of K in $3x^2 - 2kx + 5 = 0$

if $-x = 2$

(a) 17/4

(b) - 7/14

(c) 4/17

(d) -4/17

2020 - November

123. The rational root of the equation

$$0 = 2p^3 - p^2 - 4n + 2 \text{ is;}$$

(a)2

(b)-2

(c)1/2

(d)-1/2

124. If $2x^2 - (a + 6) 2x + 12a - 0$, then the roots are:

(a)6 and a

(b)4 and a^2

(c)3 and $2a$

(d)6 and $3a$

125. Solving equation $m + \sqrt{m} = 6/25$, the value of m works out to:

(a)1/25

(b)2/25

(c)3/25

(d)1

2021 - January

126. The value of P/or which the difference between the root of equation $x^2 + px + 8 = 0$ $1 < 2$ is

(a) ± 2

(b) ± 4

(c) ± 6

(d) ± 8 (1 mark)

127. If the quadratic equation $x^2 + px + q = 0$ and $x^2 + qx + p = 0$ have a common root then $p + q = ?$

(a)0

(b)1

(c)-1

(d)2

128. The harmonic mean of the roots of the equation

$$(5 + \sqrt{2})x^2 - (4 + \sqrt{5})x + 8 + 2\sqrt{5} = 0 \text{ is}$$

(a)2

(b)4

(c)6

(d)8

2021 - July

129. If α and β are the roots of the equation $2x^2 + 5x + k = 0$, and $4(\alpha^2 + \beta^2 + \alpha\beta) = 23$, then which of the following is true?

(a) $k^2 + 3k - 2 = 0$

(b) $k^2 - 2k + 3 = 0$

(c) $k^2 - 2k - 3 = 0$

(d) $k^2 - 3k + 2 = 0$

130. The value of 'k' is _____, if 2 is the root of the following cubic equation:
 $x^3 - (k+1)x + k = 0$.

(a)2

(b)6

(c)1

(d)4

Answer:

(b) $x^3 - (k+1)x + k = 0$

$$\Rightarrow 2^3 - (k+1)2 + k = 0$$

$$\Rightarrow 8 - 2k - 2 + k = 0$$

$$\Rightarrow 6 - k = 0$$

$$\Rightarrow k = 6$$

131. The cost of 2 oranges and 3 apples is Rs. 28. If the cost of an apple is doubled then the cost of 3 oranges and 5 apples is Rs. 75. The original cost of 7 oranges and 4 apples (in Rs.) is:

(a) 59

(b)47

(c)71

(d)63

132. The sum of square of any real positive quantity and its reciprocal is never less than:

(a)1

(b)2

(c)3

(d)4

2021 - DECEMBER

133. If one root is half of the other of a quadratic equation and the difference in roots is a, then the equation is

(a) $x^2 + ax + 2a^2 = 0$

(b) $x^2 - 3ax - 2a^2 = 0$

(c) $x^2 - 3ax + 2a^2 = 0$

(d) $x^2 + 3ax - 2a^2 = 0$

134. In a multiple choice question paper consisting of 100 questions of 1 mark each, a candidate gets 60% marks. If the candidate attempted all questions and there was a penalty of 0.25 marks for wrong answer, the difference between number of right answers and wrong answers is:

(a)32

(b) 36

(c)40

(d)38

135. If the square of a number exceeds twice of the number by 15, then number that satisfies the condition is

(a)-5

(b)3

(c)5

(d)15

136. Solve $x^3 - 7x + 6 = 0$

(a) $x = 6, 7, -4$

(b) $x = -1, -2, -3$

(c) $x = 1, 2, -3$

(d) $x = 2, 4, 6$

JUNE 2022

137. If the second Root of the given equation is reciprocal of first Root then the value of K in the Equation

$$5x^2 - 13x + k = 0$$

(a)3

(b)2

(c)5

(d)1

138. A plumber can be paid either Rs 600 and Rs 50 per hour or Rs 170 per hour .if the job takes n hour ,for what values of n the method earns wages for the plumber

- (a) 5 (b) 6 (c) 4 (d) 7

139. If a person has cloth of total 91 cm .if he divides into 3 parts then the longest parts is twice the shortest one and another part is 3 cm more than shortest ,what is the shortest one ?

- (a) 25 (b) 44 (c) 22 (d) 46

DEC 2022

140. If the roots of the equation $x^2 - px + q = 0$ are in the ratio 2:3, then

- A. $p^2 = 25q$ B. $p^2 = 6q$ C. $6p^2 = 5q$ D. $6p^2 = 25q$

141. The solutions of the following system of linear equations: $2x - 5y + 4 = 0$ and $2x + y - 8 = 0$ will be

- A. (2, -3) B. (1, -3) C. (3, 2) D. (-2, 2)

142. What will be the value of k, if the roots of the equation $(k - 4)x^2 - 2kx + (k + 5) = 0$ are equal?

- A. 18 B. 20 C. 19 D. 21

JUNE 2023

143. The largest side of a triangle is 3 times the shortest sides and third sides is 4 cm shorter than the longest sides. If the perimeters of triangle is 59. What is the length of shortest side

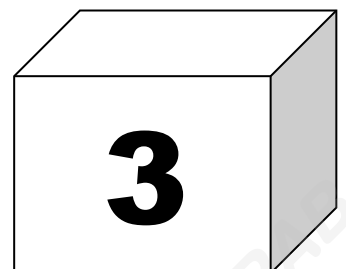
- (a) Less than 7 cm
(b) Greater than or equal to 7 cm
(c) Less than 9 cm
(d) Greater than or equal to 9 cm

144. If α and β are roots of equation of $x^2 - (n^2 + 1)x + 1/2(n^2 + n + 1) = 0$ find value of $\alpha^2 + \beta^2$

- A. 2n B. n C. $2n^2$ D. n^3

145. The age of a man is four times the sum of the of his two sons and after 10 years his age will be double the sum of their ages .find the present age of men

- (a) 56
(b) 45
(c) 60
(d) 64



LINEAR INEQUALITIES

EXERCISE: 3 (A)

Choose the correct answer/answers

1 (i) An employer recruits experienced (x) and fresh workmen (y) for his firm under the condition that he cannot employ more than 9 people, x and y can be related by the inequality

- (a) $x + y \neq 9$ (b) $x + y \leq 9$ $x \geq 0, y \geq 0$ (c) $x + y \geq 9$ $x \geq 0, y \geq 0$ (d) none of these

(ii) On the average experienced person does 5 units of work while a fresh one 3 units of work daily but the employer has to maintain an output of at least 30 units of work per day. This situation can be expressed as

- (a) $5x + 3y \leq 30$ (b) $5x + 3y > 30$ (c) $5x + 3y \geq 30$ $x \geq 0, y \geq 0$ (d) none of these

(iii) The rules and regulations demand that the employer should employ not more than 5 experienced hands to 1 fresh one and this fact can be expressed as

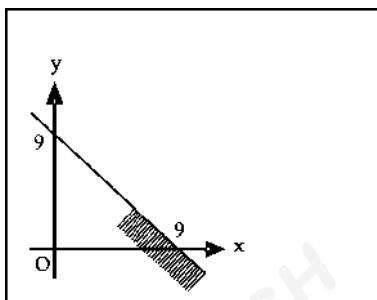
- (a) $y \geq x/5$ (b) $5y \leq x$ (c) $5y \geq x$ (d) none of these

(iv) The union however forbids him to employ less than 2 experienced person to each fresh person. This situation can be expressed as

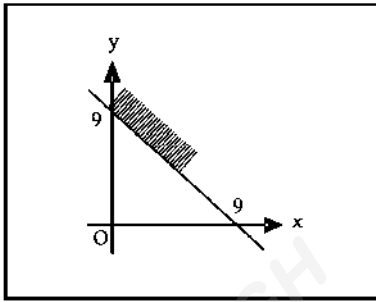
- (a) $x \leq y/2$ (b) $y \leq x/2$ (c) $y \geq x/2$ (d) $x > 2y$

(v) The graph to express the inequality $x + y \leq 9$ is

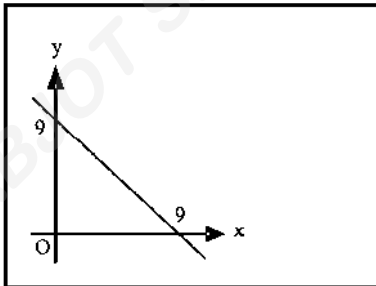
(a)



(b)



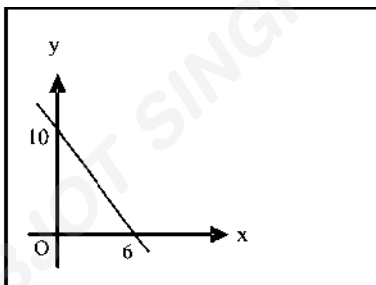
(c)



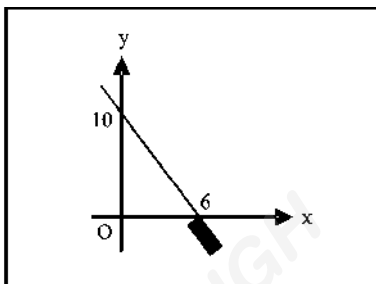
(d) none of these

(vi) The graph to express the inequality $5x + 3y \geq 30$ is

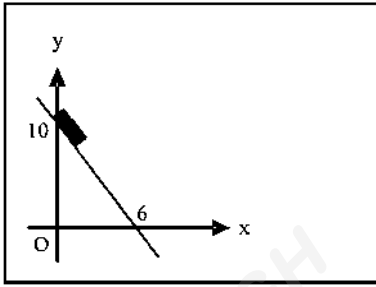
(a)



(b)



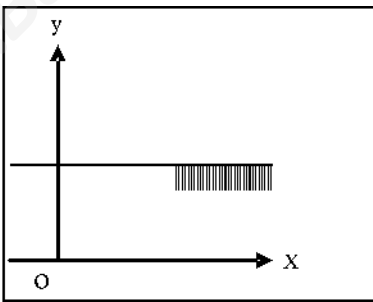
(c)



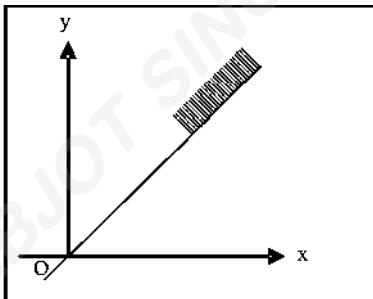
(d) none of these

(vii) The graph to express the inequality $y \leq \left(\frac{1}{2}\right)x$ is indicated by

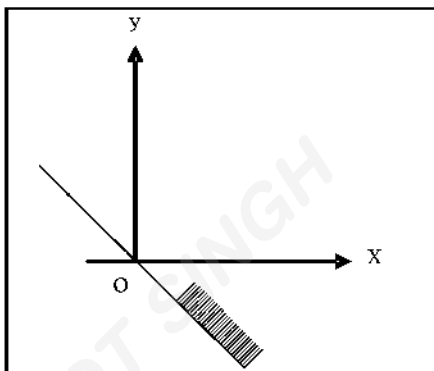
(a)



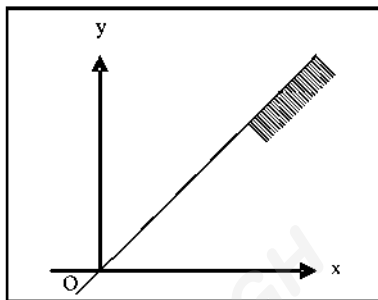
(b)



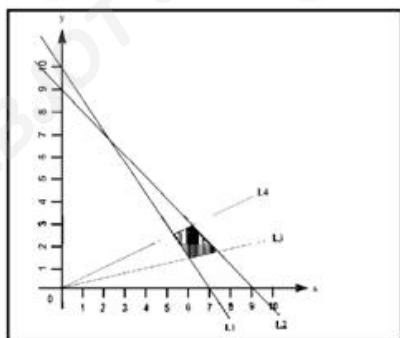
(c)



(d)



(viii)



$L1 : 5x + 3y = 30$ $L2 : x + y = 9$ $L3 : y = x/3$ $L4 : y = x/2$

The common region (shaded part) shown in the diagram refers to

(a) $5x + 3y \leq 30$ (b) $5x + 3y \geq 30$ (c) $5x + 3y \geq 30$ (d) $5x + 3y > 30$ (e) None of these

$x + y \leq 9$

$x + y \leq 9$

$x + y \geq 9$

$x + y < 9$

$y \leq 1/5 x$

$y \geq x/3$

$y \leq x/3$

$\geq$

$y < x/2$

$y < x/2$

$y > x/2$

$y < x/2$

$x \geq 0, y \geq 0$

$x \geq 0, y \geq 0$

$x \geq 0, y \geq 0$

2. A dietitian wishes to mix together two kinds of food so that the vitamin content of the mixture is at least 9 units of vitamin A, 7 units of vitamin B, 10 units of vitamin C and 12 units of vitamin D. The vitamin content per Kg. of each food is shown below:

	A	B	C	D
Food I:	2	1	1	2
Food II:	1	1	2	3

Assuming x units of food I is to be mixed with y units of food II the situation can be expressed as

(a) $2x + y \leq 9$

(b) $2x + y \geq 30$

(c) $2x + y \geq 9$

(d) $2x + y \geq 9$

$x + y \leq 7$

$x + y \leq 7$

$x + y \geq 7$

$x + y \geq 7$

$x + 2y \leq 10$

$x + 2y \geq 10$

$x + y \leq 10$

$x + 2y \geq 10$

$2x + 3y \leq 12$

$x + 3y \geq 12$

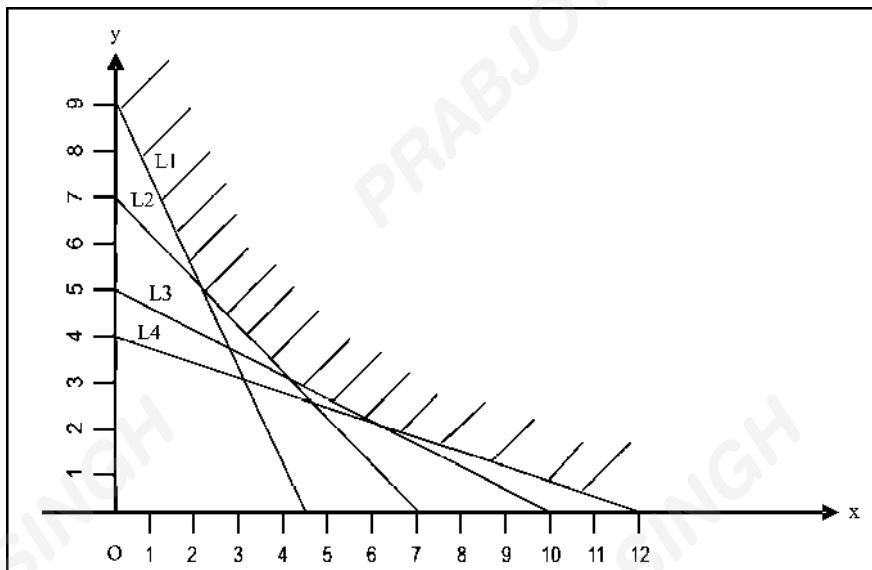
$x + 3y \geq 12$

$2x + 3y \geq 12$

$x > 0, y > 0$

$x \geq 0, y \geq 0,$

3. Graphs of the inequations are drawn below :



L1 : $2x + y = 9$ L2 : $x + y = 7$ L3 : $x + 2y = 10$ L4 : $x + 3y = 12$

The common region (shaded part) indicated on the diagram is expressed by the set of inequalities

(a) $2x + y \leq 9$

(b) $2x + y \geq 9$

(c) $2x + y \geq 9$

(d) none of these

$x + y \geq 7$

$x + y \leq 7$

$x + y \geq 7$

$x + 2y \geq 10$

$x + 2y \geq 10$

$x + 2y \geq 10$

$x + 3y \geq 12$

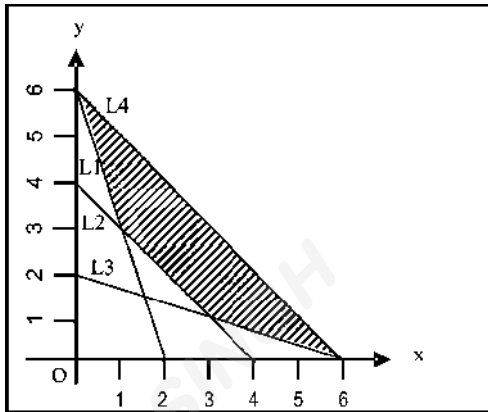
$x + 3y \geq 12$

$x + 3y \geq 12$

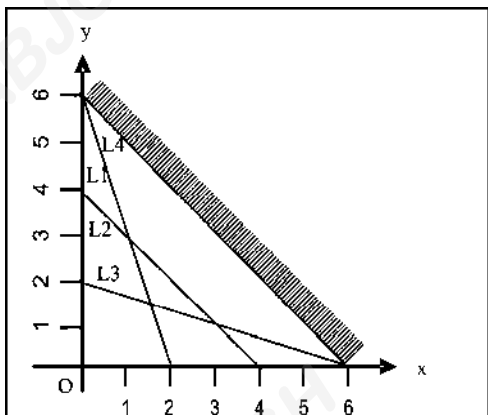
$x \geq 0, y \geq 0$

4. The common region satisfied by the inequalities L1: $3x + y \geq 6$, L2: $x + y \geq 4$, L3: $x + 3y \geq 6$, and L4: $x + y \leq 6$ is indicated by

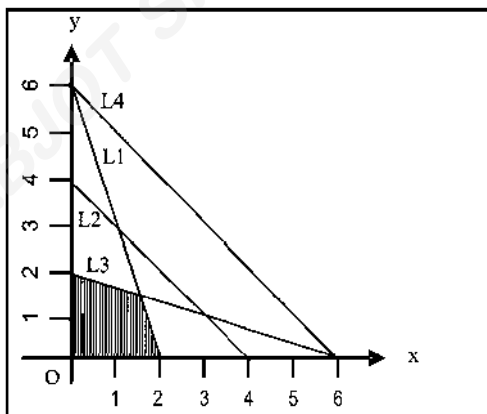
(a)



(b)

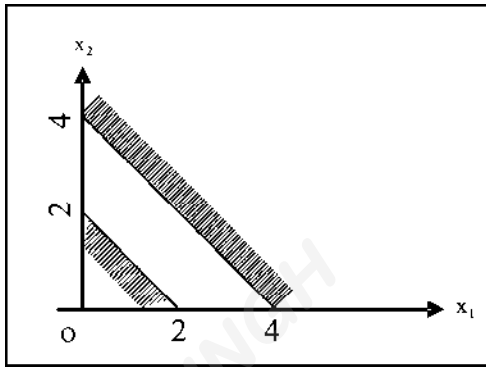


(c)



(d) None of these

5. The region indicated by the shading in the graph is expressed by inequalities



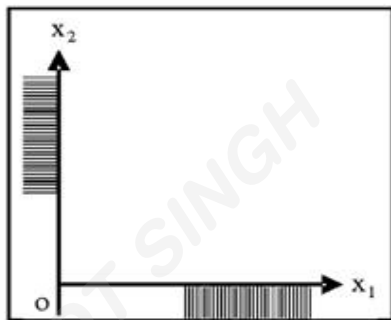
- (a) $x_1 + x_2 \leq 2$ (b) $x_1 + x_2 \leq 2$ (c) $x_1 + x_2 \geq 2$ (d) $x_1 + x_2 \leq 2$

$2x_1 + 2x_2 \geq 8$ $x_2x_1 + x_2 \leq 4$ $2x_1 + 2x_2 \geq 8$ $2x_1 + 2x_2 > 8$

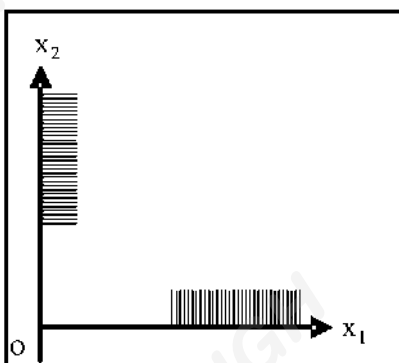
$x_1 \geq 0, x_2 \geq 0,$

6. (i) The inequalities $x_1 \geq 0, x_2 \geq 0$, are represented by one of the graphs shown below:

(a)



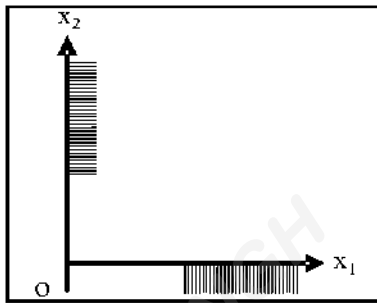
(b)



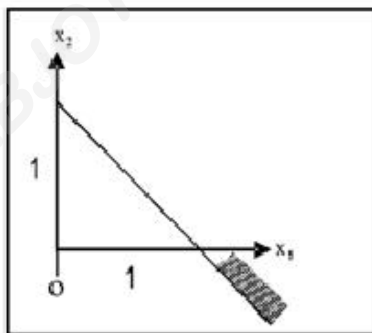
(c)



(d)



(ii)

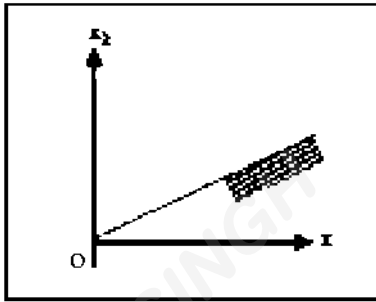


The region is expressed as

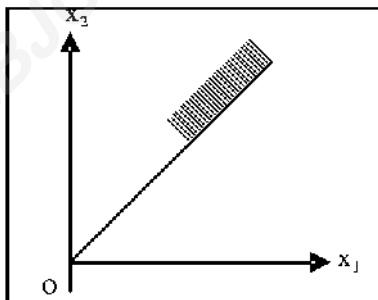
- (a) $x_1 - x_2 \geq 1$
- (b) $x_1 + x_2 \leq 1$
- (c) $x_1 + x_2 \geq 1$
- (d) none of these

(iii) The inequality $-x_1 + 2x_2 \leq 0$ is indicated on the graph as

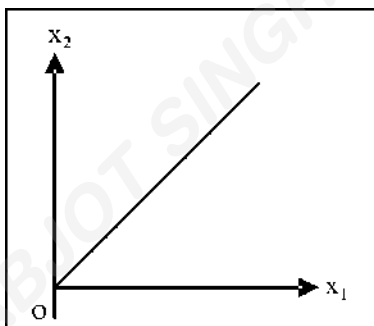
(a)



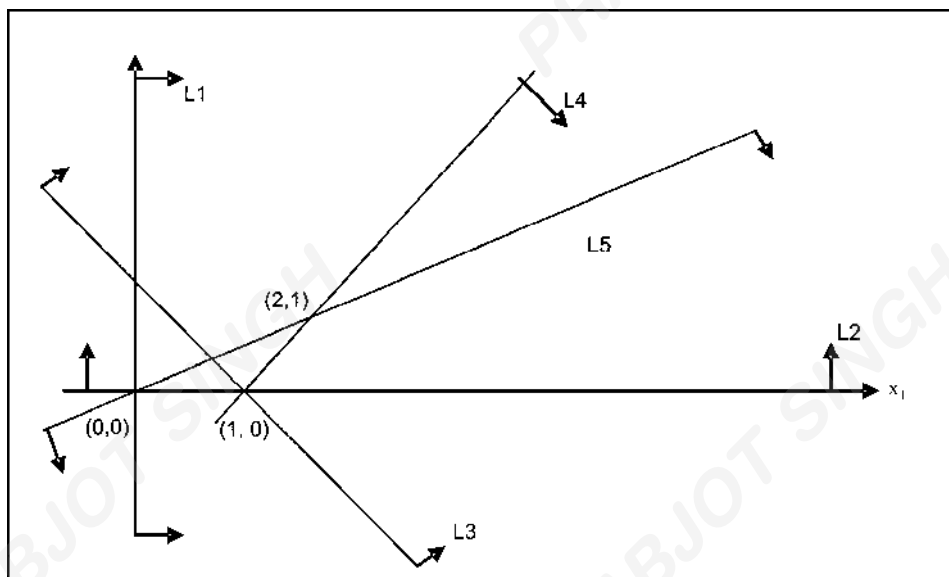
(b)



(c)



(d) None of these



The common region indicated on the graph is expressed by the set of five inequalities

(a) $L1 : x_1 \geq 0$ (b) $L1 : x_2 \geq 0$ (c) $L1 : x_1 \leq 0$ (d) None of these

$L2 : x_2 \geq 0$ $L2 : x_2 \geq 0$ $L2 : x_2 \leq 0$

$L3 : x_1 + x_2 \leq 1$ $L3 : x_1 + x_2 \geq 1$ $L3 : x_1 + x_2 \geq 1$

$L4 : x_1 - x_2 \geq 1$ $L4 : x_1 - x_2 \geq 1$ $L4 : x_1 - x_2 \geq 1$

$L5 : -x_1 + 2x_2 \leq 0$ $L5 : -x_1 + 2x_2 \leq 0$ $L5 : -x_1 + 2x_2 \leq 0$

8. A firm makes two types of products : Type A and Type B. The profit on product A is Nu. 20 each and that on product B is Nu. 30 each. Both types are processed on three machines M1, M2 and M3. The time required in hours by each product and total time available in hours per week on each machine are as follows:

Machine	Product A	Product B	Available Time
M1	3	3	36
M2	5	2	50
M3	2	6	60

The constraints can be formulated taking x_1 = number of units A and x_2 = number of unit of B as

(a) $x_1 + x_2 \leq 12$ (b) $3x_1 + 3x_2 \geq 36$ (c) $3x_1 + 3x_2 \leq 36$ (d) none of these

$5x_1 + 2x_2 \leq 50$ $5x_1 + 2x_2 \leq 50$ $5x_1 + 2x_2 \leq 50$

$$2x_1 + 6x_2 \leq 60$$

$$2x_1 + 6x_2 \geq 60$$

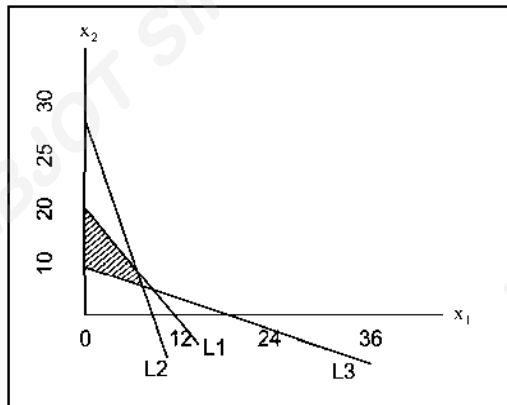
$$2x_1 + 6x_2 \leq 60$$

$$x_1 \geq 0, x_2 \geq 0$$

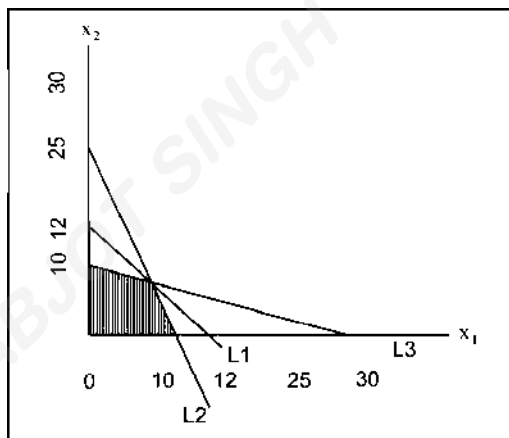
$$x_1 \geq 0, x_2 \geq 0$$

9. The set of inequalities L1: $x_1 + x_2 \leq 12$, L2: $5x_1 + 2x_2 \leq 50$, L3: $x_1 + 3x_2 \leq 30$, $x_1 \geq 0$, and $x_2 \geq 0$ is represented by

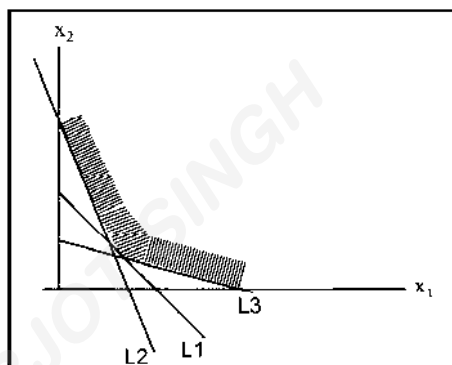
(a)



(b)



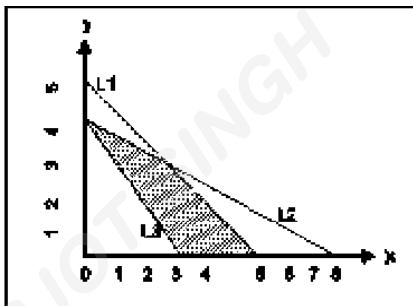
(c)



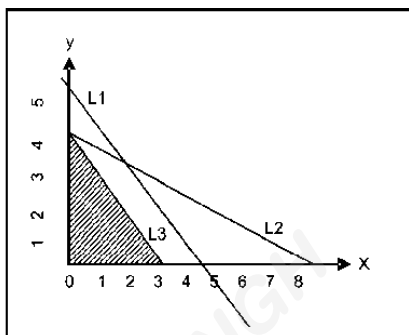
(d) None of these

10. The common region satisfying the set of inequalities $x \geq 0$, $y \geq 0$, L1: $x+y \leq 5$, L2: $x+2y \leq 8$ and L3: $4x+3y \geq 12$ is indicated by

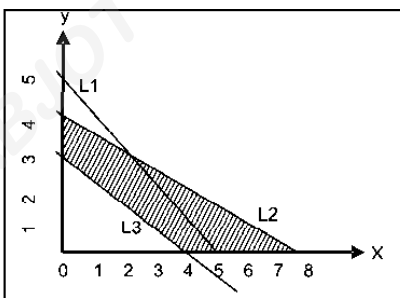
(a)



(b)



(c)



(e) None of these

(i) (b) (ii) (c) (iii) (a) (iv) (b) (v) (a) (vi) (c) (vii) (d) (viii) (e)

2. (d) 3. (c) 4. (a) 5. (a) 6. (i) (b) (ii) (c) (iii) (a)

7. (b) 8. (c) 9. (b) 10. (a)

ADDITIONAL QUESTION BANK

1. On solving the inequalities $2x + 5y \leq 20$, $2x + 2y \leq 12$, $x \geq 0$, $y \geq 0$, we get the following situation

- (a) $(0, 0)$, $(0, 4)$, $(4, 0)$ and $(\frac{20}{11}, \frac{36}{11})$ (b) $(0, 0)$, $(10, 0)$, $(0, 6)$ and $(\frac{20}{11}, \frac{36}{11})$
(c) $(0, 0)$, $(0, 4)$, $(4, 0)$ and $(2, 3)$ (d) $(0, 0)$, $(10, 0)$, $(0, 6)$ and $(2, 3)$

2. On solving the inequalities $6x + y \geq 18$, $x + 4y \geq 12$, $2x + y \geq 10$, we get the following situation

- (a) $(0, 18)$, $(12, 0)$, $(4, 2)$ and $(2, 6)$
(b) $(3, 0)$, $(0, 3)$, $(4, 2)$ and $(7, 6)$
(c) $(5, 0)$, $(0, 10)$, $(4, 2)$ and $(7, 6)$
(d) $(0, 18)$, $(12, 0)$, $(4, 2)$, $(0, 0)$ and $(7, 6)$

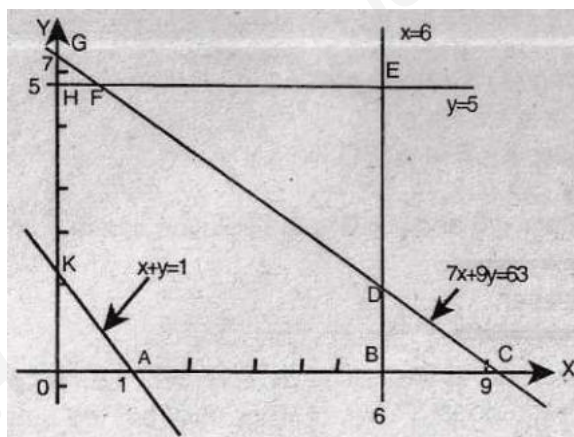
ANSWERS

1. (a) 2. (a)

PREVIOUS YEARS QUESTION

2014 - JUNE

261. The graph of linear inequalities $7x + 9y \leq 63$, $x + y \geq 1$, $0 \leq x \leq 6$ and



Common region of the inequalities is:

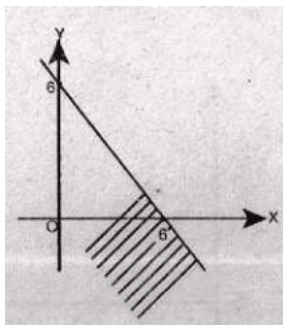
(a) BCDB and DEFD (b) Unbounded

(c) HFGH (d) **ABDFHKA**

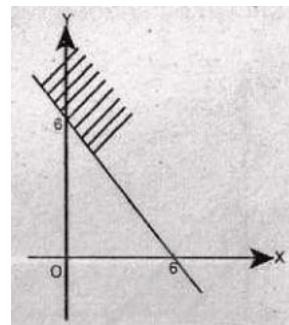
2014 - DECEMBER

262. The graph to express the inequality $x + y \leq 6$ is:

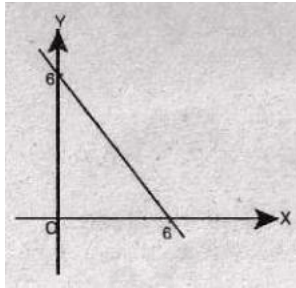
(a)



(b)

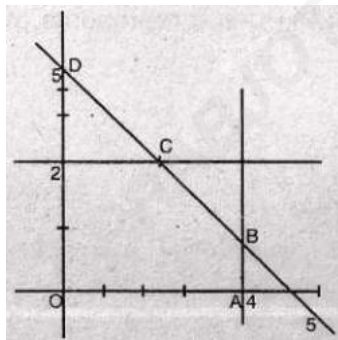


(c)



(d) None of these.

263. The graph of linear inequalities $x + y \geq 5$; $x + y \leq 5$; $0 \leq x \leq 4$ and $0 \leq y \leq 2$ is given below:



The common region of the inequalities will be:

(a) OABCEO

(b) ECDE

(c) Line Segment DC (d) Line Segment BC

2015 - JUNE

264. The common region in the graph of linear inequalities $2x + y \geq 18$, $x + y \geq 12$ and $3x + 2y \leq 34$ is:

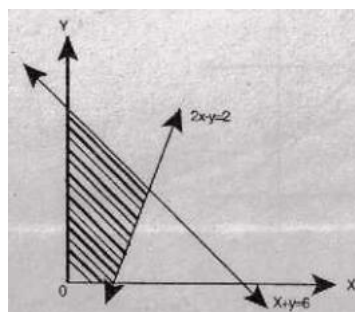
(a) unbounded (b) infeasible

(c) feasible and bounded (d) feasible and unbounded

Answer:

2015 - DECEMBER

265. The common shaded region in the graph represents the linear inequalities as:



(a) $x + y \geq 6$

$2x - y - 2 \geq 0$

$$x, y \geq 0$$

$$(b) x + y \geq 6$$

$$2x - y - 2 \leq 0$$

$$x, y \geq 0$$

$$(c) x + y \leq 6$$

$$2x - y - 2 \leq 0$$

$$x, y \geq 0$$

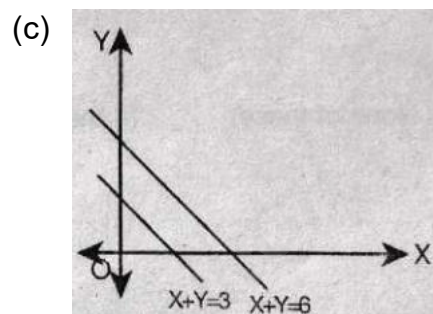
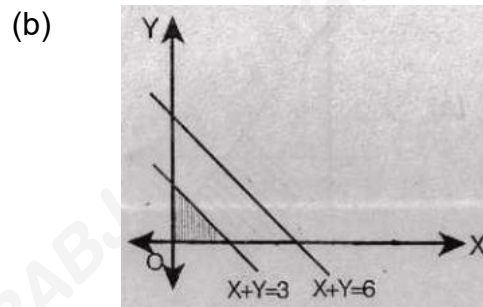
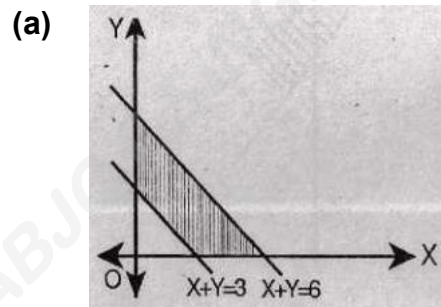
$$(d) x + y \leq 6$$

$$2x - y - 2 \geq 0$$

$$x, y \geq 0$$

2016 - JUNE

266. The common region of $x + y \leq 6$; $x + y \geq 3$; $x \geq 0$; $y \geq 0$, is (as shown by shaded region):

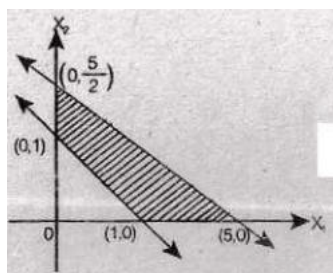


(d) None the these. (1 mark)

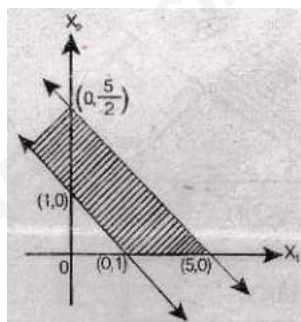
2016 - DECEMBER

267. The common region by the inequalities $x_1 + 2x_2 \leq 5$, $x_1 + x_2 \geq 1$, $x_1 \geq 0$, $x_2 \geq 0$ is given as shaded portion in:

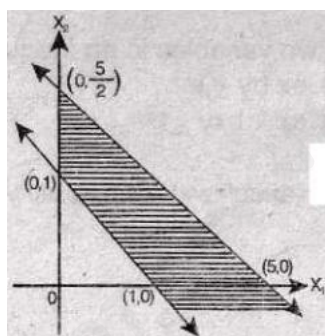
(a)



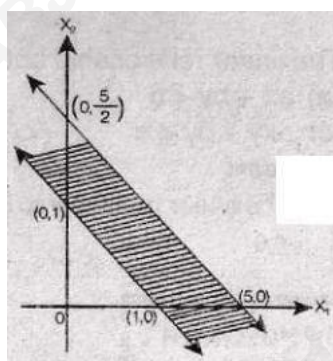
(b)



(c)



(d)



2017-JUNE

268. A dietician wishes to mix together two kinds of food so that the vitamins content of the mixture is atleast 9 units of vitamin A, 7units of vitamin B, 10 units of vitamin C, 12 units of vitamin D. The vitamin content per kg. of each food is shown in table. Assuming 'x' units of food I is to be mixed with 'y' units of food II the situation can be expressed as:

	A	B	C	D

Food I	2	1	1	2
Food II	1	1	2	3

(a) $2x + y < 9$

$x + y \leq 7$

$x + 2y \leq 10$

$2x + 3y \leq 12$

$x \geq 0, y \geq 0$

(b) $2x + y \geq 30$

$x + y \leq 7$

$x + 2y \geq 10$

$2x + 3y \geq 12$

$x \geq 0, y \geq 0$

(c) $2x + y \geq 9$

$x + y \geq 7$

$x + 2y \leq 10$

$x + 3y \leq 12$

$x \geq 0, y \geq 0$

(d) $2x + y \geq 9$

$x + y \geq 7$

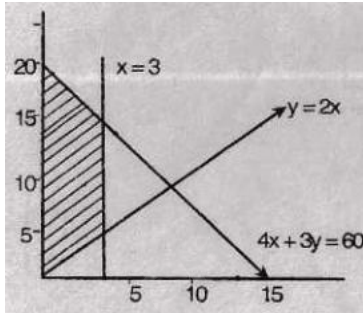
$x + 2y \geq 10$

$2x + 3y \geq 12$

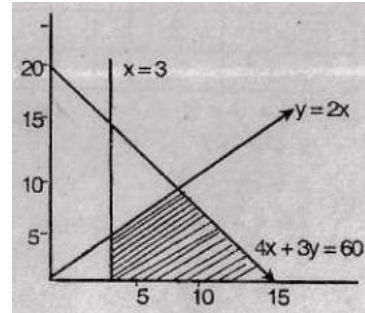
$x \geq 0, y \geq 0$

269. The common regions by the inequalities $4x + 3y \leq 60$; $y \geq 2x$; $x \geq 3$, $x \geq 0$ and $y \geq 0$ is

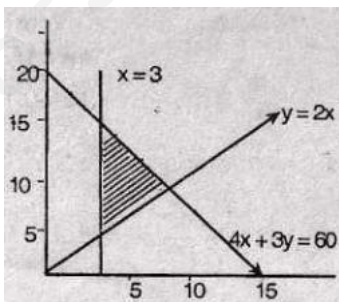
(a)



(b)



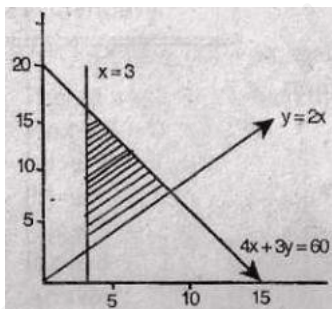
(c)



(d) None of these. (1 mark)

Answer:

(c)



2018 - MAY

270. The linear relationship between two variables in an inequality:

(a) $ax + by \leq c$ (b) $ax \cdot by \leq c$

(c) $axy + by \leq c$ (d) $ax + bxy \leq c$

2018- NOVEMBER

271. On Solving the Inequalities $5x + y \leq 100$, $x + y \leq 60$, $x \geq 0$, $y \geq 0$, we get the following solution:

(a) $(0, 0)$, $(20, 0)$, $(10, 50)$ & $(0, 60)$

(b) $(0, 0)$, $(60, 0)$, $(10, 50)$ & $(0, 60)$

(c) $(0, 0)$, $(20, 0)$, $(0, 100)$ & $(10, 50)$

(d) None of these

2019 - JUNE

272. An employer recruits experienced (x) and fresh workmen (y) for his under the condition that he cannot employ more than 11 people, x and y can related by the inequality.

(a) $x + y \neq 11$

(b) $x + y \leq 11, x \geq 0, y \geq 0$

(c) $x + y \geq 11, x \geq 0, y \geq 0$

(d) None of these (1 mark)

273. The solution set of the in equations $x + 2 > 0$ and $2x - 6 > 0$ is

(a) $(-2, \infty)$

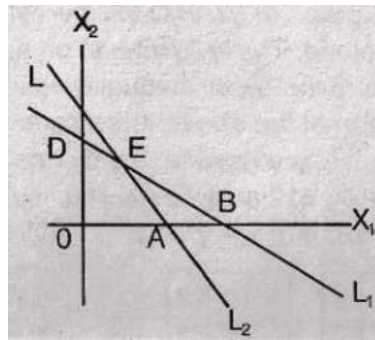
(b) $(3, \infty)$

(c) $(-\infty, -2)$

(d) $(-\infty, -3)$

274. The common region represented by the following in equalities

$L_1 = X_1 + X_2 < 4; L_2 = 2X_1 - X_2 > 6$



(a) OABC

(b) Outside of OAB

(c) ΔBCE

(d) ΔABE

2019 - NOVEMBER

275. $6x + y \geq 18, x + 4y \geq 12, 2x + y \geq 10$

On solving the inequalities; we get

(a) $(0, 18), (12, 0), (4, 2), \& (7, 6)$

(b) $(3, 0), (0, 3), (4, 2) \& (7, 6)$

(c) $(5, 0), (0, 10), (4, 2) \& (7, 6)$

(d) $(0, 18), (12, 0), (4, 2), (0, 0)$ and $(7, 6)$

2020 - NOVEMBER

276. Solve for x of the Inequalities

$2 \leq \frac{3x-2}{5} \leq 4$ where $x \leftarrow N$

- (a){5,6,7}
- (b) {3, 4, 5, 6}
- (c){4,5,6}
- (d)None**

2021 - JANUARY

277. The common region in the graph of the inequalities $x + y \leq 4$, $x - y \leq 4$, $x \geq 2$ is

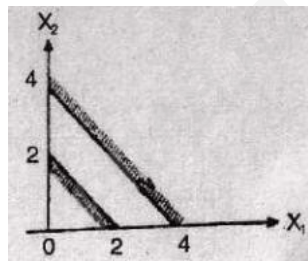
- (a)Equilateral triangle
- (b)Isosceles triangle**
- (c)Quadrilateral
- (d)Square

2021 - DECEMBER

278. XVZ Company has a policy for its recruitment as: it should not recruit more than eight men (x) to three women (y). How can this fact be expressed in inequality?

- (a) $3y \geq 8x$
- (b) $3y \leq x/8$
- (c) $8y \geq 3x$**
- (d) $8y \leq 3x$

279. The region indicated by the shading in the graph is expressed by the inequalities



(a) $x_1 + x_2 \leq 2$;

$x_1 + x_2 \geq 4$;

$x_1 \geq 0, x_2 \geq 0$

(b) $x_1 + x_2 \leq 2$;

$x_1 + x_2 \leq 4$;

$x_1 \geq 0, x_2 \geq 0$

(c) $x_1 + x_2 \geq 2$;

$$x_1 + x_2 \geq 4;$$

$$x_1 \geq 0, x_2 \geq 0$$

$$(d) x_1 + x_2 \leq 2;$$

$$x_1 + x_2 \geq 4;$$

$$x_1 \geq 0, x_2 \geq 0$$

DEC2022

280. If $2x + 5 > 3x + 2$ and $2x - 3 \leq 4x - 5$, the 'x' can take which of the following values?

A. 4

B. -4

C. 2

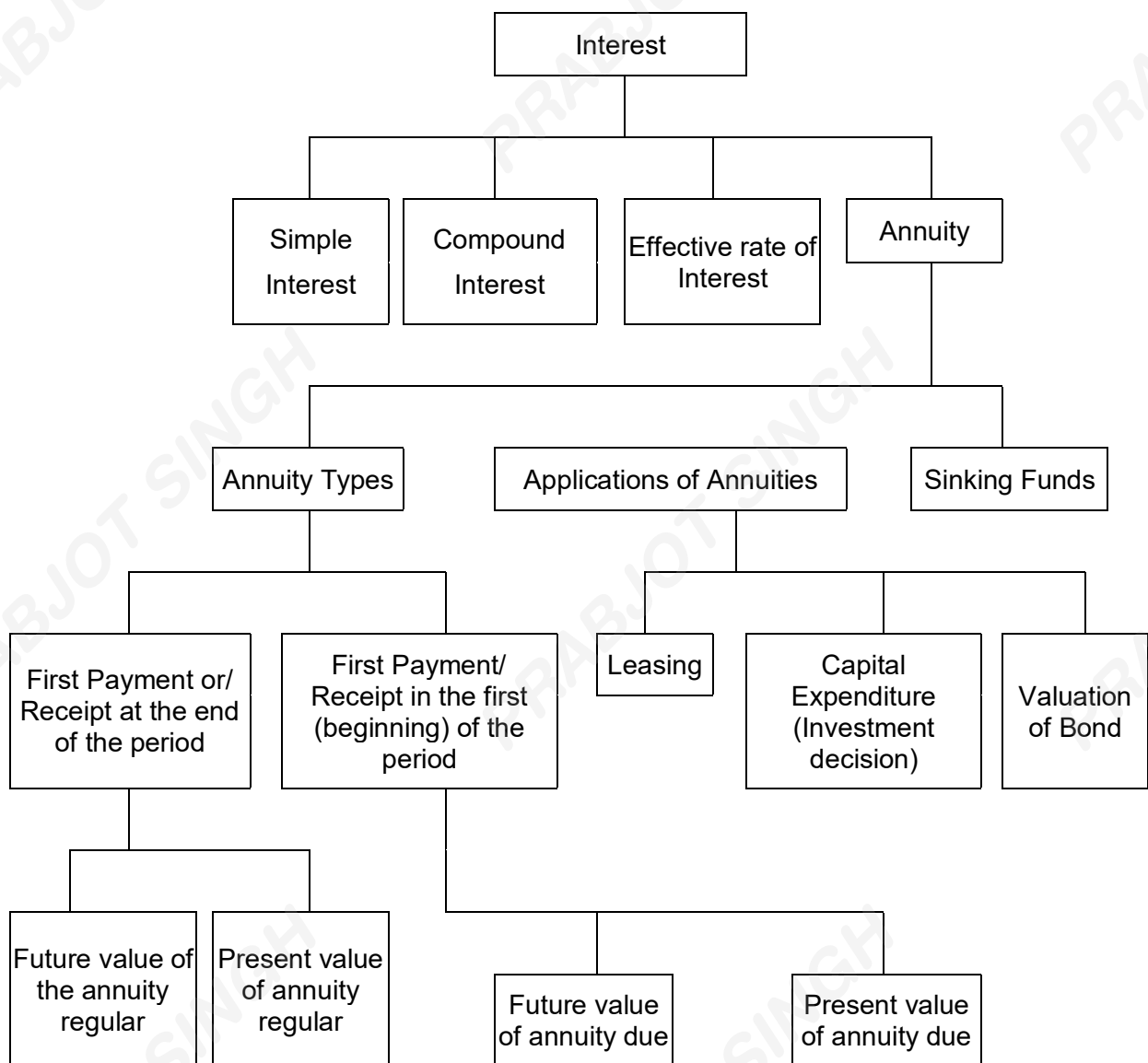
D. -2

June 2023

281. A Fertilizers company produce to fertilizers called Grade I and Grade II Each of these is processed through a critical chemical plant unit .tha plant has maximum 180 hours available in a week . manufacture one bag of grade I fertilizers required 4 hours in the plant . Manufacture one bag of grade II fertilizers required 10 hours in a plant .Express this in linear equation.

(a) $2x_1 + 5x_2 \leq 180$ B. $4x_1 + 10x_2 > 180$ C.. $2x_1 + 5x_2 > 180$ D. $4x_1 + 10x_2 \geq 180$

TIME VALUE OF MONEY



Simple interest can be computed by applying following formulas:

$$I = Pit$$

$$A = P + I$$

$$= P + Pit$$

$$= P(1 + it)$$

$$I = A - P$$

Here,

A = Accumulated amount (final value of an investment)

P = Principal (initial value of an investment)

i = Annual interest rate in decimal.

I = Amount of Interest

t = Time in years

Let us consider the following examples in order to see how exactly are these quantities related.

EXAMPLE AND ILLUSTRATION :

Example: 1 How much interest will be earned on Rs. 2000 at 6% simple interest for 2 years.

Example 2: Sania deposited Rs. **50,000** in a bank for two years with the interest rate of **5.5%** p.a. How much interest would she earn?

Example 3: In example 2 what will be the final value of investment?

Example 4: Sachin deposited Rs. 1,00,000 in his bank for 2 years at simple interest rate of 6%. How much interest would he earn? How much would be the final value of deposit?

Example 5: Find the rate of interest if the amount owed after 6 months is Rs. 1050, borrowed amount being Rs. 1000.

Example 7: Kapil deposited some amount in a bank for $7\frac{1}{2}$ years at the rate of 6% p.a. simple interest. Kapil received Rs. 1,01,500 at the end of the term. Compute initial deposit of Kapil.

Example 8: A sum of Rs. 46,875 was lent out at simple interest and at the end of 1 year 8 months the total amount was Rs. 50,000. Find the rate of interest percent per annum.

Example 9: What sum of money will produce Rs. 28,600 as an interest in 3 years and 3 months at 2.5% p.a. simple interest?

Example 10: In what time will Rs. 85,000 amount to Rs. 1,57,675 at 4.5 % p.a. ?

EXERCISE 4 (A)

Choose the most appropriate option (a) (b) (c) or (d).

1. S.I on Rs. 3,500 for 3 years at 12% per annum is

- (a) Rs. 1,200 (b) Rs. 1,260 (c) Rs. 2,260 (d) none of these

2. $P = 5,000$, $R = 15$, $T = 4$ % using $I = \frac{PRT}{100}$, I will be

- (a) Rs. 3,375 (b) Rs. 3,300 (c) Rs. 3,735 (d) none of these

3. If $P = 5,000$, $T = 1$, $I = \text{Rs. } 300$, R will be

- (a) 5% (b) 4% (c) 6% (d) none of these

4. If $P = \text{Rs. } 4,500$, $A = \text{Rs. } 7,200$, then Simple interest i.e. I will be

- (a) Rs. 2,000 (b) Rs. 3,000 (c) Rs. 2,500 (d) Rs. 2,700

5. $P = \text{Rs. } 12,000$, $A = \text{Rs. } 16,500$, $T = 2 \frac{1}{2}$ years. Rate percent per annum simple interest will be

- (a) 15% (b) 12% (c) 10% (d) none of these

6. $P = \text{Rs. } 10,000$, $I = \text{Rs. } 2,500$, $R = 12 \frac{1}{2}$ % SI. The number of years T will be

- (a) $1 \frac{1}{2}$ years (b) 2 years (c) 3 years (d) none of these

7. $P = \text{Rs. } 8,500$, $A = \text{Rs. } 10,200$, $R = 12 \frac{1}{2}$ % SI, t will be.

- (a) 1 yr. 7 mth. (b) 2 yrs. (c) $1 \frac{1}{2}$ yr. (d) none of these

8. The sum required to earn a monthly interest of Rs. 1,200 at 18% per annum SI is

- (a) Rs. 50,000 (b) Rs. 60,000 (c) Rs. 80,000 (d) none of these

9. A sum of money amount to Rs. 6,200 in 2 years and Rs. 7,400 in 3 years. The principal and rate of interest are

- (a) Rs. 3,800, 31.57% (b) Rs. 3,000, 20% (c) Rs. 3,500, 15% (d) none of these

10. A sum of money doubles itself in 10 years. The number of years it would triple itself is
- (a) 25 years. (b) 15 years. (c) 20 years (d) none of these

ANSWERS

Exercise 4(a)

1. (b) 2. (a) 3. (c) 4. (d) 5. (a) 6. (b)
7. (a) 8. (c) 9. (a) 10. (c)

Compound Interest:

We have learnt about the simple interest. We know that if the principal remains the same for the entire period or time then interest is called as simple interest. However in practice the method according to which banks, insurance corporations and other money lending and deposit taking companies calculate interest is different. To understand this method we consider an example :

Suppose you deposit Rs. 50,000 in ICICI bank for 2 years at 7% p.a. compounded annually. Interest will be calculated in the following way:

Example 11: Saina deposited Rs. 1,00,000 in a nationalized bank for three years. If the rate of interest is 7% p.a., calculate the interest that bank has to pay to Saina after three years if interest is compounded annually. Also calculate the amount at the end of third year.

Conversion period

Typical conversion periods are given below:

Conversion period	Description	Number of conversion period in a year
1 day	Compounded daily	365
1 month	Compounded monthly	12
3 months	Compounded quarterly	4
6 months	Compounded semi annually	2
12 months	Compounded annually	1

Formula for compound interest

Taking the principal as P, the rate of interest per conversion period as i (in decimal), the number of conversion period as n, the accrued amount after n payment periods as A_n we have accrued amount at the end of first payment period

$$A_1 = P + Pi = P(1 + i);$$

$$= P(1 + i)^n$$

$$A = P (1 + i)^n$$

$$\text{where, } i = \frac{\text{Annual rate of interest}}{\text{Number of conversion periods per year}}$$

$$\text{Interest} = A_n - P = P(1 + i)^n - P$$

$$= P [(1 + i)^n - 1]$$

n is total conversions i.e. t × no. of conversions per year

Example 12: Rs. 2,000 is invested at annual rate of interest of 10%. What is the amount after two years if compounding is done (a) Annually (b) Semi-annually (c) Quarterly (d) monthly.

Example 13: Determine the compound amount and compound interest on Rs. 1000 at 6% compounded semi-annually for 6 years. Given that $(1 + i)^n = 1.42576$ for $i = 3\%$ and $n = 12$.

Example 14: Compute the compound interest on Rs. 4,000 for IVi years at 10% per annum compounded half- yearly.

Examples 15: On what sum will the compound interest at 5% per annum for two years compounded annually be Rs. 1,640?

Example 16: What annual rate of interest compounded annually doubles an investment in 7 years? Given that $2^{\frac{1}{7}} = 1.104090$

Example 17: In what time will Rs. 8,000 amount to Rs. 8,820 at 10% per annum interest compounded half-yearly?

Example 18: Find the rate percent per annum if Rs. 2,00,000 amount to Rs. 2,31,525 in 1 ½ year interest being compounded half-yearly.

Example 19: A certain sum invested at 4% per annum compounded semi-annually amounts to Rs.78,030 at the end of one year. Find the sum.

Example 20: Rs. 16,000 invested at 10% p.a. compounded semi-annually amounts to Rs. 18,522. Find the time period of investment.

Example 21: A person opened an account on April, 2001 with a deposit of Rs. 800. The account paid 6% interest compounded quarterly. On October 1 2011 he closed the account and added enough additional money to invest in a 6 month time-deposit for Rs. 1,000, earning 6% compounded monthly.

(a) How much additional amount did the person invest on October 1?

(b) What was the maturity value of his time deposit on April 1 2012?

(c) How much total interest was earned?

Given that $(1 + i)^n$ is 1.03022500 for $i = 1\frac{1}{2}\%$ $n = 2$ and $(1 + i)^n$ is 1.03037751 for $i = \frac{1}{2}\%$ and $n = 6$.

EFFECTIVE RATE OF INTEREST

If interest is compounded more than once a year the effective interest rate for a year exceeds the per annum interest rate. Suppose you invest Rs. 10,000 for a year at the rate of 6% per annum compounded semi annually. Effective interest rate for a year will be more than 6% per annum since interest is being compounded more than once in a year. For computing effective rate of interest first we have to compute the interest

The effective interest rate can be computed directly by following formula:

$$E = (1 + i)^n - 1$$

Where E is the effective interest rate

i = actual interest rate in decimal

n = number of conversion period

Example 22: Rs. 5,000 is invested in a Term Deposit Scheme that fetches interest 6% per annum compounded quarterly. What will be the interest after one year? What is effective rate of interest?

Example 23: Find the amount of compound interest and effective rate of interest if an amount of Rs. 20,000 is deposited in a bank for one year at the rate of 8% per annum compounded semi annually.

Example 24: Which is a better investment 3% per year compounded monthly or 3.2% per year simple interest? Given that $(1+0.0025)^{12} = 1.0304$.

EXERCISE 4 (B)

Choose the most appropriate option (a) (b) (c) or (d).

1. If $P = \text{Rs. } 1,000$, $R = 5\%$ p.a, $n = 4$; What is Amount and C.I. is

- (a) Rs. 1,215.50, Rs. 215.50 (b) Rs. 1,125, Rs. 125
(c) Rs. 2,115, Rs. 115 (d) none of these

2. Rs. 100 will become after 20 years at 5% p.a compound interest amount of

- (a) Rs. 250 (b) Rs. 205 (c) Rs. 265.50 (d) none of these

3. The effective rate of interest corresponding to a nominal rate 3% p.a payable half yearly is

- (a) 3.2% p.a (b) 3.25% p.a (c) 3.0225% p.a (d) none of these

4. A machine is depreciated at the rate of 20% on reducing balance. The original cost of the machine was Rs. 1,00,000 and its ultimate scrap value was Rs. 30,000. The effective life of the machine is

- (a) 4.5 years (appx.) (b) 5.4 years (appx.)
(c) 5 years (appx.) (d) none of these

5. If $A = \text{Rs. } 1,000$, $n = 2$ years, $R = 6\%$ p.a compound interest payable half-yearly, then principal (P) is

- (a) Rs. 888.80 (b) Rs. 885 (c) 800 (d) none of these

6. The population of a town increases every year by 2% of the population at the beginning of that year. The number of years by which the total increase of population be 40% is

- (a) 7 years (b) 10 years (c) 17 years (app) (d) none of these

7. The difference between C.I and S.I on a certain sum of money invested for 3 years at 6% p.a is Rs. 110.16. The sum is

- (a) Rs. 3,000 (b) Rs. 3,700 (c) Rs. 12,000 (d) Rs. 10,000

8. The useful life of a machine is estimated to be 10 years and cost Rs. 10,000. Rate of depreciation is 10% p.a. The scrap value at the end of its life is

- (a) Rs. 3,486.78 (b) Rs. 4,383 (c) Rs. 3,400 (d) none of these

9. The effective rate of interest corresponding a nominal rate of 7% p.a convertible quarterly is

- (a) 7% (b) 7.5% (c) 5% (d) 7.18%

10. The C.I on Rs. 16000 for 1 $\frac{1}{2}$ years at 10% p.a payable half -yearly is

- (a) Rs. 2,222 (b) Rs. 2,522 (c) Rs. 2,500 (d) none of these

11. The C.I on Rs. 40000 at 10% p.a for 1 year when the interest is payable quarterly is

- (a) Rs. 4,000 (b) Rs. 4,100 (c) Rs. 4,152.51 (d) none of these

12. The difference between the S.I and the C.I on Rs. 2,400 for 2 years at 5% p.a is

- (a) Rs. 5 (b) Rs. 10 (c) Rs. 16 (d) Rs. 6

13. The annual birth and death rates per 1,000 are 39.4 and 19.4 respectively. The number of years in which the population will be doubled assuming there is no immigration or emigration is

- (a) 35 years. (b) 30 years. (c) 25 years (d) none of these

14. The C.I on Rs. 4,000 for 6 months at 12% p.a payable quarterly is

- (a) Rs. 243.60 (b) Rs. 240 (c) Rs. 243 (d) none of this

ANSWERS

Exercise 4(b)

1. (a) 2. (c) 3. (c) 4. (b) 5. (a) 6. (c)
7. (d) 8. (a) 9. (d) 10. (b) 11. (c) 12. (d)
13. (a) 14. (a)

ANNUITY

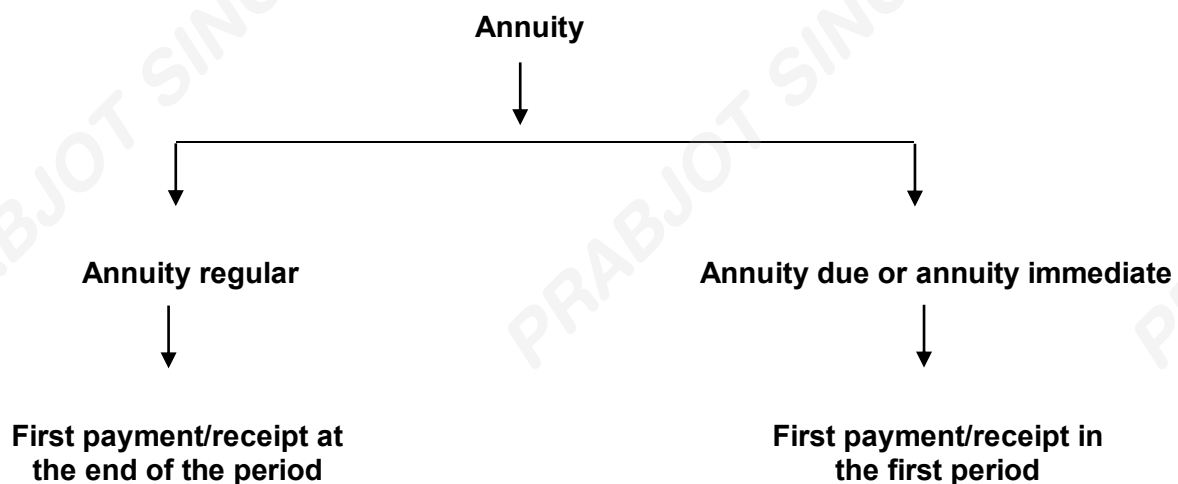
In many cases you must have noted that your parents have to pay an equal amount of money regularly like every month or every year. For example payment of life insurance premium, rent of your house (if you stay in a rented house), payment of housing loan, vehicle loan etc. In all these cases they pay a constant amount of money regularly. Time period between two consecutive payments may be one month, one quarter or one year.

Sometimes some people received a fixed amount of money regularly like pension rent of house etc. In all these cases annuity comes into the picture. When we pay (or receive) a fixed amount of money periodically over a specified time period we create an annuity.

Thus annuity can be defined as a sequence of periodic payments (or receipts) regularly over a specified period of time.

There is a special kind of annuity also that is called Perpetuity. It is one where the receipt or payment takes place forever. Since the payment is forever we cannot compute a future value of perpetuity. However we can compute the present value of the perpetuity. We will discuss later about future value and present value of annuity.

Annuity regular and Annuity due/immediate



Annuity may be of two types:

Example 25: You invest Rs. 3000 in a two year investment that pays you 12% per annum. Calculate the future value of the investment.

Example 26: Find the future value of an annuity of Rs. 500 made annually for 7 years at interest rate of 14% compounded annually. Given that $(1.14)^7 = 2.5023$.

Example 27: Rs. 200 is invested at the end of each month in an account paying interest 6% per year compounded monthly. What is the future value of this annuity after 10th payment? Given that $(1.005)^{10} = 1.0511$

Example 28: Z invests Rs. 10,000 every year starting from today for next 10 years. Suppose interest rate is 8% per annum compounded annually. Calculate future value of the annuity. Given that $(1 + 0.08)^{10} = 2.15892500$.

Example 29: What is the present value of Rs. 1 to be received after two years compounded annually at 10% interest rate?

Example 30: Find the present value of Rs. 10,000 to be required after 5 years if the interest rate be 9%. Given that $(1.09)^5 = 1.5386$.

Example 31: S borrows Rs. 5,00,000 to buy a house. If he pays equal installments for 20 years and 10% interest on outstanding balance what will be the equal annual installment?

Example 32: Rs. 5,000 is paid every year for ten years to pay off a loan. What is the loan amount if interest rate be 14% per annum compounded annually?

Example 33: Y bought a TV costing Rs. 13,000 by making a down payment of Rs. 3000 and agreeing to make equal annual payment for four years. How much would be each payment if the interest on unpaid amount be 14% compounded annually?

Solution: In the present case we have present value of the annuity i.e. Rs. 10,000 (13,000-3,000) and we have to calculate equal annual payment over the period of four years.

Example 34: Suppose your mom decides to gift you Rs. 10,000 every year starting from today for the next five years. You deposit this amount in a bank as and when you receive and get 10% per annum interest rate compounded annually. What is the present value of this annuity?

Example 35: How much amount is required to be invested every year so as to accumulate Rs. 300000 at the end of 10 years if interest is compounded annually at 10%?

APPLICATIONS

Leasing

Leasing is a financial arrangement under which the owner of the asset (lessor) allows the user of the asset (lessee) to use the asset for a defined period of time (lease period) for a consideration (lease rental) payable over a given period of time. This is a kind of taking an asset on rent. How can we decide whether a lease agreement is favourable to lessor or lessee, it can be seen by following example.

Example 36: ABC Ltd. wants to lease out an asset costing Rs. 3,60,000 for a five year period. It has fixed a rental of Rs. 1,05,000 per annum payable annually starting from the end of first year. Suppose rate of interest is 14% per annum compounded annually on which money can be invested by the company. Is this agreement favourable to the company?

Example 37: A company is considering proposal of purchasing a machine either by making full payment of Rs. 4,000 or by leasing it for four years at an annual rate of Rs. 1,250. Which course of action is preferable if the company can borrow money at 14% compounded annually?

Capital Expenditure (investment decision)

Capital expenditure means purchasing an asset (which results in outflows of money) today in anticipation of benefits (cash inflow) which would flow across the life of the investment. For taking investment decision we compare the present value of cash outflow and present value of cash inflows. If present value of cash inflows is greater than present value of cash outflows decision should be in the favour of investment. Let us see how do we take capital expenditure (investment) decision.

Example 38: A machine can be purchased for Rs. 50000. Machine will contribute Rs. 12000 per year for the next five years. Assume borrowing cost is 10% per annum compounded annually. Determine whether machine should be purchased or not.

Example 39: A machine with useful life of seven years costs Rs. 10,000 while another machine with useful life of five years costs Rs. 8,000. The first machine saves labour expenses of Rs. 1,900 annually and the second one saves labour expenses of Rs. 2,200 annually. Determine the preferred course of action. Assume cost of borrowing as 10% compounded per annum.

Valuation of Bond

A bond is a debt security in which the issuer owes the holder a debt and is obliged to repay the principal and interest. Bonds are generally issued for a fixed term longer than one year.

Example 40: An investor intends purchasing a three year Rs. 1,000 par value bond having nominal interest rate of 10%. At what price the bond may be purchased now if it matures at par and the investor requires a rate of return of 14%?

PERPETUITY

Perpetuity is an annuity in which the periodic payments or receipts begin on a fixed date and continue indefinitely or perpetually. Fixed coupon payments on permanently invested (irredeemable) sums of money are prime examples of perpetuities.

Example 41: Ramesh wants to retire and receive Rs. 3,000 a month. He wants to pass this monthly payment to future generations after his death. He can earn an interest of 8% compounded annually. How much will he need to set aside to achieve his perpetuity goal?

Example 42: Assuming that the discount rate is 7% per annum, how much would you pay to receive Rs. 50, growing at 5%, annually, forever?

Net Present Value Technique (NPV): The net present value technique is a discounted cash flow method that considers the time value of money in evaluating capital investments. An investment has cash flows throughout its life, and it is assumed that a rupee of cash flow in the early years of an investment is worth more than a rupee of cash flow in a later year.

Net present value = Present value of net cash inflow - Total net initial investment

Since it might be possible that some additional investment may also be required during the life time of the project then appropriate formula shall be:

Net present value = Present value of cash inflow - Present value of cash outflow

Decision Rule:

If $NPV \geq 0$ Accept the Proposal

If $NPV \leq 0$ Reject the Proposal

Example 43: Compute the net present value for a project with a net investment of Rs. 1,00,000 and net cash flows year one is Rs. 55,000; for year two is Rs. 80,000 and for year three is Rs. 15,000. Further, the company's cost of capital is 10%?

[PVIF @ 10% for three years are 0.909, 0.826 and 0.751]

Solution:

Year	Net Cash Flows	PVIF @ 10%	Discounted Cash Flows
0	(1,00,000)	1.000	(1,00,000)
1	55,000	0.909	49,995
2	80,000	0.826	66,080
3	15,000	0.751	11,265
Net Present Value			27,340

Recommendation: Since the net present value of the project is positive, the company should accept the project.

NOMINAL RATE OF RETURN

The nominal rate is the stated interest rate. If a bank pays 5% annually on a savings account, then 5% is the nominal interest rate. So if you deposit Rs. 100 for 1 year, you will receive Rs. 5 in interest. However, that \$5 will probably be worth less at the end of the year than it would have been at the beginning. This is because inflation lowers the value of money. As goods, services, and assets, such as real estate, rise in price.

The nominal interest rate is conceptually the simplest type of interest rate. It is quite simply the stated interest rate of a given bond or loan. It is also defined as a stated interest rate. This interest works according to the simple interest and does not take into account the compounding periods.

Real Rate of Return: The real interest rate is so named because it states the "real" rate that the lender or investor receives after inflation is factored in; that is, the interest rate that exceeds the inflation rate.

A comparison of real and nominal interest rates can therefore be summed up in this equation:

Nominal Rate of Return - Inflation = Real Rate of Return

Nominal Interest Rate = Real Interest Rate + Inflation

Effective Rate:

EXERCISE 4 (C)

Choose the most appropriate option (a) (b) (c) or (d).

1. The present value of an annuity of Rs. 3000 for 15 years at 4.5% p.a CI is

- (a) Rs. 23,809.41 (b) Rs. 32,218.63 (c) Rs. 32,908.41 (d) none of these

2. The amount of an annuity certain of Rs. 150 for 12 years at 3.5% p.a C.I is

- (a) Rs. 2,190.28 (b) Rs. 1,290.28 (c) Rs. 2,180.28 (d) none of these

3. A loan of Rs. 10,000 is to be paid back in 30 equal instalments. The amount of each installment to cover the principal and at 4% p.a CI is

- (a) Rs. 587.87 (b) Rs. 587 (c) Rs. 578.87 (d) none of these

4. $A = \text{Rs. } 1,200$ $n = 12$ years $i = 0.08$, $V = ?$

Using the formula $V = \frac{A}{i} \left[1 - \frac{1}{(1+i)^n} \right]$ value of v will be

- (a) Rs. 3,039 (b) Rs. 3,990 (c) Rs. 9930 (d) none of these

5. $a = \text{Rs. } 100$ $n = 10$, $i = 5\%$ find the FV of annuity

Using the formula $FV = a \{ (1+i)^n - 1 \}$, FV is equal to

- (a) Rs. 1,258 (b) Rs. 2,581 (c) Rs. 1,528 (d) none of these

6. If the amount of an annuity after 25 years at 5% p.a C.I is Rs. 50,000 the annuity will be

- (a) Rs. 1,406.90 (b) Rs. 1,046.90 (c) Rs. 1,146.90 (d) none of these

7. Given annuity of Rs. 100 amounts to Rs. 3137.12 at 4.5% p.a C.I. The number of years will be

- (a) 25 years (appx.) (b) 20 years (appx.) (c) 22 years (d) none of these

8. A company borrows Rs. 10,000 on condition to repay it with compound interest at 5% p.a by annual installments of Rs. 1000 each. The number of years by which the debt will be clear is

- (a) 14.2 years (b) 10 years (c) 12 years (d) none of these

9. Mr. X borrowed Rs. 5,120 at 12 Vi % p.a C.I. At the end of 3 yrs, the money was repaid along with the interest accrued. The amount of interest paid by him is

- (a) Rs. 2,100 (b) Rs. 2,170 (c) Rs. 2,000 (d) none of these

10. Mr. Paul borrows Rs. 20,000 on condition to repay it with C.I. at 5% p.a in annual installments of Rs. 2000 each. The number of years for the debt to be paid off is

- (a) 10 years (b) 12 years (c) 11 years (d) none of these

11. A person invests Rs. 500 at the end of each year with a bank which pays interest at 10% p. a C.I. annually. The amount standing to his credit one year after he has made his yearly investment for the 12th time is.

- (a) Rs. 11,764.50 (b) Rs. 10,000 (c) Rs. 12,000 (d) none of these

12. The present value of annuity of Rs. 5,000 per annum for 12 years at 4% p.a C.I. annually is

- (a) Rs. 46,000 (b) Rs. 46,850 (c) Rs. 15,000 (d) none of these

13. A person desires to create a fund to be invested at 10% CI per annum to provide for a prize of Rs. 300 every year. Using $V = a/i$ find V and V will be

- (a) Rs. 2,000 (b) Rs. 2,500 (c) Rs. 3,000 (d) none of these

Exercise 4(c)

1. (b) 2. (a) 3. (c) 4. (d) 5. (a) 6. (b)
7. (b) 8. (a) 9. (b) 10. (d) 11. (a) 12. (d)
13. (c)

MISCELLANEOUS PROBLEMS

EXERCISE 4 (D)

Choose the most appropriate option (a), (b), (c) or (d).

1. A = Rs. 5,200, R = 5% p.a., T = 6 years, P will be

- (a) Rs. 2,000 (b) Rs. 3,880 (c) Rs. 3,000 (d) none of these

2 If P = 1,000, n = 4 years., R = 5% p.a then C. I will be

- (a) Rs. 215.50 (b) Rs. 210 (c) Rs. 220 (d) none of these

3 The time in which a sum of money will be double at 5% p.a C.I is

(a) Rs. 10 years (b) 12 years (c) 14.2 years (d) none of these

4. If $A = \text{Rs. } 10,000$, $n = 18\text{yrs.}$, $R = 4\% \text{ p.a C.I.}$, P will be

(a) Rs. 4,000 (b) Rs. 4,900 (c) Rs. 4,500 (d) none of these

5. The time by which a sum of money would treble itself at $8\% \text{ p. a C. I}$ is

(a) 14.28 years (b) 14 years (c) 12 years (d) none of these

6. The present value of an annuity of Rs. 80 a years for 20 years at $5\% \text{ p.a}$ is

(a) Rs. 997 (appx.) (b) Rs. 900 (c) Rs. 1,000 (d) none of these

7. A person bought a house paying Rs. 20,000 cash down and Rs. 4,000 at the end of each year for 25 yrs. at $5\% \text{ p.a. C.I.}$ The cash down price is

(a) Rs. 75,000 (b) Rs. 76,000 (c) Rs. 76,392 (d) none of these.

8. A man purchased a house valued at Rs. 3,00,000. He paid Rs. 2,00,000 at the time of purchase and agreed to pay the balance with interest at $12\% \text{ per annum compounded half yearly}$ in 20 equal half yearly installments. If the first installment is paid after six months from the date of purchase then the amount of each installment is

[Given $\log 10.6 = 1.0253$ and $\log 31.19 = 1.494$]

(a) Rs. 8,719.66 (b) Rs. 8,769.21 (c) Rs. 7,893.13 (d) none of these.

Exercise 4(d)

1. (b) 2. (a) 3. (c) 4. (d) 5. (a) 6. (a)

7. (c) 8. (a)

ADDITIONAL QUESTION BANK

1. The difference between compound and simple interest at $5\% \text{ per annum}$ for 4 years on Rs. 20,000 is Rs. _____

(a) 250 (b) 277 (c) 300 (d) 310

2. The compound interest on half-yearly rests on Rs. 10,000 the rate for the first and second years being 6% and for the third year $9\% \text{ p.a.}$ is Rs. _____

(a) 2,200 (b) 2,287 (c) 2,285 (d) None

3. The present value of Rs. 10,000 due in 2 years at $5\% \text{ p.a.}$ compound interest when the interest is paid on yearly basis is Rs. _____

(a) 9,070 (b) 9,000 (c) 9,061 (d) None

4. The present value of Rs. 10,000 due in 2 years at $5\% \text{ p.a.}$ compound interest when the interest is paid on half-yearly basis is Rs. _____

- (a) 9,070 (b) 9,069 (c) 9,061 (d) None

5. Johnson left Rs. 1,00,000 with the direction that it should be divided in such a way that his minor sons Tom, Dick and Harry aged 9, 12 and 15 years should each receive equally after attaining the age 25 years. The rate of interest being 3.5%, how much each son receive after getting 25 years old?

- (a) 50,000 (b) 51,994 (c) 52,000 (d) None

6. In how many years will a sum of money double at 5% p.a. compound interest?

- (a) 15 years 3 months (b) 14 years 2 months
(c) 14 years 3 months (d) 15 years 2 months

7. In how many years a sum of money trebles at 5% p.a. compound interest payable on half-yearly basis?

- (a) 18 years 7 months (b) 18 years 6 months
(c) 18 years 8 months (d) 22 years 3 months

8. A machine depreciates at 10% of its value at the beginning of a year. The cost and scrap value realized at the time of sale being Rs. 23,240 and Rs. 9,000 respectively. For how many years the machine was put to use?

- (a) 7 years (b) 8 years (c) 9 years (d) 10 years

9. A machine worth Rs. 4,90,740 is depreciated at 15% on its opening value each year. When its value would reduce to Rs. 2,00,000?

- (a) 4 years 6 months (b) 4 years 7 months
(c) 4 years 5 months (d) 5 years 7 months approximately

10. A machine worth Rs. 4,90,740 is depreciated at 15% of its opening value each year. When its value would reduce by 90%?

- (a) 11 years 6 months (b) 11 years 7 months
(c) 11 years 8 months (d) 14 years 2 months approximately

11. Alibaba borrows Rs. 6 lakhs Housing Loan at 6% repayable in 20 annual installments commencing at the end of the first year. How much annual payment is necessary.

- (a) 52,420 (b) 52,419 (c) 52,310 (d) 52,320

12. A sinking fund is created for redeeming debentures worth Rs. 5 lakhs at the end of 25 years. How much provision needs to be made out of profits each year provided sinking fund investments can earn interest at 4% p.a.?

- (a) 12,006 (b) 12,040 (c) 12,039 (d) 12,035

13. A machine costs Rs. 5,20,000 with an estimated life of 25 years. A sinking fund is created to replace it by a new model at 25% higher cost after 25 years with a scrap value

realization of Rs. 25000. What amount should be set aside every year if the sinking fund investments accumulate at 3.5% compound interest p.a.?

- (a) 16,000 (b) 16,500 (c) 16,050 (d) 16,005

14. Raja aged 40 wishes his wife Rani to have Rs. 40 lakhs at his death. If his expectation of life is another 30 years and he starts making equal annual investments commencing now at 3% compound interest p.a. how much should he invest annually?

- (a) 84,448 (b) 84,450 (c) 84,449 (d) 84,077

15. Appu retires at 60 years receiving a pension of 14,400 a year paid in half-yearly installments for rest of his life after reckoning his life expectation to be 13 years and that interest at 4% p.a. is payable half-yearly. What single sum is equivalent to his pension?

- (a) 1,45,000 (b) 1,44,900 (c) 1,44,800 (d) 1,44,700

ANSWERS

1. (d) 2. (d) 3. (a) 4. (c) 5. (d) 6. (b)
7. (d) 8. (c) 9. (d) 10. (d) 11. (c) 12. (a)
13. (c) 14. (d) 15. (b)

PAST YEARS QUESTION

S.I & C.I , EFFECTIVE RATE AND DEP RELATED WORK SHEET

1. 1 Rs. 8,000 becomes Rs. 10,000 in two years at simple interest. The amount that will become Rs. 6,875 in 3 years at the same rate of interest is :
(a) Rs. 4,850 (b) **Rs. 5,000** (c) Rs. 5,500 (d) Rs. 5,275
2. The difference between the simple and compound interest on a certain sum for 3 year at 5% p.a. is Rs. 228.75. The compound interest on the sum for 2 years at 5% p.a. is :
(a) Rs. 3,175 (b) **Rs. 3,075** (c) Rs. 3,275 (d) Rs. 2,975.
3. The rate of simple interest on a sum of money is 6% p.a. for first 3 years, 8% p.a. for the next five years and 10% p.a. for the period beyond 8 years. If the simple interest accrued by the sum for a period for 10 years is Rs. 1,560. The sum is :
(a) Rs. 1,500 (b) **Rs. 2,000** (c) Rs. 3,000 (d) Rs. 5,000
4. A sum of money doubles itself in 10 years. The number of years it would triple itself is:
(a) 25 years (b) 15 years (c) **20 years** (d) None.
5. In what time will Rs. 3,90,625 amount to Rs. 4,56,976 at 8% per annum, when the interest is compounded semi-annually? [Given : $(1.04)^4 = 1.16986$]

(a) 2 years (b) 4 years (c) 5 years (d) 7 years

6. A certain sum of money amounts to Rs. 6,300 in two years and Rs. 7,875 in three years nine months at simple interest. Find the rate of interest per annum :

(a) 20% (b) 18% (c) 15% (d) 10%

7. How long will Rs. 12,000 take to amount to Rs. 14,000 at 5% p.a. converted quarterly ?
[Given : $(1.0125)^{12.4} = 1.1666$]

(a) 3 years (b) 3.1 years (c) 13.5 years (d) 12.4 years.

8. If Rs. 1,000 be invested at interest rate of 5% and the interest be added to the principal every 10 years, then the number of years in which it will amount to Rs. 2,000 is :

(a) $16\frac{2}{3}$ years (b) $6\frac{1}{4}$ years (c) 16 years (d) $6\frac{2}{3}$ years.

9. The annual birth and death rates per 1000 are 39.4 and 19.4 respectively. The number of years in which the population will be doubled assuming there is no immigration or emigration is :

(a) 35 years (b) 30 years (c) 25 years (d) None of these

10. The effective rate equivalent to nominal rate of 6% compounded monthly is :

(a) 6.05 (b) 6.16 (c) 6.26 (d) 6.07

11. A person borrows Rs. 5,000 for 2 years at 4% p.a. simple interest. He immediately lends to another person $6\frac{1}{4}$ % p.a. simple interest for 2 years. Find his gain in the transaction per year:

(a) Rs. 112.50 (b) Rs. 125 (c) Rs. 225 (d) Rs. 167.50

12. A person deposited Rs. 5,000 in a bank. The deposit was left to accumulate at 6% compounded quarterly for the first five years and at 8% compounded semi-annually for the next eight years. The compound amount at the end of 13 years is :

(a) Rs. 12621.50 (b) Rs. 12613.10 (c) Rs. 13613.10 (d) None.

13. Two equal sums of money were lent at simple interest at 11 % p.a. for $3\frac{1}{2}$ years and $4\frac{1}{2}$ years respectively. If the difference in interests for two periods was Rs. 412.50, then each sum is:

(a) Rs. 3,250 (b) Rs. 3,500 (c) Rs. 3,750 (d) Rs. 4,350

14. Anshul's father wishes to have Rs. 75,000 in a bank account when his first college expenses begin. How much amount his father should deposit now at 6.5% compounded annually if Anshul is to start college in 8 years hence from now ?

(a) Rs. 45,360 (b) Rs. 46,360 (c) Rs. 55,360 (d) Rs. 48,360.

15. In how much time would the simple interest on a certain sum be 0.125 times the principal at 10% per annum?

(a) $1\frac{1}{4}$ years

(b) $1\frac{3}{4}$ years

(c) $2\frac{1}{4}$ years

(d) $2\frac{3}{4}$ years

16. The difference between compound interest and simple interest on a certain sum for 2 years @ 10% p.a. is Rs. 10. Find the sum :

(a) Rs. 1,010

(b) Rs. 1,095

(c) Rs. 1,000

(d) Rs. 990

17. A machine worth Rs. 4,90,740 is depreciated at 15% on its opening value each year. When its value would reduce to Rs. 2,00,000 :

(a) 4 years 6 months

(b) 4 years 7 months

(c) 4 years 5 months

(d) 5 years 7 months approximately

18. If the difference between simple interest and compound interest is Rs. 11 at the rate of 10% for two years, then find the sum.

(a) Rs. 1,200

(b) Rs. 1,100

(c) Rs. 1,000

(d) None of these

19. Find the numbers of years in which a sum doubles itself at the rate of 8% per annum.

(a) $11\frac{1}{2}$

(b) $12\frac{1}{2}$

(c) $9\frac{1}{2}$

(d) $13\frac{1}{2}$

20. In how many years, a sum will become double at 5% p.a. compound interest.

(a) 14.0 years

(b) 15 years

(c) 16 years

(d) 14.3 years

21. The time by which a sum of money is 8 times of itself if it doubles itself in 15 years interest compounded annually.

(a) 42 years

(b) 43 years

(c) 45 years

(d) 46 years

22. What is the rate of simple interest if a sum of money amounts to Rs. 2,784 in 4 years and Rs. 2,688 in 3 years ?

(a) 1% p.a.

(b) 4% p.a

(c) 5% p.a

(d) 8% p.a. (1 mark)

23. A sum amount to Rs. 1,331 at a principal of Rs. 1,000 at 10 % compounded annually. Find the time.

(a) 3.31 years

(b) 4 years

(c) 3 years

(d) 2 years

24. In how many years, a sum of Rs. 1,000 compounded annually @ 10%, will amount to Rs. 1,331?

(a) 6 years

(b) 5 years

(c) 4 years

(d) 3 years

25. The compound interest for a certain sum @ 5% p.a. for first year is Rs. 25. The SI for the same money @ 5% p.a. for 2 years will be.

(a) Rs. 40

(b) Rs. 50

(c) Rs. 60

(d) Rs. 70

26. At what % rate of compound interest (C.I) will a sum of money become 16 times in four years, if interest is being calculated compounding annually:

(a) r = 100%

(b) r = 10%

(c) r = 200%

(d) r = 20%

27. Find the present value of an annuity of Rs. 1,000 payable at the end of each year for 10 years. If rate of interest is 6% compounding per annum (given $(1.06)^{-10} = 0.5584$):
 (a) **Rs. 7,360** (b) Rs. 8,360 (c) Rs. 12,000 (d) None of these.
28. If the simple Interest on a sum of money at 12% p.a. for two years is Rs. 3,600. The compound interest on the same sum for two years at the same rate is :
 (a) **Rs. 3,816** (b) Rs. 3,806 (c) Rs. 3,861 (d) Rs. 3,860
29. The effective annual rate of interest corresponding to nominal rate 6% p.a. payable half yearly is
 (a) 6.06% (b) 6.07% (c) 6.08% (d) **6.09%**
30. The cost of Machinery is Rs. 1,25,000/- If its useful life is estimated to be 20 years and the rate of depreciation of its cost is 10% p.a., then the scrap value of the Machinery is [given that $(0.9)^{20} = 0.1215$]
 (a) **Rs. 15,187** (b) Rs. 15,400 (c) Rs. 15,300 (d) Rs. 15,250
31. Mr. X invests 'P' amount at Simple Interest rate 10% and Mr. Y invests 'Q' amount at Compound Interest rate 5% compounded annually. At the end of two years both get the same amount of interest, then the relation between two amounts P and Q is given by :
 (a) **$P = \frac{41Q}{80}$** (b) $P = \frac{41Q}{40}$ (c) $P = \frac{41Q}{100}$ (d) $P = \frac{41Q}{200}$
32. If the difference of S.I and C.I is Rs. 72 at 12% for 2 years. Calculate the amount.
 (a) Rs. 8,000 (b) Rs. 6,000 (c) **Rs. 5,000** (d) Rs. 7,750
33. If a simple interest on a sum of money at 6% p.a. for 7 years is equal to twice of simple interest on another sum for 9 years at 5% p.a.. The ratio will be :
 (a) 2:15 (b) 7 : 15 (c) **15:7** (d) 1:7
34. By mistake a clerk, calculated the simple interest on principal for 5 months at 6.5% p.a. instead of 6 months at 5.5% p.a. If the error in calculation was Rs. 25.40. The original sum of principal was _____.
 (a) Rs. 60,690 (b) **Rs. 60,960** (c) Rs. 90,660 (d) Rs. 90,690
35. If the Simple Interest on Rs. 1,400 for 3 years is less than the simple interest on Rs. 1,800 for the same period by Rs. 80, then the rate of interest is
 (a) 5.67% (b) **6.67%** (c) 7.20% (d) 5.00%
36. Nominal rate of interest is 9.9% p.a. If interest is Compounded monthly, What will be the effective rate of interest (given $\left(\frac{4033}{4000}\right)^{12} = 1.1036$ (approx))?
 (a) **10.36%** (b) 9.36% (c) 11.36% (d) 9.9%
37. The S.I. on a sum of money is $\frac{4}{9}$ of the principal and the no. of years is equal to the rate of interest per annum. Find the rate of interest per annum ?
 (a) 5% (b) **20/3%** (c) 22/7% (d) 6%

38. Simple interest on Rs. 2,000 for 5 months at 16% p.a. is _____.
(a) Rs. 133.33 (b) Rs. 133.26 (c) Rs. 134.00 (d) Rs. 132.09
39. How much investment is required to yield an Annual income of Rs. 420 at 7% p.a. Simple interest.
(a) Rs. 6,000 (b) Rs. 6,420 (c) Rs. 5,580 (d) Rs. 5,000
40. Mr. X invests Rs. 90,500 in post office at 7.5% p.a. simple interest. While calculating the rate was wrongly taken as 5.7% p.a. The difference in amounts at maturity is Rs. 9,774. Find the period for which the sum was invested:
 (a) 7 years (b) 5.8 years **(c) 6 years** (d) 8 years
41. The difference between compound and simple interest on a certain sum of money for 2 years at 4% p.a. is Rs. 1. The sum (in Rs.) is:
(a) 625 (b) 630 (c) 640 (d) 635
42. A sum of money compounded annually becomes Rs. 1,140 in two years and Rs. 1,710 in three years. Find the rate of interest per annum.
 (a) 30% (b) 40% **(c) 50%** (d) 60%
43. On what sum difference between compound interest and simple interest for two years at 7% p.a. interest is Rs. 29.4
 (a) Rs. 5,000 (b) Rs. 5,500 **(c) Rs. 6,000** (d) Rs. 6,500
44. In what time will a sum of money double itself at 6.25% p.a. simple interest?
 (a) 5 years (b) 8 years (c) 12 years **(d) 16 years**
45. What principal will amount to Rs. 370 in 6 years at 8% p.a. at simple interest?
 (a) Rs. 210 **(b) Rs. 250** (c) Rs. 310 (d) Rs. 350
46. The partners A and B together lent Rs. 3,903 at 4% per annum interest compounded annually. After a span of 7 years, A gets the same amount as B gets after 9 years. The share of A in the sum of Rs. 3,903 would have been:
 (a) Rs. 1,875 (b) Rs. 2,280 **(c) Rs. 2,028** (d) Rs. 2,820
47. If a sum triples in 15 years at simple rate of interest, the rate of interest per annum will be:
 (a) 13.0% **(b) 13.3%** (c) 13.5% (d) 18.0%
48. A sum of money invested of compound interest doubles itself in four years, it becomes 32 times of itself at the same rate of compound interest in
 (a) 12 years (b) 16 years **(c) 20 years** (d) 24 years
49. A certain sum of money was invested at simple rate of interest for three years, if the same has been invested at a rate that was seven percent higher, the interest amount would have been Rs. 382 more. The amount of sum invested is:

- (a) Rs. 12,600 (b) Rs. 6,800 **(c) Rs. 4,200** (d) Rs. 2,800
50. A sum of money doubles itself in 8 years at simple interest. The number of years it would triple itself is _____.
(a) 20 years (b) 12 years **(c) 16 years** (d) None of these.
51. A sum of Rs. 44,000 is divided into three parts such that the corresponding interest earned after 2 years, 3 years and 6 years may be equal. If the rates of simple interest are 6% p.a., 8% p.a. and 6% p.a. respectively, then the smallest part of the sum will be:
(a) Rs. 4,000 **(b) Rs. 8,000** (c) Rs. 10,000 (d) Rs. 12,000
52. Suppose your parent decides to open a PPF (Public Provident Fund) account in a bank towards your name with Rs. 10,000 every year starting from today for next 16 years. When you receive and get 8.5% per annum interest rate compounded annually. What is the present value of this annuity? (Give answer in Rs. without any fraction.) (Given $P(15, 0.085) = 8.304236576$)
(a) 83,042 (b) 1,66,084 **(c) 93,042** (d) 8,30,423
53. In how many years will a sum of money become four times at 12% p.a. simple interest?
(a) 18 years (b) 21 years **(c) 25 years** (d) 28 years
54. The simple interest for a certain sum for 2 years at 10% per annum is Rs. 90. The corresponding compound interest is (In Rs.):
(a) 99 (b) 95.60 **(c) 94.50** (d) 108
55. Mr. X bought an electronic item for Rs. 1,000. What would be the future value of the same item after 2 years, if the value is compounded semi-annually at 22% per annum?
(a) Rs. 1,488.40 **(b) Rs. 1,518.07** (c) Rs. 2,008.07 (d) Rs. 2,200.00
56. If an amount is kept at simple interest, it earns an interest of Rs. 600 in first two years but when kept at compound interest it earns an interest of Rs. 660 for the same period, then the rate of interest and principal amount respectively are:
(a) 20%, Rs. 1,200 (b) 10%, Rs. 1,200 **(c) 20%, Rs. 1,500** (d) 10%, Rs. 1,500
57. The sum invested at 4% per annum compounded Semi-annually amounts to Rs. 7,803 at the end of one year, is:
(a) Rs. 7,000 **(b) Rs. 7,500** (c) Rs. 7,225 (d) Rs. 8,000
58. A compound interest on a sum for 2 years is Rs. 30 more than the simple interest at the rate of 5% per annum then the sum is
(a) Rs. 11,000 (b) Rs. 13,000 **(c) Rs. 12,000** (d) Rs. 15,000
59. A person lends Rs. 6,000 for 4 years and Rs. 8,000 for 3 years at simple interest. If he gets Rs. 2,400 as total interest, the rate of interest is:
(a) 5% (b) 4% (c) 6% (d) 7%
60. The difference between the Compound interest and Simple interest at 10% per annum for 4 years on Rs. 10,000 is Rs. _____.

- (a) 650 (b) 640 **(c) 641** (d) 600
61. If compound interest on any sum at the rate of 5% for two years is Rs. 512.50 then the sum would be:
 (a) Rs. 3,000 (b) Rs. 4,000 **(c) Rs. 5,000** (d) Rs. 6,000
62. The effective rate of interest equivalent to the nominal rate of 7% converted monthly:
 (a) 7.26% **(b) 7.22%** (c) 7.02% (d) 7.20%
63. How much amount is required to be invested every year so as to accumulate Rs. 3,00,000 at the end of 10 years, if interest is compounded annually at 10%?
(a) Rs. 18,823.65 (b) Rs. 18 (c) Rs. 18,828.85 (d) Rs. 18,882.65
64. If Rs. 1,000 be invested at interest rate of 5% and the interest be added to the principal every 10 years, than the number of years in which it will amount to Rs. 2,000 is:
(a) $16\frac{2}{3}$ years (b) $6\frac{1}{4}$ years (c) 16 years (d) $6\frac{2}{3}$ years
65. A person borrows Rs. 5,000 for 2 years at 4% per annual simple interest. He immediately lends to another person at $6\frac{1}{4}$ % . Per annual for 2 years find his gain in the transaction for year:
 (a) Rs. 112.50 **(b) Rs. 225** (c) Rs. 125 (d) Rs. 107.50
66. If an amount is kept at S.I. it earns an interest of Rs. 600 in first two years but when kept at compound interest it earns an interest of Rs. 660 for the same period, then the rate of interest and principal amount respectively are:
 (a) 20%., Rs. 1,200 **(b) 20%, Rs. 1,500** (c) 10%, Rs. 1,200 (d) 10%., Rs. 1,500
67. If Rs. 10,000 is invested at 8% per year compounded quarterly, then the value of the investment after 2 years is: [given $(1 + 0.02)^8 = 1.171659$]
(a) Rs. 11,716.59 (b) Rs. 10,716.59 (c) Rs. 117.1659 (d) None of the above
68. A bank pays 10% rate of interest compounded annually. A sum of Rs. 400 is deposited in the bank. The amount at the end of 1 year will be
(a) Rs. 440 (b) Rs. 439 (c) Rs. 441 (d) Rs. 442
69. A certain money doubles itself in 10 years when deposited on simple interest. It would triple itself in
(a) 20 years (b) 15 years (c) 25 years (d) 30 years
70. A man deposited Rs. 8,000 in a bank for 3 years at 5% per annum compound interest, after 3 years he will get
 (a) Rs. 8,800 **(b) Rs. 9,261** (c) Rs. 9,200 (d) Rs. 9,000
71. If in two years time a principal of Rs. 100 amounts to Rs. 121 when the interest at the rate of r % is compounded annually, then the value of r will be
 (a) 10.5 **(b) 10%** (c) 15 (d) 14

72. A certain sum of money Q was deposited for 5 year and 4 months at 4.5% simple interest and amounted to Rs. 248, then the value of Q is
(a) Rs. 200 (b) Rs. 210 (c) Rs. 220 (d) Rs. 240
73. If compound interest on a sum for 2 years at 4% per annum is Rs. 102, then the simple interest on the same sum for the same period at the same rate will be
 (a)Rs. 99 (b) Rs. 101 **(c) Rs. 100** (d) Rs. 95
74. A man invests an amount of Rs. 15,860 in the names of his three sons A, B and C in such a way that they get the same interest after 2, 3 and 4 years respectively. If the rate of interest is 5%, then the ratio of amount invested in the name of A, B and C is:
(a)6: 4: 3 (b) 3: 4: 6 (c) 30: 12:5 (d) None of the above
75. If the difference between the compound interest compounded annually and simple interest on a certain amount at 10% per annum for two years is Rs. 372, then the principal amount is
(a) Rs. 37,200 (b) Rs. 37,000 (c) Rs. 37,500(d) None of the above
76. The effective rate of interest for one year deposit corresponding to a nominal 7% rate of interest per annum convertible quarterly is
 (a) 7% (b) 7.5% (c) 7.4% **(d) 7.18%**
77. How much will Rs. 25,000 amount to in 2 years at compound interest if the rates for the successive years are 4% and 5% per year
(a) Rs. 27,300 (b) Rs. 27,000 (c) Rs. 27,500 (d) Rs. 27,900
78. Rs. 8,000/- at 10% per annum interest compounded half yearly will become at the end of one year
(a) Rs. 8,800 (b) Rs. 8,820 (c) Rs. 8,900 (d) Rs. 9,600
79. The value of furniture depreciates by 10% a year, it the present value of the furniture in an office is Rs. 21,870, calculate the value of furniture 3 years ago
(a) Rs. 30,000 (b) Rs. 35,000 (c) Rs. 40,000(d) Rs. 50,000
80. The certain sum of money became Rs. 692/- in 2 yrs and Rs. 800/- in 5 yrs then the principle amount is _____
 (a)Rs. 520 **(b)Rs. 620** (c)Rs. 720 (d)Rs. 820
81. A sum of money amount to Rs. 6,200 in 2 years and Rs. 7,400 in 3 years as per S.I. then the principal is
 (a)Rs. 3,000 (b)Rs. 3,500 **(c)Rs. 3,800** (d)None
82. A sum was invested for 3 years as per C.I. and the rate of interest for first year is 9%, 2nd year is 6% and 3rd year is 3% p.a. respectively. Find the sum if the amount in three years is Rs. 550?

(a)Rs. 250 (b)Rs. 300 (c)**Rs. 462.16** (d)Rs. 350

83. $P = \text{Rs. } 5,000$ $R = 15\%$ $T = 4^{1/2}$ using $I = \frac{PTR}{100}$ then I will be

(a)**Rs. 3,375** (b)Rs. 3,300 (c)Rs. 3,735 (d)None

84. The effective rate of interest does not depend upon

(a)**Amount of Principal** (b)Amount of Interest
(c)Number of Conversion Periods (d)None of these

85. If $P i^2 = \text{Rs. } 96$, and $R = 8\%$ compounded annually then $P =$

(a)Rs. 14,000 (b)**Rs. 15,000** (c)Rs. 16,000 (d)Rs. 17,000

86. Determine the present value of perpetuity of Rs. 50,000 per month @ rate of interest 12% p.a. is _____

(a)Rs. 45,00,000 (b)**Rs. 50,00,000** (c)Rs. 55,00,000 (d)Rs. 60,00,000

87. In simple interest if the principal is Rs. 2,000 and the rate and time are the roots of the equation $x^2 - 11x + 30 = 0$ then simple interest is

(a)Rs. 500 (b)**Rs. 600** (c)Rs. 700 (d)Rs. 800

88. A man invests Rs. 12,000 at 10% p.a. and another sum of money at 20% p.a. for one year. The total investment earns at 14% p.a. simple interest the total investment is:

(a)Rs. 8,000 (b)**Rs. 20,000** (c)Rs. 14,000 (d)Rs. 16,000

89. The difference in simple interest of a sum invested of Rs. 1,500 for 3 years is Rs. 18. The difference in their rates is:

(a)**0.4** (b)0.6 (c)0.8 (d)0.10

90. Find the effective rate of interest on Rs. 10,000 on which interest is payable half yearly at 5% p.a.

(a)**5.06%** (b)4% (c)0.4% (d)3%

91. Find the effective rate of interest at 10% p.a. when interest is payable quarterly.

(a)**10.38%** (b)5% (c)5.04% (d)4%

92. What will be the population after 3 years when present population is Rs. 25,000 and population increases at the rate of 3% in I year, at 4% in II year and at 5% in III year?

(a)**Rs. 28,119** (b)Rs. 29,118 (c)Rs. 27,000 (d)Rs. 30,000

93. The value of scooter is Rs. 10,000 find its value after 7 years if rate of depreciation is 10% p.a.

(a)**Rs. 4,782.96** (b)Rs. 4,278.69 (c)Rs. 42,079 (d)Rs. 42,000

94. $SI = 0.125P$ at 10% p.a. Find time.

- (a)1.25 years (b)25 years (c)0.25 years (d)None
95. Scrap value of a machine valued at Rs. 10,00,000, after 10 years within depreciation at 10% p.a.:
- (a)Rs. 3,48,678.44 (b)Rs. 3,84,679.45 (c)Rs. 4,00,000 (d)Rs. 3,00,000
96. The difference between CI and SI for 2 years, is 21. If rate of interest is 5% find principal
- (a)Rs. 8,400 (b)Rs. 4,800 (c)Rs. 8,000 (d)Rs. 8,200
97. Present value of a scooter is Rs. 7,290 if its value decreases every year by 10% then its value before 3 years is equal to:
- (a)10,000 (b)10,500 (c)20,000 (d)20,500
98. On what sum will the compound interest at 5% per annum for 2 year compounded annually be Rs. 3,280.
- (a)Rs. 32,000 (b)Rs. 16,000 (c)Rs. 48,000 (d)Rs. 64,000
99. An amount P becomes Rs. 5,100.5 and Rs. 5,203 after second and fourth years respectively at 1 % of interest per annum compounded annually Thus values of P and R are:
- (a)Rs. 4,000 and 1.5 (b)Rs. 5,000 and 1
(c)Rs. 6,000 and 2 (d)Rs. 5,500 and 3
100. A certain sum invested at 4% per annum compounded semi- annually amounts to Rs. 1,20,000 at the end of one year. Find the sum:
- (a)1,15,340 (b)1,10,120 (c)1,12,812 (d)1,13,113
101. Find the compound interest if an amount of Rs. 50,000 is deposited in a bank for one year at the rate of 8% per annum compounded semiannually.
- (a)Rs. 3,080 (b)Rs. 4,080 (c)Rs. 5,456 (d)Rs. 7,856
102. Rs. 2,500 is paid every year for 10 years to pay off a loan. What is the loan amount if interest rate be 14% per annum compounded annually?
- (a)Rs15,847.90 (b)Rs. 13,040.27(c)Rs. 14,674.21 (d)Rs. 16,345.11
103. An amount is lent at a nominal rate of 4.5% per annum compounded quarterly. What would be the gain in rupees over when compounded annually?
- (a)0.56 (b)0.45 (c)0.07 (d)0.85
104. What sum of money will produce Rs. 42,800 as an interest in 3 years and 3 months at 2.5% p.a. simple interest?
- (a)Rs. 3,78,000 (b)Rs. 5,26,769 (c)Rs. 4,22,000 (d)Rs. 2,24,000

105. The ratio of principal and the compound interest value for three years (compounded annually) is 216 : 127. The rate of interest is:
 (a)0.1777 (b)0.1567 (c)0.1666 (d)0.1587
106. A certain sum amounted to Rs. 575 at 5% in a time in which Rs. 750 amounted to Rs. 840 at 4%. If the rate of interest is simple, find the sum-of
 (a) 525 (b)550 (c)515 (d)**500**
107. Find the amount of compound interest, if an amount of Rs. 50,000 is deposited in a bank for one year at the rate of 8% per annum compounded semiannually
 (a)3,080 (b)**4,080** (c)5,456 (d)7,856
108. The population of a town increase by 2% of the population at the beginning of the year. The number of year by which the total increases in population would be 40% is :
 (a)7 years (b)10 years (c)**17 years** (d)19 years (approx)
109. Two equal amounts of money are deposited in two banks each at 15% p.a. for 3.5 years in the bank and for 5 years in the other. The difference between the interest amount from the bank is Rs. 144. Find the sum
 (a)Rs. 620 (b)**Rs. 640** (c)Rs. 820 (d)Rs. 840
110. The simple interest on a sum at 4% p.a. for 2 years is Rs. 80. Find the CI on the same sum for the same period.
 (a)**Rs. 81.60** (b)Rs. 80.80 (c) Rs. 83.20 (d) Rs. 82.30
111. Which is a better investment 9% p.a. compounded quarterly or 9.1 % p.a. simple interest?
 (a)**9% compounded** (b)9.1% S.T.(c)Both are same(d)Cannot be said
112. The effective rate of interest corresponding to a nominal rate of 7% p.a. compounded quarterly is
 (a)7.5% (b)7.6% (c)7.7% (d)**7.18%**
113. Assuming that the discount rate is 7% p.a. how much would you pay to receive Rs. 200 growing at 5% annually for ever?
 (a)Rs. 2,500 (b)Rs. 5,000 (c)Rs. 7,500 (d)**Rs. 10,000**
114. A man invested one-third of his capital at 7% one-fourth at 8% and the remainder at 10%. If the annual income is Rs. 561. The capital is -
 (a)Rs. 4,400 (b)Rs. 5,500 (c)**Rs. 6,600** (d)Rs. 5,800
115. A sum of money is lent at C.I. Rate 20% p.a. 2 years. It would fetch Rs. 482 more if the interest is compounded half yearly. The sum is:

- (a)Rs. 19,800 (b)Rs. 19,900 (c)**Rs.20,000**
(d)Rs.20,100

116. What T denote the actual rate of interest in decimal, and n denote the number of conversion periods, the formula for computing the effective rate of interest E is given by,

- (a) $(1 + i)^n$ (b) $(1 + i)^n - 1$ (c) $1 - (1 + i)^n$ (d) $(1 + i)^{-n}$

117. The effective rate of return for 24% per annum convertible monthly is given as:

- (a)24% (b)**26.82%** (c)18% (d)24.24%

118. What is the compound interest (in Rs.) on a sum of Rs. 12,600 for $1\frac{1}{2}$ years at 20% per annum if the interest is compounded half yearly? (Nearest to a rupee).

- (a)4,271 (b)**4,171** (c)4,711 (d)4,117

119. If discount rate is 14% per annum, then how much a company has to pay to receive Rs. 280 growing at 9% annually forever?

- (a)**Rs. 5,600** (b)Rs. 2,800 (c)Rs. 1,400 (d)Rs. 4,200

120. If the nominal rate of growth is 17% and inflation is 9% for the five years. Let P be the Gross Domestic Product (GDP) amount at the present year then the projected real GDP after 6 years is:

- (a)**1.587 P** (b)1.921 P (c)1.403 P (d) 2.51 P

121. A sum of Rs. 7,500 amounts to Rs. 9,075 at 10% p.a., interest being compounded yearly in a certain time. The simple interest (in Rs.) on the same sum for the same time and the same rate is:

- (a)1,000 (b)1,250 (c)1,800 (d)**1,500**

122. if a person bought a house by paying Rs. 45,00,000 down payment and Rs. 80,000 at the end of each year till the perpetuity. Assuming the rate of interest as 16% the present value of house (in Rs.) is given as:

- (a)47,00,000 (b)45,00,000 (c)57,80,000 (d)**50,00,000**

123. Let the operating profit of a manufacturer for five years is given as:

Years	1	2	3	4	5	6
Operating profit (in lakh Rs.)	90	100	106.4	107.14	120.24	157.34

Then the operating profit of Compound Annual Growth Rate (CAGR) for year 6 with respect to year 2 is given that:

- (a)9% (b)**12%** (c)11% (d)13%

124. A certain sum amounts to Rs. 15,748 in 3 years at simple interest at $r\%$ p.a. The same sum amounts to Rs. 16,510 at $(r + 2)\%$ p.a. simple interest in the same time. What is the value of r ?

- (a) 10% (b)3% (c)12% (d)6%

125. What is the difference (in Rs.) between the simple interest and the compound interest on a sum of Rs. 8,000 for $2\frac{2}{5}$ years at the rate of 10% p.a. when the interest is compounded yearly?

- (a) **136.12** (b) 129.50 (c) 151.75 (d) 147.20

126. A sum of Rs. x amounts to Rs. 27,900 in 3 years and to Rs. 41,850 in 6 years at a certain rate percent per annum, when the interest is compounded yearly. The value of x is;

- (a) 16,080 (b) **18,600** (c) 18,060 (d) 16,800

127. Mr. X wants to accumulate Rs. 50,00,000 at the end of 10 years. Then how much amount is required to be invested every year if interest is compounded annually at 10%? (Given that $P(10,0.10) = 15.9374298$)

- (a) **Rs. 3,13,726.87** (b) Rs. 4,13,726.87 (c) Rs. 3,53,726.87 (d) Rs. 4,53,726.87

128. Rahul invested Rs. 70,000 in a bank at the rate of 6.5% p.a. simple interest rate. He received Rs. 85,925 after the end of term. Find out the period for which sum was invested by Rahul.

- (a) 2 years (b) 3 years (c) **3.5 years** (d) 2.5 years

129. A company needs Rs. 10,000 in five years to replace as equipment. How much (in Rs.) should be invested now at an interest rate of 8% p.a. in order to provide for this equipment?

- (a) 6,000 (b) **6,805** (c) 10,000 (d) 11,000

130. An amount is lent at R% simple interest for R years and the simple interest amount was one-fourth of the principal amount. Then R is _____

- (a) **5** (b) 6 (c) $5^{1/2}$ (d) $6^{1/2}$

131. A sum of money is put at 20% compound interest rate p.a. At which year the aggregated amount just exceeds the double of the original sum?

- (a) 6 (b) 5 (c) **4** (d) 3

132. In how much time a sum of amount doubles at simple interest at 12.5% rate.

- (a) 7 year (b) **8 year** (c) 9 year (d) 10 year

133. The effective rate of return for 7% per annum convertible Quarterly is given as:

- (a) 7% (b) **7.18%** (c) 5% (d) 7.5%

134. The CAGR of Initial Value of a investment of Rs 15000 and Final Value of Rs 25000 in a 3 years is

(a)19%

(b)18.56%

(c) 17.56%

(d)17%

135. A machine worth Rs. 4,90,740 is depreciated at 15% on its opening value each year. When its value would reduce to Rs. 2,00,750

A. 5 years 5 months

B. 5 years 6 months

C. 5 years 7 months

D. 5 years 8 months

136. If Rs. 64 amounts to Rs. 83.20 in 2 years, what will Rs. 86 amount to in 4 years at the same rate percent per annum?

A. Rs. 127.60

B. Rs. 147.60

C. Rs. 145.3

D. 117.6

137. The effective annual rate of interest corresponding to a nominal rate of 6% per annum payable half yearly is:

A. 6.06 %

B. 6.07 %

C. 6.08 %

D. 6.09 %

138. 10 years ago the earning per share (EPS) of ABC Ltd. was Rs. 5 share. Its EPS for this year is Rs. 22. Compute at what rate, EPS of the company grows annually?

A. 15.97 %

B. 16.77 %

C. 18.64 %

D. 14.79

%

139. A sum of money invested at compound interest doubles itself in four years. In how many years it becomes 32 times of itself at the same rate of compound interest.

A 12 years

B. 16 years

C. 20 years

D. 24 years

2023 – JUNE

140. Mr Paul invested Rs 1,00,000 in a mutual fund scheme in January 2018. After one year in January 2019, she got a dividend amounting to Rs 10,000 for first year, Rs 12,000 for second year, Rs 16,000 for third year, Rs 18,000 for fourth year and Rs 21,000 for fifth year in January 2023. What is the compounded annual growth rate (CAGR) for dividend return? given $1.2038^4 = 2.1$

A. 20.38%

B. 18.59%

C. 16.36%

D. 15.89%

141. Mr Ram invested a total of Rs 1,00,000 in two different banks for a fixed period. The first bank yields interest 9% per annum and the second bank 11% per annum. If the total interest at the end of one year is 9.75% per annum, then the amount invested in these banks are respectively:

A. Rs. 52,500, Rs 47,500

B. Rs. 62,500, Rs 37,500

C. Rs. 57,500, Rs 42,500

D. Rs 67,500, 32,500

142. The Nominal Rate of interest is 10% per annum. The interest is compounded quarterly. The effective rate of interest per annum will be-

A. 10%

B. 10.10%

C. 10.25%

D 10.38%

143. The difference between compound interest and simple interest on a certain sum of Money for 3 years at 6% per annum is Rs 110.16 the principle is
A. Rs. 3000 B. Rs. 3700 C. Rs. 12000 **D Rs 10,000**
144. A machine depreciates at 10% of its value at the beginning of a year. The cost and scrap value realized at the time of sale being Rs 23240 and Rs 9000 respectively approximately, for how years the machine is put to use ?
A. 7 B. 8 **C.9** D 10
145. The population of a town increases every year by 2% of the population at the beginning of that year. the approximate number of year, by which the total increase of population will be 40% .is ----- (Given $1.02^N = 1.17166$)
A. 15 **B. 17** C.19 D 20
146. The compound interest on Rs 15625 for 9 months at 16% per annum compounded quarterly is
A. Rs. 1851 B. Rs. 1941 **C. Rs. 1951** D Rs 1961
147. If the discount rate is 10% per annum, how much amount would you pay to receive Rs 2500 growing at 8% annually forever?
A. Rs. 1,25,000 B. Rs. 2,50,000 C. Rs. 1,50,000 D Rs 2,00,000

CHAPTER -4 TIME VALUE OF MONEY

ANNUITY RELATED PROBLEM

2006 - NOVEMBER

148. Mr. X Invests Rs. 10,000 every year starting from today for next 10 years suppose interest rate is 8% per annum compounded annually. Calculate future value of the annuity: (Given that $(1 + 0.08)^{10} = 2.15892500$)
(a) Rs. 1,56,454.88 (b) Rs. 1,44,865.625 (c) Rs. 1,56,554.88 (d) None of these
149. The present value of an annuity of Rs. 3,000 for 15 years at 4.5% p.a. C.I. is [Given that $(1.045)^{15} = 1.935282$]
(a) Rs. 23,809.67 **(b) Rs. 32,218.67** (c) Rs. 32,908.67 (d) None of these

2014 - DECEMBER

150. The future value of an annuity of Rs. 1,000 made annually for 5 years at the interest of 14% compounded annually is: (Given $(1.14)^5 = 1.92541$)

(a) Rs. 5,610 **(b) Rs. 6,610** (c) Rs. 6,160 (d) Rs. 5,160

2015 - JUNE

No asked question

2015 - DECEMBER

151. Suppose your parent decides to open a PPF (Public Provident Fund) account in a bank towards your name with Rs. 10,000 every year starting from today for next 16 years. When you receive and get 8.5% per annum interest rate compounded annually. What is the present value of this annuity? (Give answer in Rs. without any fraction.) (Given $P(15, 0.085) = 8.304236576$)

(a) 83,042 (b) 1,66,084 **(c) 93,042** (d) 8,30,423

2016 - JUNE

No asked question

2016 - DECEMBER

No asked question

2017 - JUNE

152. The future value of an annuity of Rs. 1,500 made annually for five years at interest rate 10% compounded annually is (Given that $(1.1)^5 = 1.61051$):

(a) Rs. 9,517.56 **(b) Rs. 9,157.65** (c) Rs. 9,715.56 (d) Rs. 9,175.65

2017 - DECEMBER

No asked question

2018 - MAY

153. Mr. X invests Rs. 10,000 every year starting from today for next: 10 years suppose interest rate is 8% per annual compounded annually. Calculate future value of the annuity.

(a) Rs. 1,56,454.88 (b) Rs. 1,56,554.88 (c) Rs. 1,44,865.625 (d) None of these

154. How much amount is required to be invested every year so as to accumulate Rs. 3,00,000 at the end of 10 years, if interest is compounded annually at 10%?

(a) Rs. 18,823.65 (b) Rs. 18 (c) Rs. 18,828.85 (d) Rs. 18,882.65

155. The future value of an annuity of Rs. 1,000. made annually for 5 years at the interest of 14% compounded annually is: (Given $(1.14)^5 = 1.92541$)

(a) Rs. 5,610 **(b) Rs. 6,610** (c) Rs. 6,160 (d) Rs. 5,160

2018 - NOVEMBER

156. What is the net present value of piece of property which would be valued at Rs. 2 lakh at the end of 2 years? (Annual rate of increase = 5%)

(a) **Rs. 1.81 lakh** (b) Rs. 2.01 lakh (c) Rs. 2.00 lakh (d) None of the above

2019-JUNE

157. A person wants to lease out a machine costing Rs. 5,00,000 for a 10 year period. It has fixed a rental of Rs. 51,272 per annum payable annually starting from the end of first year. Suppose rate of interest is 10% per annum compounded annually on which money can be invested. To whom this agreement is favourable?

(a) **Favour of Lessee** (b) Favour of Lessor (c) Not for both (d) Can't be determined

158. Let a person invest a fixed sum at the end of each month in an account paying interest 12% per year compounded monthly. If the future value of this annuity after the 12th payment is Rs. 55,000 then the amount invested every month is?

(a) Rs. 4,837 (b) Rs. 4,637 (c) **Rs. 4,337** (d) Rs. 3,337

159. Determine the present value of perpetuity of Rs. 50,000 per month @ rate of interest 12% p.a. is _____

(a) Rs. 45,00,000 (b) **Rs. 50,00,000** (c) Rs. 55,00,000 (d) Rs. 60,00,000

2019 - NOVEMBER

160. The value of scooter is Rs. 10,000 find its value after 7 years if rate of depreciation is 10% p.a.

(a) **Rs. 4,782.96** (b) Rs. 4,278.69 (c) Rs. 42,079 (d) Rs. 42,000

161. Scrap value of a machine valued at Rs. 10,00,000, after 10 years within depreciation at 10% p.a.:

(a) **Rs. 3,48,678.44** (b) Rs. 3,84,679.45 (c) Rs. 4,00,000 (d) Rs. 3,00,000

162. Present value of a scooter is Rs. 7,290 if its value decreases every year by 10% then its value before 3 years is equal to:

(a) **10,000** (b) 10,500 (c) 20,000 (d) 20,500

2020 - NOVEMBER

163. Find the future value of annuity of Rs. 1,000 made annually for 7 years at interest rate of 14% compounded annually. Given that $1.14^7 = 2.5023$

(a) **10,730.7** (b) 5,365.35 (c) 8,756
(d) 9,892.34

164. Find the present value of Rs. 1,00,000 to be required after 5 years if the interest rate be 9%. Given that $1.09^5 = 1.5386$.

(a) 78,995.98 (b) **64,994.15** (c) 88,992.43 (d) 93,902.12

165. A five year annuity due has periodic cash flow of Rs. 100 each year. If the interest rate is 8% the future value of this annuity is given by:

- (a) $(Rs.100) \times (\text{future value at rate } 8\% \text{ for } 5 \text{ years}) \times (0.08)$
(b) $(Rs.100) \times (\text{future value at rate } 8\% \text{ for } 5 \text{ years}) \times (1 - .08)$
(c) $(Rs.100) \times (\text{future value at rate } 8\% \text{ for } 5 \text{ years}) \times (1 + 0.08)$
(d) $(Rs.100) \times (\text{future value at rate } 8\% \text{ for } 5 \text{ years}) \times (1/0.08)$

166. A person decides to invest Rs. 1,25,000 per year for the next five years in an annuity which gives 5% per annum compounded annually. What is the approx future value? (use $1.05^5 = 1.2762$, if needed)

- (a) 1,59,535 **(b) 6,90,500** (c) 5,90,704 (d) 3,59,535

167. Which of the following statements is True? (assume that the yearly cash flow? Are identical for both annuities)

(a) The present value of an annuity due is greater than the present value of an ordinary annuity

(b) The present value of an ordinary annuity is greater than the present value of an annuity due

(c) The future value of an ordinary annuity is greater than the future value of an annuity due

(d) The future value of an annuity due is equal to future value of an ordinary annuity. (1 mark)

168. An amount is lent at a nominal rate of 4.5% per annum compounded quarterly. What would be the gain in rupees over when compounded annually?

- (a) 0.56 (b) 0.45 (c) 0.07 (d) 0.85

169. What sum of money will produce Rs. 42,800 as an interest in 3 years and 3 months at 2.5% p.a. simple interest?

- (a) Rs. 3,78,000 (b) Rs. 5,26,769 (c) Rs. 4,22,000 (d) Rs. 2,24,000

170. The ratio of principal and the compound interest value for three years (compounded annually) is 216 : 127. The rate of interest is:

- (a) 0.1777 (b) 0.1567 (c) 0.1666 (d) 0.1587

171. [A stock pays annually an amount of Rs.10 from 6th year onwards. What is the present value of the perpetuity, if the rate of return is 20%?

- (a) 20.1 (b) 19.1 (c) 21.1 (d) 22.1

2021 - JANUARY

172. A certain sum amounted to Rs. 575 at 5% in a time in which Rs. 750 amounted to Rs.

840 at 4%. If the rate of interest is simple, find the sum-of

- (a) 525 (b) 550 (c) 515 (d) **500**

173. Find the amount of compound interest, if an amount of Rs. 50,000 is deposited in a bank for one year at the rate of 8% per annum compounded semiannually

- (a) 3,080 (b) **4,080** (c) 5,456 (d) 7,856

174. The population of a town increase by 2% of the population at the beginning of the year. The number of year by which the total increases in population would be 40% is :

- (a) 7 years (b) 10 years (c) **17 years** (d) 19 years (approx)

175. Find the future value of annuity of Rs. 1,000 made annually for 7 year at interest rate of 14% compounded annually (Given that $1.14^7 = 2.5023$)

- (a) **Rs. 10,730.7** (b) Rs. 5,365.35 (c) Rs. 8,756 (d) Rs. 9892.34

176. Two equal amounts of money are deposited in two banks each at 15% p.a. for 3.5 year in the bank and for 5 years in the other. The difference between the interest amount from the bank is Rs. 144. Find the sum

- (a) Rs. 620 (b) **Rs. 640** (c) Rs. 820 (d) Rs. 840

177. The simple interest on a sum at 4% p.a. for 2 years is Rs. 80. Find the CI on the same sum for the same period.

- (a) **Rs. 81.60** (b) Rs. 80.80 (c) Rs. 83.20 (d) Rs. 82.30

178. Which is a better investment 9% p.a. compounded quarterly or 9.1 % p.a. simple interest?

- (a) **9% compounded** (b) 9.1% S.T. (c) Both are same (d) Cannot be said

179. The effective rate of interest corresponding to a nominal rate of 7% p.a. compounded quarterly is

- (a) 7.5% (b) 7.6% (c) 7.7% (d) **7.18%**

180. Assuming that the discount rate is 7% p.a. how much would you pay to receive Rs. 200 growing at 5% annually for ever?

- (a) Rs. 2,500 (b) Rs. 5,000 (c) Rs. 7,500 (d) **Rs. 10,000**

181. A man invested one-third of his capital at 7% one-fourth at 8% and the remainder at 10%. If the annual income is Rs. 561. The capital is -

- (a) Rs. 4,400 (b) Rs. 5,500 (c) **Rs. 6,600** (d) Rs. 5,800

182. A sum of money is lent at C.I. Rate 20% p.a. 2 years. It would fetch Rs. 482 more if the interest is compounded half yearly. The sum is:

- (a) Rs. 19,800 (b) Rs. 19,900 (c) **Rs. 20,000**
(d) Rs. 20,100

183. Rs. 800 is invested at the end of each month in an account paying interest 6% per year compounded monthly. What is the future value of this annually after 10th payment?
 (a)Rs. 4,444 (b)Rs. 8,756 (c)Rs. 3,491 (d)**Rs. 8,151.67**

184. What T denote the actual rate of interest in decimal, and n denote the number of conversion periods, the formula for computing the effective rate of interest E is given by,
 (a) $(1 + i)^n$ (b) $(1 + i)^n - 1$ (c) $1 - (1 + i)^n$ (d) $(1 + i)^{-n}$

185. The present value of an Annuity immediate is the same as
(a)Annuity regular for (n - 1) year plus the initial receipt in the beginning of the period.
 (b)Annuity regular for (n - 1) years
 (c)Annuity regular for (n + 1) years
 (d)Annuity regular for (n + 1) years plus the initial receipt in the beginning of the period

2021 - JULY

186. If the desired future value after 5 years with 18% interest rate is Rs. 1,50,000, then the present value (in Rs.) is (Given that $(1.18)^5 = 2.2877$)?
 (a)63,712 (b)**65,568** (c)53,712 (d)41,712

187. If discount rate is 14% per annum, then how much a company has to pay to receive Rs. 280 growing at 9% annually forever?
(a)Rs. 5,600 (b)Rs. 2,800 (c)Rs. 1,400 (d)Rs. 4,200

188. If the nominal rate of growth is 17% and inflation is 9% for the five years. Let P be the Gross Domestic Product (GDP) amount at the present year then the projected real GDP after 6 years is:
(a)1.587 P (b)1.921 P (c)1.403 P (d) 2.51 P

189. A loan of Rs. 1,02,000 is to be paid back in two equal annual instalments. If the rate of interest is 4% p.a, compounded annually, then the total interest charged {in Rs.) under this instalment plan is:
(a)6,160 (b)8,120 (c)5,980 (d)7,560

190. if a person bought a house by paying Rs. 45,00,000 down payment and Rs. 80,000 at the end of each year till the perpetuity. Assuming the rate of interest as 16% the present value of house (in Rs.) is given as:
 (a)47,00,000 (b)45,00,000 (c)57,80,000 (d)**50,00,000**

191. Let the operating profit of a manufacturer for five years is given as:

Years	1	2	3	4	5	6

Operating profit (in lakh Rs.)	90	100	106.4	107.14	120.24	157.34

Then the operating profit of Compound Annual Growth Rate (CAGR) for year 6 with respect to year 2 is given that:

- (a)9% **(b)12%** (c)11% (d)13%

192. If the cost of capital be 12% per annual, then the net present value (in nearest Rs.) from the given cash flow is given as:

Years	0	1	2	3
Operating profit (in thousands Rs.)	(100)	60	40	50

- (a)31048 (b)34185 **(c)21048** (d)24187

193. The future value of annuity of Rs.2,000 for 5 years at 5% compounded annually is given (in nearest Rs.) as:

- (a)51,051 (b)21,021 **(c)11,051** (d)61,254

2021 - DECEMBER

194. Mr. X wants to accumulate Rs. 50,00,000 at the end of 10 years. Then how much amount is required to be invested every year if interest is compounded annually at 10%? (Given that $P(10,0.10) = 15.9374298$)

- (a)Rs. 3,13,726.87** (b)Rs. 4,13,726.87 (c)Rs. 3,53,726.87 (d)Rs. 4,53,726.87

195. A company needs Rs. 10,000 in five years to replace as equipment. How much (in Rs.) should be invested now at an interest rate of 8% p.a. in order to provide for this equipment?

- (a)6,000 **(b)6,805** (c)10,000 (d) 11,000

196. The present value of Rs. 25,000 to be received after 10 years at 6% per annum compounded annually is Rs. _____. ($1.06^5 = 1.33823$)

- (a)Rs. 15,960 **(b)Rs. 13,960** (c)Rs. 11,960 (d)Rs. 17,960

2022 JUNE :

197. Rs. 200 is invested at the end of each Month in an account paying interest 6% per year compounded monthly. What is the future value of this annuity after 10th payment ? _____.

- (a)Rs. 12044 **(b)Rs. 2044** (c)Rs. 2040 (d)Rs. 12000

198. Anshika took loan of Rs 1,00,000 @8% for 5 years. What amount will she pay wants if she wants the whole amount in five equal installment ?

- (a) 26045 (b) **Rs. 25045.63** (c) 28045.50 (d) none

199. If discount rate is 7% per annum, then how much a company has to pay to receive Rs. 200 growing at 5% annually forever?

- (a) 2500 (b) **Rs. 5000** (c) 7500 (d) **Rs. 10000**

200. A company establishes a sinking fund to provide for the payment of Rs 2,00,000 debt maturity in 20 years. Contributions to the fund are to be made at the end of every year. Find the Amount of each deposit of interest is 10% per annum.?

- (a) Rs. 3592.11 (b) **Rs. 3492.11** (c) Rs. 3392.11 (d) None

201. The CAGR of Initial Value of an investment of Rs 15000 and Final Value of Rs 25000 in 3 years is

- (a) 19% (b) **18.56%** (c) 17.56% (d) 17%

202. ABC LTD. Wants to lease out an asset costing Rs. 3,60,000 for Five Years period. It has a Fixed rental of Rs 1,05,000 per annum payable annually starting from end of first year. Suppose rate of interest is 14% per annum compounded annually on which money can be invested by the company. Is this agreement favourable to company.

- (a) **yes** (b) no (c) it depends (d) none

2022 - DECEMBER

203. Rs. 5,000 is invested every month end in an account paying interest @ 12% per annum compounded monthly. What is the future value of this annuity just after making 11th payment? (Given that $(1.01)^{11} = 1.1156$)

- A. Rs. 57,800 B. Rs. 56,100 C. Rs. 56,800
D. Rs. 57,100

204. A farmer borrowed 3600 at the rate of 15% simple interest per Annum. At the end of 4 years, he cleared this account by paying Rs. 4000 and a cow. The cost of the cow is:

- A. Rs. 1000 B. Rs. 1200 C. Rs. 1550 **D. Rs. 1760**

205. Sinking fund factor is the reciprocal of :

- A. Present value interest factor of a single cash flow
B. Present value interest factor of an annuity.
C. Future value interest factor of an annuity.
D. Future value interest factor of a single cash flow.

206. Raju invests Rs. 20,000 every year in a deposit scheme starting from today for next

12 years. Assuming that interest rate on this deposit is 7% per annum compounded annually. What will be the future value of this annuity? Given that $(1+0.07)^{12} = 2.25219169$.

- A. Rs. 540,526 **B. Rs. 382,813** C. Rs. 643,483 D. Rs. 357,769

207. Mr A invested Rs. 10,000 every year for next 3 years at the interest rate of 8 percent per annum compounded annually. What is future value of the annuity?

- A. 32644 **B. 32464** C. 34264 D. 96442

208. How much amount is required to be invested every year so as to accumulate Rs. 5,00,000 at the end of 12 years if interest is compounded annually at 10%? {Where $A(12,0.1) = 21.384284$ }

- A. Rs. 23381.65** B. Rs. 24385.85 C. Rs. 26081.65 D. Rs. 28362.75

2024 – JUNE

209. Suppose you have decided to make a systematic plan in annual fund with Rs 1,00,000 every year from today for next year where you get return at the rate of 10% per annum compounded annually. What is the future value of this annuity?

- A. Rs. 1735,114 B. Rs. 1753411 C. Rs. 1735411 D. Rs. 1753114

210. Mr Paul invested Rs 1,00,000 in a mutual fund scheme in January 2018. After one year in January 2019, she got a dividend amounting to Rs 10,000 for first year, Rs 12,000 for second year, Rs 16,000 for third year, Rs 18,000 for fourth year and Rs 21,000 for fifth year in January 2023. What is compounded annual growth rate (CAGR) for dividend return? Given $1.2038^4 = 2.1$

- A. 20.38% B. 18.59% C. 16.36% D. 15.89%

211. Mr Ram invested a total of Rs 1,00,000 in two different banks for a fixed period. The first bank yields interest 9% per annum and second bank 11% per annum. If the total interest at the end of one year is 9.75% per annum, then the amount invested in these banks are respectively:

- A. Rs. 52,500, Rs 47,500 B. Rs. 62,500, Rs 37,500
C. Rs. 57,500, Rs 42,500 D. Rs. 67,500, Rs 32,500

212. A company wants to replace its existing tool room machine at the end of 10 years. The expected cost of machine would be Rs 10,00,000. If management of the company creates a sinking fund, how much provision needs to be made out of Revenue each year which can earn at the rate of 10% compounded annually? Given $A(10, 10) = 15.9375425$

- A. Rs. 74,625 B. Rs. 72,514 C. Rs. 62,745 D. Rs. 67,245

213. A car is available for Rs 4,98,200 cash payment or Rs 60,000 cash down payment followed by three equal annual installments. If the rate of interest charged is 14% per annum compounded yearly, then total interest charged in the installment plan is given

$$P(3,0.14) = 2.32163$$

A. Rs. 146314 B. Rs. 146137 C. Rs. 128040
D. Rs. 158040

214. Govinda's mother decides to gift him Rs 50,000 every year starting from today for the next five years. Govinda deposits this amount in the bank as and when he receives and gets 10% per annum interest rate compounded annually, what is the present value of the annuity? (Given $p(4.0.10) = 3.16987$)

A. Rs. 2,80,493.5 B. Rs. 208593.5 C. Rs. 208943.5 D. Rs. 258493.5

215. If the discount rate is 10% per annum, how much amount would you pay to receive Rs 2500 growing at 8% annually forever?

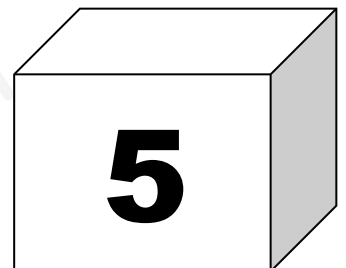
A. Rs. 1,25,000 B. Rs. 2,50,000 C. Rs. 1,50,000 D. Rs. 2,00,000

216. Mr. Sharad got his retirement benefits amounting to Rs 50,00,000. He wants to receive a fixed monthly sum of amount for his rest of life, starting after one month and thereafter he wants to pass on the same future generation. He expects to earn an interest of Rs 9% compounded annually. Determine how much perpetuity amount he will receive every month?

A. Rs. 39500 B. Rs. 38500 C. Rs. 37500 D. Rs. 36600

217. Jonny wants to have Rs 2,00,000 in his saving account after three years. The rate of interest offered by banks is 8% per annum compounded annually. How much should he invest today to achieve his target amount?

A. Rs. 147489.10 B. Rs. 158766.44 C. Rs. 171035.59 D. Rs. 184417.96



BASIC CONCEPTS OF PERMUTATIONS AND COMBINATION

THE FACTORIAL

Definition: The factorial n , written as $n!$ or $[n$, represents the product of all integers from 1 to n both inclusive. To make the notation meaningful, when $n = 0$, we define $0!$ or ${}_0 = 1$.

Thus, $n! = n (n - 1) (n - 2) \dots \dots \dots 3.2.1$

Example 1: Find $5!$, $4!$ and $6!$

Solution: $5! = 5 \times 4 \times 3 \times 2 \times 1 = 120$; $4! = 4 \times 3 \times 2 \times 1 = 24$; $6! = 6 \times 5 \times 4 \times 3 \times 2 \times 1 = 720$.

Example 2: Find $9! / 6!$; $10! / 7!$.

Solution: $\frac{9!}{6!} = \frac{9 \times 8 \times 7 \times 6!}{6!} = 9 \times 8 \times 7 = 504$; $\frac{10!}{7!} = \frac{10 \times 9 \times 8 \times 7!}{7!} = 10 \times 9 \times 8 = 720$

Example 3: Find x if $1/9! + 1/10! = x/11!$

Solution: $1/9! (1 + 1/10) = x/11 \times 10 \times 9!$ or, $11/10 = x/11 \times 10$ i.e., $x = 121$

Example 4: Find n if $\frac{n+1}{n-1} = 30$

Solution: $\frac{n+1}{n-1} = 30 \Rightarrow (n+1).n \frac{n-1}{n-1} = 30 \frac{n-1}{n-1}$

or, $n^2 + n = 30$ or, $n^2 + n - 30$ or, $n^2 + 6n - 5n - 30 = 0$ or, $(n + 6) (n - 5) = 0$ either $n = 5$ or $n = -6$. (Not possible) $n = 5$.

PERMUTATIONS

Definition: The ways of arranging or selecting smaller or equal number of persons or objects from a group of persons or collection of objects with due regard being paid to the order of arrangement or selection, are called permutations.

$${}^n P_r = n (n - 1)(n - 2) \dots (n - r + 1)$$

where the product has exactly r factors.

Example 1: Evaluate each of ${}^5P_3$, ${}^{10}P_2$, ${}^{11}P_5$.

Example 2: How many three letters words can be formed using the letters of the words (a) SQUARE and (b) HEXAGON?

Example 3: In how many different ways can five persons stand in a line for a group photograph?

Example 4: First, second and third prizes are to be awarded at an engineering fair in which 13 exhibits have been entered. In how many different ways can the prizes be awarded?

Example 5: In how many different ways can 3 students be associated with 4 chartered accountants, assuming that each chartered accountant can take at most one student?

Example 6: If six times the number permutations of n things taken 3 at a time is equal to seven times the number of permutations of $(n - 1)$ things taken 3 at a time, find n .

Example 7: Compute the sum of 4 digit numbers which can be formed with the four digits 1, 3, 5, 7, if each digit is used only once in each arrangement.

Example 8: Find n if ${}^nP_3 = 60$.

Example 9: If ${}^{56}P_{r+6} : {}^{54}P_{r+3} = 30,800 : 1$, find r .

Example 10: Prove the following

Example 11: In how many different ways can a club with 10 members select a President, Secretary and Treasurer, if no member can hold two offices and each member is eligible for any office?

Example 12: When Jhon arrives in New York, he has eight shops to see, but he has time only to visit six of them. In how many different ways can he arrange his schedule in New York?

Example 13: When Dr. Ram arrives in his dispensary, he finds 12 patients waiting to see him. If he can see only one patient at a time, find the number of ways, he can schedule his patients (a) if they all want their turn, and (b) if 3 leave in disgust before Dr. Ram gets around to seeing them.

EXERCISE 5 (A)

Choose the most appropriate option (a) (b) (c) or (d)

1. ${}^4P_3$ is evaluated as

a) 43

b) 34

c) 24

d) None of these

2. ${}^4P_4$ is equal to

- a) 1 b) 24 c) 0 d) none of these

3. ${}_7P_7$ is equal to

- a) 5040 b) 4050 c) 5050 d) none of these

4. ${}_0P_0$ is a symbol equal to

- a) 0 b) 1 c) Infinity d) none of these

5. In ${}^nP_r$, n is always

- a) an integer b) a fraction c) a positive integer d) none of these

6. In ${}^nP_r$, the restriction is

- a) $n > r$ b) $n \geq r$ c) $n \leq r$ d) none of these

7. In ${}^nP_r = n(n-1)(n-2)\dots(n-r+1)$, the number of factors is

- a) n b) r - 1 c) n - r d) r

8. ${}^nP_r$ can also written as

- a) $\frac{n!}{(n-r)!}$ b) $\frac{r!}{(n-r)!}$ c) $\frac{r!}{n!}$ d) none of these

9 If ${}^nP_4 = 12 \times {}^nP_2$, the n is equal to

- a) -1 b) 6 c) 5 d) none of these

10. If ${}^nP_3 : {}^nP_2 = 3 : 1$, then n is equal to

- a) 7 b) 4 c) 5 d) none of these

11. ${}^{m+n}P_2 = 56$, ${}^{m-n}P_2 = 30$ then

- a) m = 6, n = 2 b) m = 7, n = 1 c) m = 4, n = 4 d) none of these

12. if ${}^5P = 60$, then the value of r is

- a) 3 b) 2 c) 4 d) none of these

13. If ${}^{n_1+n_2}P_2 = 132$, ${}^{n_1-n_2}P_2 = 30$ then,

- a) $n = 6$, $n_2 = 6$ b) $n_1 = 10$, $n_2 = 2$ c) $n_1 = 9$, $n_2 = 3$ d) none of these

14. The number of ways the letters of the word 'COMPUTER' can be rearranged is

- a) 40,320 b) 40,319 c) 40,318 d) none of these

15. The number of arrangements of the letters in the word 'FAILURE', so that vowels are always coming together is

- a) 576 b) 575 c) 570 d) none of these

16. 10 examination papers are arranged in such a way that the best and worst papers never come together. The number of arrangements is

- a) 98 b) 10 c) 89 d) none of these

17. n articles are arranged in such a way that 2 particular articles never come together. The number of such arrangements is

- a) $(n - 2) \underline{n - 1}$ b) $(n - 1) \underline{n - 2}$ c) n d) none of these

18. If 12 school teams are participating in a quiz contest, then the number of ways the first, second and third positions may be won is

- a) 1,230 b) 1,320 c) 3,210 d) none of these

19. The sum of all 4 digit number containing the digits 2, 4, 6, 8, without repetitions is

- a) 1,33,330 b) 1,22,220 c) 2,13,330 d) 1,33,320

20. The number of 4 digit numbers greater than 5,000 can be formed out of the digits 3,4,5,6 and 7(No. digit is repeated). The number of such is

- a) 72 b) 27 c) 70 d) none of these

21. 4 digit numbers to be formed out of the figures 0, 1, 2, 3, 4 (no digit is repeated) then number of such numbers is

- (a) 120 (b) 20 (c) 96. (d) none of these

22. The number of ways the letters of the word 'TRIANGLE' to be arranged so that the word 'angle' will be always present is

- (a) 20 (b) 60 (c) 24 (d) 32

23. If the letters word 'DAUGHTER' are to be arranged so that vowels occupy the odd places, then number of different words are

- (a) 2,880 (b) 676 (c) 625 (d) 576

Exercise 5(A)

1. (c) 2. (b) 3. (a) 4. (b) 5. (c) 6. (b) 7. (d) 8. (a)
9. (b) 10. (c) 11. (b) 12. (b) 13. (c) 14. (b) 15. (a) 16. (c)

17. (a) 18. (b) 19. (d) 20. (a) 21 (c) 22 (c) 23 (a)

CIRCULAR PERMUTATIONS

So far we have discussed arrangements of objects or things in a row which may be termed as linear permutation. But if we arrange the objects along a closed curve viz., a circle, the permutations are known as circular permutations.

The number of circular permutations of n different things chosen at a time is $(n - 1)!$.

Example 1: In how many ways can 4 persons sit at a round table for a group discussions?

Hence, the number of necklaces formed with n beads of different

$$\text{colours} = \frac{1}{2} (n - 1)$$

Example 1: How many arrangements can be made out of the letters of the word 'DRAUGHT', the vowels never being separated?

Example 2: Show that the number of ways in which n books can be arranged on a shelf so that two particular books are not together. The number is $(n - 2) \cdot (n - 1)!$

Example 3: There are 6 books on Economics, 3 on Mathematics and 2 on Accountancy. In how many ways can these be placed on a shelf if the books on the same subject are to be together?

Example 4: How many different numbers can be formed by using any three out of five digits 1, 2, 3, 4, 5, no digit being repeated in any number?

Example 5: How many four digit numbers can be formed out of the digits 1, 2, 3, 5, 7, 8, 9, if no digit is repeated in any number? How many of these will be greater than 3000?

Example 6: Find the total number of numbers greater than 2000 that can be formed with the digits 1, 2, 3, 4, 5 no digit being repeated in any number.

Example 7: There are 6 students of whom 2 are Indians, 2 Americans, and the remaining 2 are Russians. They have to stand in a row for a photograph so that the two Indians are together, the two Americans are together and so also the two Russians. Find the number of ways in which they can do so.

Solution: The two Indians can stand together in ${}^2P_2 = 2! = 2$ ways. So is the case with the two Americans and the two Russians.

Now these 3 groups of 2 each can stand in a row in ${}^3P_3 = 3 \times 2 = 6$ ways. Hence by the generalized fundamental principle, the total number of ways in which they can stand for a photograph under given conditions is

$$6 \times 2 \times 2 \times 2 = 48$$

Example 8: A family of 4 brothers and three sisters is to be arranged for a photograph in one row. In how many ways can they be seated if (i) all the sisters sit together, (ii) no two sisters sit together?

Example 9: In how many ways can 8 persons be seated at a round table? In how many cases will 2 particular persons sit together?

Example 10: Six boys and five girls are to be seated for a photograph in a row such that no two girls sit together and no two boys sit together. Find the number of ways in which this can be done.

EXERCISE 5 (B)

Choose the most appropriate option (a) (b) (c) or (d)

- 1 The number of ways in which 7 girls form a ring is
(a) 700 (b) 710 (c) 720 (d) none of these
2. The number of ways in which 7 boys sit in a round table so that two particular boys may sit together is
(a) 240 (b) 200 (c) 120 (d) none of these
3. If 50 different jewels can be set to form a necklace then the number of ways is
(a) $\frac{1}{2} \times 50$ (b) $\frac{1}{2} \times 49$ (c) 49 (d) none of these
4. 3 ladies and 3 gents can be seated at a round table so that any two and only two of the ladies sit together. The number of ways is
(a) 70 (b) 27 (c) 72 (d) none of these
5. The number of ways in which the letters of the word 'DOGMATIC' can be arranged is
(a) 40,319 (b) 40,320 (c) 40,321 (d) none of these
6. The number of arrangements of 10 different things taken 4 at a time in which one particular thing always occurs is
(a) 2015 (b) 2016 (c) 2014 (d) none of these
7. The number of permutations of 10 different things taken 4 at a time in which one particular thing never occurs is
(a) 3,020 (b) 3,025 (c) 3,024 (d) none of these
8. Mr. X and Mr. Y enter into a railway compartment having six vacant seats. The number of ways in which they can occupy the seats is
(a) 25 (b) 31 (c) 32 (d) 30
9. The number of numbers lying between 100 and 1000 can be formed with the digits 1, 2, 3, 4, 5, 6, 7 is
(a) 210 (b) 200 (c) 110 (d) none of these
10. The number of numbers lying between 10 and 1000 can be formed with the digits 2,3,4,0,8,9 is
(a) 124 (b) 120 (c) 125 (d) none of these
11. In a group of boys the number of arrangement of 4 boys is 12 times the number of arrangements of 2 boys. The number of boys in the group is

- (a) 10 (b) 8 (c) 6 (d) none of these
12. The value of $\sum_{r=1}^{10} r \cdot {}^r P_r$ is
 (a) ${}^{11}P_{11}$ (b) ${}^{11}P_{11} - 1$ (c) ${}^{11}P_{11} + 1$ (d) none of these
13. The total number of 9 digit numbers of different digits is
 (a) $10|9$ (b) $8|9$ (c) $9|9$ (d) none of these
14. The number of ways in which 6 men can be arranged in a row so that the particular 3 men sit together, is
 (a) ${}^4P_4$ (b) ${}^4P_4 \times {}^3P_3$ (c) $(|3|)^2$ (d) none of these
15. There are 5 speakers A, B, C, D and E. The number of ways in which A will speak always before B is
 (a) 24 (b) $|4| \times |2|$ (c) $|5|$ (d) none of these
16. There are 10 trains plying between Calcutta and Delhi. The number of ways in which a person can go from Calcutta to Delhi and return by a different train is
 (a) 99 (b) 90 (c) 80 (d) none of these
17. The number of ways in which 8 sweats of different sizes can be distributed among 8 persons of different ages so that the largest sweat always goes to be younger assuming that each one of them gets a sweat is
 (a) $|8|$ (b) 5040 (c) 5039 (d) none of these
18. The number of arrangements in which the letters of the word 'MONDAY' be arranged so that the words thus formed begin with M and do not end with N is
 (a) 720 (b) 120 (c) 96 (d) none of these
19. The total number of ways in which six '+' and four '-' signs can be arranged in a line such that no two signs occur together is
 (a) $|7| |3|$ (b) $|6| \times |7| / |3|$ (c) 35 (d) none of these
20. The number of ways in which the letters of the word 'MOBILE' be arranged so that consonants always occupy the odd places is
 (a) 36 (b) 63 (c) 30 (d) none of these.
21. 5 persons are sitting in a round table in such way that Tallest Person is always on the right-side of the shortest person; the number of such arrangements is
 (a) 6 (b) 8 (c) 24 (d) none of these

Exercise 5 (B)

1. (c) 2. (a) 3. (b) 4. (c) 5. (b) 6. (b) 7. (c) 8. (d)
9. (a) 10. (c) 11. (c) 12. (b) 13. (c) 14. (b) 15. (a) 16. (b)
17. (b) 18. (c) 19. (c) 20. (a) 21. (a)

COMBINATIONS

Definition: The number of ways in which smaller or equal number of things are arranged or selected from a collection of things where the order of selection or arrangement is not important, are called combinations.

$$\therefore {}^nC = n! / r! (n - r)!$$

Remarks: Using the above formula, we get

$$(i) {}^nC_0 = n! / 0! (n - 0)! = n! / n! = 1. \text{ [As } 0! = 1 \text{]}$$

$${}^nC_n = n! / n! (n - n)! = n! / n! 0! = 1 \text{ [Applying the formula for } {}^nC_r \text{ with } r = n \text{]}$$

Example 1: Find the number of different poker hands in a pack of 52 playing cards.

Example 2: Let S be the collection of eight points in the plane with no three points on the straight line. Find the number of triangles that have points of S as vertices.

Example 3: A committee is to be formed of 3 persons out of 12. Find the number of ways of forming such a committee.

Example 4: A committee of 7 members is to be chosen from 6 Chartered Accountants, 4 Economists and 5 Cost Accountants. In how many ways can this be done if in the committee, there must be at least one member from each group and at least 3 Chartered Accountants?

Example 5: A person has 12 friends of whom 8 are relatives. In how many ways can he invite 7 guests such that 5 of them are relatives?

Solution: Of the 12 friends, 8 are relatives and the remaining 4 are not relatives. He has to invite 5 relatives and 2 friends as his guests. 5 relatives can be chosen out of 8 in ${}^8C_5$ ways; 2 friends can be chosen out of 4 in ${}^4C_2$ ways.

Hence, by the fundamental principle, the number of ways in which he can invite 7 guests such that 5 of them are relatives and 2 are friends.

$$= {}^8C_5 \times {}^4C_2$$

$$= \{8! / 5! (8-5)!\} \times \{4! / 2! (4-2)!\} = [(8 \times 7 \times 6 \times 5!) / 5! \times 3!] \times \frac{4 \times 3 \times 2 \times 1}{2! \times 2!} = 8 \times 7 \times 6$$

$$= 336.$$

Example 6: A Company wishes to simultaneously promote two of its 6 department heads to assistant managers. In how many ways these promotions can take place?

Example 7: A building contractor needs three helpers and ten men apply. In how many ways can these selections take place?

Example 8: In each case, find n:

(a) ${}^nC_2 = {}^{n+2}C_3$

(b) ${}^{n+2}C_n = 45$.

Example 9: A box contains 7 red, 6 white and 4 blue balls. How many selections of three balls can be made so that (a) all three are red (b) none is red (c) one is of each colour?

Example 10: If ${}^{10}P_r = 6,04,800$ and ${}^{10}C_r = 120$; find the value of r ,

Example 11: Find r if ${}^{18}C_r = {}^{18}C_{r+2}$

Example 12: Prove that

$${}^nC_r = {}^{n-2}C_{r-2} + 2{}^{n-2}C_{r-1} + {}^{n-2}C_r$$

Example 13: If ${}^{28}C_{2r} : {}^{24}C_{2r-4} = 225 : 11$, find r .

$$= 14 \times 13 \times 12 \times 11$$

$$\therefore 2r = 14 \text{ i.e., } r = 7$$

Example 14: Find x if ${}^{12}C_5 + 2{}^{12}C_4 + {}^{12}C_3 = {}^{14}C_x$

Example 15: How many different permutations are possible from the letters of the word 'CALCULUS'?

Example 16: In how many ways can 17 billiard balls be arranged, if 7 of them are black, 6 red and 4 white?

Example 17: An examination paper with 10 questions consists of 6 questions in Algebra and 4 questions in Geometry. At least one question from each section is to be attempted. In how many ways can this be done?

Example 18: A man has 5 friends. In how many ways can he invite one or more of his friends to dinner?

Example 19: There are 7 men and 3 ladies. Find the number of ways in which a committee of 6 can be formed of them if the committee is to include at least two ladies?

Example 20: Find the number of ways of selecting 4 letters from the word 'EXAMINATION'.

EXERCISE 5 (C)

Choose the most appropriate option (a, b, c or d)

1. The value of ${}^{12}C_4 + {}^{12}C_3$ is
(a) 715 (b) 710 (c) 716 (d) none of these
2. If ${}^np_r = 336$ and ${}^nC_r = 56$, then n and r will be
(a) (3, 2) (b) (8, 3) (c) (7, 4) (d) none of these
3. If ${}^{18}C_r = {}^{18}C_{r+2}$, the value of ${}^rC_5$ is
(a) 55 (b) 50 (c) 56 (d) none of these
4. If ${}^nC_{r-1} = 56$, ${}^nC_r = 28$ and ${}^nC_{r+1} = 8$, then r is equal to
(a) 8 (b) 6 (c) 5 (d) none of these
5. A person has 8 friends. The number of ways in which he may invite one or more of them to a dinner is.
(a) 250 (b) 255 (c) 200 (d) none of these
6. The number of ways in which a person can chose one or more of the four electrical appliances : T.V, Refrigerator, Washing Machine and a cooler is
(a) 15 (b) 25 (c) 24 (d) none of these
7. If ${}^nC_{10} = {}^nC_{14}$, then ${}^{25}C_n$ is
(a) 24 (b) 25 (c) 1 (d) none of these
8. Out of 7 gents and 4 ladies a committee of 5 is to be formed. The number of committees such that each committee includes at least one lady is
(a) 400 (b) 440 (c) 441 (d) none of these
9. If ${}^{28}C_{2r} : {}^{24}C_{2r-4} = 225 : 11$, then the value of r is
(a) 7 (b) 5 (c) 6 (d) none of these
10. The number of diagonals in a decagon is
(a) 30 (b) 35 (c) 45 (d) none of these
Hint: The number of diagonals in a polygon of n sides is $\frac{1}{2}n(n-3)$.
11. There are 12 points in a plane of which 5 are collinear. The number of triangles is

- (a) 200 (b) 211 (c) 210 (d) none of these

12. The number of straight lines obtained by joining 16 points on a plane, no three of them being on the same line is

- (a) 120 (b) 110 (c) 210 (d) none of these

13. At an election there are 5 candidates and 3 members are to be elected. A voter is entitled to vote for any number of candidates not greater than the number to be elected. The number of ways a voter choose to vote is

- (a) 20 (b) 22 (c) 25 (d) none of these

14. Every two persons shakes hands with each other in a party and the total number of hand shakes is 66. The number of guests in the party is

- (a) 11 (b) 12 (c) 13 (d) 14

15. The number of parallelograms that can be formed from a set of four parallel lines intersecting another set of three parallel lines is

- (a) 6 (b) 18 (c) 12 (d) 9

16. The number of ways in which 12 students can be equally divided into three groups is

- (a) 5775 (b) 7575 (c) 7755 (d) none of these

17. The number of ways in which 15 mangoes can be equally divided among 3 students is

- (a) $\frac{15}{(5)^4}$ (b) $\frac{15}{(5)^3}$ (c) $\frac{15}{(5)^2}$ (d) none of these

18. 8 points are marked on the circumference of a circle. The number of chords obtained by joining these in pairs is

- (a) 25 (b) 27 (c) 28 (d) none of these

19. A committee of 3 ladies and 4 gents is to be formed out of 8 ladies and 7 gents. Mrs. X refuses to serve in a committee in which Mr. Y is a member. The number of such committees is

- (a) 1530 (b) 1500 (c) 1520 (d) 1540

20. If ${}^{500}C_{92} = {}^{499}C_{92} + {}^nC_{91}$ then n is

- (a) 501 (b) 500 (c) 502 (d) 499

21. The Supreme Court has given a 6 to 3 decision upholding a lower court; the number of ways it can give a majority decision reversing the lower court is

- (a) 256 (b) 276 (c) 245 (d) 226.

22. Five bulbs of which three are defective are to be tried in two bulb points in a dark room. Number of trials the room shall be lighted is

- (a) 6 (b) 8 (c) 5 (d) 7.

ANSWERS

Exercise 5 (C)

1. (a) 2. (b) 3. (c) 4. (b) 5. (b) 6. (a) 7. (b) 8. (c)
9. (a) 10. (b) 11. (c) 12. (a) 13. (c) 14. (b) 15. (b) 16. (a)
17. (b) 18. (c) 19. (d) 20. (d) 21. (a) 22. (d)

MISCELLANEOUS EXAMPLE

EXERCISE 5(D)

Choose the appropriate option a,b,c or d

1. The letters of the words 'CALCUTTA' and 'AMERICA' are arranged in all possible ways. The ratio of the number of there arrangements is

- (a) 1:2 (b) 2:1 (c) 2:2 (d) none of these

2. The ways of selecting 4 letters from the word 'EXAMINATION' is

- (a) 136 (b) 130 (c) 125 (d) none of these

3. The number of different words that can be formed with 12 consonants and 5 vowels by taking 4 consonants and 3 vowels in each word is

- (a) ${}^{12}C_4 \times {}^5C_3$ (b) ${}^{17}C_7$ (c) $4950 \times 7!$ (d) none of these

4. Eight guests have to be seated 4 on each side of a long rectangular table. 2 particular guests desire to sit on one side of the table and 3 on the other side. The number of ways in which the sitting arrangements can be made is

- (a) 1732 (b) 1728 (c) 1730 (d) 1278.

5 A question paper contains 6 questions, each having an alternative.

The number of ways an examine can answer one or more questions is

- (a) 720 (b) 728 (c) 729 (d) none of these

6. ${}^{51}C_{31}$ is equal to

- (a) ${}^{51}C_{20}$ (b) $2 \cdot {}^{50}C_{20}$ (c) $2 \cdot {}^{45}C_{15}$ (d) none of these

7. The number of words that can be made by rearranging the letters of the word APURNA so that vowels and consonants appear alternate is

- (a) 18 (b) 35 (c) 36 (d) none of these

8. The number of arrangement of the letters of the word 'COMMERCE' is

- (a) $\frac{8!}{2!2!2!}$ (b) $\frac{8!}{(2!2!2!)}$ (c) $7!$ (d) none of these

9. A candidate is required to answer 6 out of 12 questions which are divided into two groups containing 6 questions in each group. He is not permitted to attempt not more than four from any group. The number of choices are.

- (a) 750 (b) 850 (c) 800 (d) none of these

10. The results of 8 matches (Win, Loss or Draw) are to be predicted. The number of different forecasts containing exactly 6 correct results is

- (a) 316 (b) 214 (c) 112 (d) none of these

11. The number of ways in which 8 different beads be strung on a necklace is

- (a) 2500 (b) 2520 (c) 2250 (d) none of these

12. The number of different factors the number 75,600 has is

- (a) 120 (b) 121 (c) 119 (d) none of these

13. The number of 4 digit numbers formed with the digits 1,1, 2, 2, 3, 4 is

- (a) 100 (b) 101 (c) 201 (d) none of these

14. The number of ways a person can contribute to a fund out of 1 ten - rupee note, 1 five-rupee note, 1 two-rupee and 1 one rupee note is

- (a) 15 (b) 25 (c) 10 (d) none of these

15. The number of ways in which 9 things can be divided into twice groups containing 2,3, and 4 things respectively is

- (a) 1250 (b) 1260 (c) 1200 (d) none of these

16. ${}^{(n-1)}P_r + r \cdot {}^{(n-1)}P_{(r-1)}$ is equal to

- (a) ${}^nC_r$ (b) $\frac{n!}{r!(n-r)!}$ (c) ${}^nP_r$ (d) none of these

17. $2n$ can be written as

- (a) $2^n \{1.3.5....(2n-1)\}$ (b) $2^n n$ (c) $\{1.3.5....(2n-1)\}$ (d) none of these

18. The number of even numbers greater than 300 can be formed with the digits 1, 2, 3, 4, 5 without repetition is

- (a) 110 (b) 112 (c) 111 (d) none of these

19. 5 letters are written and there are five letter-boxes. The number of ways the letters can be dropped into the boxes, are in each

- (a) 119 (b) 120 (c) 121 (d) none of these

20. ${}^nC_1 + {}^nC_2 + {}^nC_3 + {}^nC_4 + \dots + {}^nC_n$ equals

- (a) $2^n - 1$ (b) 2^n (c) $2^n + 1$ (d) none of these

Exercise 5 (D)

1. (b) 2. (a) 3. (c) 4. (b) 5. (b) 6. (a) 7. (c) 8. (b)&(c)
 9. (b) 10. (c) 11. (b) 12. (c) 13. (d) 14. (a) 15. (b) 16. (c)
 17. (a) 18. (c) 19. (b) 20. (a)

ADDITIONAL QUESTION BANK

1. There are 6 routes for journey from station A to station B. In how many ways you may go from A to B and return if for returning you make a choice of any of the routes?

- (a) 6 (b) 12 (c) 36 (d) 30

2. As per question No.(1) if you decided to take the same route you may do it in _____ number of ways.

- (a) 6 (b) 12 (c) 36 (d) 30

3. As per question No.(I) if you decided not to take the same route you may do it in _____ number of ways.

- (a) 6 (b) 12 (c) 36 (d) 30

4. How many telephones connections may be allotted with 8 digits form the numbers 0,1,2 9?

- (a) 10^8 (b) $10!$ (c) ${}^{10}C_8$ (d) ${}^{10}P_8$

5. In how many different ways 3 rings of a lock can not combine when each ring has digits 0,1,2..... 9 leading to unsuccessful events?

- (a) 999 (b) 10^3 (c) $10!$ (d) 997

6. A dealer provides you Maruti Car & Van in 2 body patterns and 5 different colours. How many choices are open to you?

- (a) 2 (b) 7 (c) 20 (d) 10

7. 3 persons go into a railway carriage having 8 seats. In how many ways they may occupy the seats?

- (a) ${}^8P_3$ (b) ${}^8C_3$ (c) ${}^8C_5$ (d) None

8. Find how many five-letter words can be formed out of the word "LOGARITHMS" (the words may not convey any meaning)

- (a) ${}^{10}P_5$ (b) ${}^{10}C_5$ (c) ${}^9C_4$ (d) None

9. How many 4 digits numbers greater than 7000 can be formed out of the digits 3,5,7,8,9?

- (a) 24 (b) 48 (c) 72 (d) 50

10. In how many ways 5 Sanskrit 3 English and 3 Hindi books be arranged keeping the books of the same language together?

- (a) $5! \times 3! \times 3! \times 3!$ (b) $5! \times 3! \times 3!$ (c) ${}^5P_3$ (d) None

11. In how many ways can 6 boys and 6 girls be seated around a table so that no 2 boys are adjacent?

- (a) $4! \times 5!$ (b) $5! \times 6!$ (c) ${}^6P_6$ (d) $5 \times {}^6P_6$

12. In how many ways can 4 Americans and 4 English men be seated at a round table so that no 2 Americans may be together?

- (a) $4! \times 3!$ (b) ${}^4P_4$ (c) $3 \times {}^4P_4$ (d) ${}^4C_4$

13. The chief ministers of 17 states meet to discuss the hike in oil price at a round table. In how many ways they seat themselves if the Kerala and Bengal chief ministers choose to sit together?

- (a) $15! \times 2!$ (b) $17! \times 2!$ (c) $16! \times 2!$ (d) None

14. The number of permutation of the word 'ACCOUNTANT' is

- (a) $10! \div (2!)^4$ (b) $10! \div (2!)^3$ (c) $10!$ (d) None

15. The number of permutation of the word 'ENGINEERING' is

- (a) $11! \div [(3!)^2(2!)^2]$ (b) $11!$ (c) $11! \div [(3!)(2!)]$ (d) None

16. The number of arrangements that can be made with the word 'ASSASSINATION' is

- (a) $13! \div [3! \times 4! \times (2!)^2]$ (b) $13! \div [3! \times 4! \times 2!]$ (c) $13!$ (d) None

17. How many numbers higher than a million can be formed with the digits 0,4,4,5,5,5,3?

- (a) 420 (b) 360 (c) 7! (d) None

18. The number of permutation of the word 'ALLAHABAD' is

- (a) $9! \div (4! \times 2!)$ (b) $9! \Rightarrow 4!$ (c) $9!$ (d) None

19. In how many ways the vowels of the word 'ALLAHABAD' will occupy the even places?

- (a) 120 (b) 60 (c) 30 (d) None

20. How many arrangements can be made with the letter of the word 'MATHEMATICS'?

- (a) $11! \div (2!)^3$ (b) $11! \div (2!)^2$ (c) $11!$ (d) None

21. In how many ways of the word 'MATHEMATICS' be arranged so that the vowels occur together?

- (a) $11! \div (2!)^3$ (b) $(8! \times 4!) \div (2!)^3$ (c) $12! \div (2!)^3$ (d) None

22. In how many ways can the letters of the word 'ARRANGE' be arranged?

- (a) 1,200 (b) 1,250 (c) 1,260 (d) 1,300

23. In how many ways the word 'ARRANGE' be arranged such that the 2 'R's come together?

- (a) 400 (b) 440 (c) 360 (d) None

24. In how many ways the word 'ARRANGE' be arranged such that the 2 'R's do not come together?

- (a) 1,000 (b) 900 (c) 800 (d) None

25. ha how many ways the word 'ARRANGE' be arranged such that the 2 'R's and 2 'A's come together?

- (a) 120 (b) 130 (c) 140 (d) None

26. If ${}^nP_4 = 12$, ${}^nP_2$ the value of n is

- (a) 12 (b) 6 (c) -1 (d) both 6 -1

27. If $4 \cdot {}^nP_3 = 5 \cdot {}^{n-1}P_3$ the value of n is

- (a) 12 (b) 13 (c) 14 (d) 15

28. ${}^nP_r \div {}^{n-1}P_{r-1}$ is

- (a) n (b) n! (c) (n - 1)! (d) ${}^nC_n$

29. The total number of numbers less than 1000 and divisible by 5 formed with 0,1,2, ...9 such that each digit does not occur more than once in each number is

- (a) 150 (b) 152 (c) 154 (d) None

30. The number of ways in which 8 examination papers be arranged so that the best and worst papers never come together is

- (a) $8! - 2 \times 7!$ (b) $8! - 7!$ (c) $8!$ (d) None

31. In how many ways can 4 boys and 3 girls stand in a row so that no two girls are together?

- (a) $5! \times 4! \div 3!$ (b) ${}^5P_3 \times 3$ (c) ${}^5P_3 \times 2$ (d) None

32. In how many ways can 3 boys and 4 girls be arranged in a row so that all the three boys are together?

- (a) $4! \times 3!$ (b) $5! \times 3!$ (c) $7!$ (d) None

33. How many six digit numbers can be formed out of 4 5 9 no digits being repeated?

- (a) $6! - 5!$ (b) $6!$ (c) $6! + 5!$ (d) None

34. In terms of question No.(33) how many of them are not divisible by 5?

- (a) $6! - 5!$ (b) $6!$ (c) $6! + 5!$ (d) None

35. In how many ways the word 'FAILURE' can be arranged so that the consonants occupy only the odd positions?

- (a) $4!$ (b) $(4!)^2$ (c) $7! \div 3!$ (d) None

36. In how many ways can the word 'STRANGE' be arranged so that the vowels are never separated?

- (a) $6! \times 2!$ (b) $7!$ (c) $7! \div 2!$ (d) None

37. In how many ways can the word 'STRANGE' be arranged so that the vowels never come together?

- (a) $7! - 6! \times 2!$ (b) $7! - 6!$ (c) ${}^7P_6$ (d) None

38. In how many ways can the word 'STRANGE' be arranged so that the vowels occupy only the odd places?

- (a) ${}^5P_5$ (b) ${}^5P_5 \times {}^4P_4$ (c) ${}^5P_5 \times {}^4P_2$ (d) None

39. How many four digits number can be formed by using 1,2, ...7?

- (a) ${}^7P_4$ (b) ${}^7P_3$ (c) ${}^7C_4$ (d) None

40. How many four digits numbers can be formed by using 1,2, ...7 which are greater than 3400?

- (a) 500 (b) 550 (c) 560 (d) None

41. In how many ways it is possible to write the word 'ZENITH' in a dictionary?

- (a) ${}^6P_6$ (b) ${}^6C_6$ (c) ${}^6P_0$ (d) None

42. In terms of question No.(41) what is the rank or order of the word 'ZENITH' in the dictionary?

- (a) 613 (b) 615 (c) 616 (d) 618

43. If ${}^{n+1}P_3 \div {}^{n+1}P_3 = \frac{5}{12}$ the value of n is

- (a) 8 (b) 4 (c) 5 (d) 2

44. If ${}^{n+3}P_6 \div {}^{n+2}P_4 = 14$ the value of n is

- (a) 8 (b) 4 (c) 5 (d) 2

45. If ${}^7P_n \div {}^7P_{n-3} = 60$ the value of n is

- (a) 8 (b) 4 (c) 5 (d) 2

46. There are 4 routes for going from Dumdum to Sealdah and 5 routes for going from Sealdah to Chandni. In how many different ways can you go from Dumdum to Chandni via Sealdah?

- (a) 9 (b) 1 (c) 20 (d) None

47. In how many ways can 5 people occupy 8 vacant chairs?

- (a) 5,720 (b) 6,720 (c) 7,720 (d) None

48. If there are 50 stations on a railway line how many different kinds of single first class tickets may be printed to enable a passenger to travel from one station to other?

- (a) 2,500 (b) 2,450 (c) 2,400 (d) None

49. How many six digits numbers can be formed with the digits 9, 5, 3, 1, 7, 0?

- (a) 600 (b) 720 (c) 120 (d) None

50. In terms of question No.(49) how many numbers will have 0's in ten's place?

- (a) 600 (b) 720 (c) 120 (d) None

51. How many words can be formed with the letters of the word 'SUNDAY'?

- (a) 6! (b) 5! (c) 4! (d) None

52. How many words can be formed beginning with 'N' with the letters of the word 'SUNDAY'?

- (a) 6! (b) 5! (c) 4! (d) None

53. How many words can be formed beginning with 'N' and ending in 'A' with the letters of the word 'SUNDAY'?

- (a) 6! (b) 5! (c) 4! (d) None

54. How many different arrangements can be made with the letters of the word 'MONDAY'?

- (a) 6! (b) 8! (c) 4! (d) None

55. How many different arrangements can be made with the letters of the word 'ORIENTAL'?

- (a) 6! (b) 8! (c) 4! (d) None

56. How many different arrangements can be made beginning with 'A' and ending in 'N' with the letters of the word 'MONDAY'?

- (a) 6! (b) 8! (c) 4! (d) None

57. How many different arrangements can be made beginning with 'A' and ending with 'N' with the letters of the word 'ORIENTAL'?

- (a) $6!$ (b) $8!$ (c) $4!$ (d) None

58. In how many ways can a consonant and a vowel be chosen out of the letters of the word 'LOGARITHM'?

- (a) 18 (b) 15 (c) 3 (d) None

59. In how many ways can a consonant and a vowel be chosen out of the letters of the word 'EQUATION'?

- (a) 18 (b) 15 (c) 3 (d) None

60. How many different words can be formed with the letters of the word 'TRIANGLE'?

- (a) $8!$ (b) $7!$ (c) $6!$ (d) $2! \times 6!$

61. How many different words can be formed beginning with 'T' of the word 'TRIANGLE'?

- (a) $8!$ (b) $7!$ (c) $6!$ (d) $2! \times 6!$

62. How many different words can be formed beginning with 'E' of the letters of the word 'TRIANGLE'?

- (a) $8!$ (b) $7!$ (c) $6!$ (d) $2! \times 6!$

63. In question No. (60) how many of them will begin with 'T' and end with 'E'?

- (a) $8!$ (b) $7!$ (c) $6!$ (d) $2! \times 6!$

64. In question No.(60) how many of them have 'T' and 'E' in the end places?

- (a) $8!$ (b) $7!$ (c) $6!$ (d) $2! \times 6!$

65. In question No.(60) how many of them have consonants never together?

- (a) $8! - 4! \times 5!$ (b) ${}^6P_3 \times 5!$ (c) $2! \times 5! \times 3!$ (d) ${}^4P_3 \times 5!$

66. In question No. (60) how many of them have arrangements that no two vowels are together?

- (a) $8! - 4! \times 5!$ (b) ${}^6P_3 \times 5!$ (c) $2! \times 5! \times 3!$ (d) ${}^4P_3 \times 5!$

67. In question No.(60) how many of them have arrangements that consonants and vowels are always together?

- (a) $8! - 4! \times 5!$ (b) ${}^6P_3 \times 5!$ (c) $2! \times 5! \times 3!$ (d) ${}^4P_3 \times 5!$

68. In question No.(60) how many of them have arrangements that vowels occupy odd places?

- (a) $8! - 4! \times 5!$ (b) ${}^6P_3 \times 5!$ (c) $2! \times 5! \times 3!$ (d) ${}^4P_3 \times 5!$

69. In question No.(60) how many of them have arrangements that the relative positions of the vowels and consonants remain unchanged?

- (a) $8! - 4! \times 5!$ (b) ${}^6P_3 \times 5!$ (c) $2! \times 5! \times 3!$ (d) $5! \times 3!$

70. In how many ways the letters of the word 'FAILURE' can be arranged with the condition that the four vowels are always together?

- (a) $(4!)^2$ (b) $4!$ (c) $7!$ (d) None

71. In how many ways n books can be arranged so that two particular books are not together?

- (a) $(n - 2) \times (n - 1)!$ (b) $n \times n!$ (c) $(n - 2) \times (n - 2)!$ (d) None

72. In how many ways can 3 books on Mathematics and 5 books on English be placed so that books on the same subject always remain together?

- (a) 1,440 (b) 240 (c) 480 (d) 144

73. 6 papers are set in an examination out of which two are mathematical. In how many ways can the papers be arranged so that 2 mathematical papers are together?

- (a) 1,440 (b) 240 (c) 480 (d) 144

74. In question No.(73) will your answer be different if 2 mathematical papers are not consecutive?

- (a) 1,440 (b) 240 (c) 480 (d) 144

75. The number of ways the letters of the word 'SIGNAL' can be arranged such that the vowels occupy only odd positions is _____.

- (a) 1,440 (b) 240 (c) 480 (d) 144

76. In how many ways can be letters of the word 'VIOLENT' be arranged so that the vowels occupy even places only?

- (a) 1,440 (b) 240 (c) 480 (d) 144

77. How many numbers between 1000 and 10000 can be formed with 1, 2, ...9?

- (a) 3,024 (b) 60 (c) 78 (d) None

78. How many numbers between 3000 and 4000 can be formed with 1, 2, ...6?

- (a) 3,024 (b) 60 (c) 78 (d) None

79. How many numbers greater than 23,000 can be formed with 1, 2, ...5?

- (a) 3,024 (b) 60 (c) 78 (d) None

80. If you have 5 copies of one book, 4 copies of each of two books, 6 copies each of three books and single copy of 8 books you may arrange it in _____ number of ways.

- (a) $\frac{39!}{5! \times (4!)^2 \times (6!)^3}$ (b) $\frac{39!}{5! \times 8! \times (4!)^2 \times (6!)^3}$ (c) $\frac{39!}{5! \times 8! \times 4! \times (6!)^2}$ (d) $\frac{39!}{5! \times 8! \times 4! \times 6!}$

81. How many arrangements can be made out of the letters of the word "PERMUTATION"?

- (a) $\frac{1}{2} {}^{11}P_{11}$ (b) ${}^{11}P_{11}$ (c) ${}^{11}C_{11}$ (d) None

82. How many numbers greater than a million can be formed with the digits: One 0 Two 1 One 3 and Three 7?

- (a) 360 (b) 240 (c) 840 (d) 20

83. How many arrangements can be made out of the letters of the word 'INTERFERENCE' so that no two consonant are together?

- (a) 360 (b) 240 (c) 840 (d) 20

84. How many different words can be formed with the letter of the word "HARYANA"?

- (a) 360 (b) 240 (c) 840 (d) 20

85. In question No.(84) how many arrangements are possible keeping 'H' and 'N' together?

- (a) 360 (b) 240 (c) 840 (d) 20

86. In question No.(84) how many arrangements are possible beginning with 'H' and ending with 'N'?

- (a) 360 (b) 240 (c) 840 (d) 20

87. A computer has 5 terminals and each terminal is capable of four distinct positions including the positions of rest what is the total number of signals that can be made?

- (a) 20 (b) 1,020 (c) 1,023 (d) None

88. In how many ways can 9 letters be posted in 4 letter boxes?

- (a) 4^9 (b) 4^5 (c) ${}^9P_4$ (d) ${}^9C_4$

89. In how many ways can 8 beads of different colour be strung on a ring?

- (a) $7! \div 2$ (b) $7!$ (c) $8!$ (d) $8! \Rightarrow 2$

90. In how many ways can 8 boys form a ring?

- (a) $7! \div 2$ (b) $7!$ (c) $8!$ (d) $8! \Rightarrow 2$

91. In how many ways 6 men can sit at a round table so that all shall not have the same neighbours in any two occasions?

- (a) $5! \div 2$ (b) $5!$ (c) $(7!)^2$ (d) $7!$

92. In how many ways 6 men and 6 women sit at a round table so that no two men are together?

- (a) $5! \div 2$ (b) $5!$ (c) $(5!)^2$ (d) $7!$

93. In how many ways 4 men and 3 women are arranged at a round table if the women never sit together?

- (a) $6 \times 6!$ (b) $6!$ (c) $7!$ (d) None

94. In how many ways 4 men and 3 women are arranged at a round table if the women always sit together?

- (a) $6 \times 6!$ (b) $6!$ (c) $7!$ (d) None

95. A family comprised of an old man, 6 adults and 4 children is to be seated in a row with the condition that the children would occupy both the ends and never occupy either side of the old man. How many sitting arrangements are possible?

- (a) $4! \times 5! \times 7!$ (b) $4! \times 5! \times 6!$ (c) $2! \times 4! \times 5! \times 6!$ (d) None

96. The total number of sitting arrangements of 7 persons in a row if 3 persons sit together in a particular order is _____.

- (a) $5!$ (b) $6!$ (c) $2! \times 5!$ (d) None

97. The total number of sitting arrangements of 7 persons in a row if 3 persons sit together in any order is _____.

- (a) $5!$ (b) $6!$ (c) $2! \times 5!$ (d) None

98. The total number of sitting arrangements of 7 persons in a row if two persons occupy the end seats is _____.

- (a) $5!$ (b) $6!$ (c) $2! \times 5!$ (d) None

99. The total number of sitting arrangements of 7 persons in a row if one person occupies the middle seat is _____.

- (a) $5!$ (b) $6!$ (c) $2! \times 5!$ (d) None

100. If all the permutations of the letters of the word 'CHALK' are written in a dictionary the rank of this word will be _____.

- (a) 30 (b) 31 (c) 32 (d) None

101. In a ration shop queue 2 boys, 2 girls, and 2 men are standing in such a way that the boys the girls and the men are together each. The total number of ways of arranging the queue is _____.

- (a) 42 (b) 48 (c) 24 (d) None

102. If you have to make a choice of 7 questions out of 10 questions set, you can do it in number of ways.

- (a) $^{10}C_7$ (b) $^{10}P_7$ (c) $7! \times ^{10}C_7$ (d) None

103. From 6 boys and 4 girls 5 are to be seated. If there must be exactly 2 girls the number of ways of selection is _____.

- (a) 240 (b) 120 (c) 60 (d) None

104. In your office 4 posts have fallen vacant. In how many ways a selection out of 31 candidates can be made if one candidate is always included?

- (a) $^{30}C_3$ (b) $^{30}C_4$ (c) $^{31}C_3$ (d) $^{31}C_4$

105. In question No.(104) would your answer be different if one candidate is always excluded?

- (a) $^{30}C_3$ (b) $^{30}C_4$ (c) $^{31}C_3$ (d) $^{31}C_4$

106. Out of 8 different balls taken three at a time without taking the same three together more than once for how many number of times you can select a particular ball?

- (a) $^7C_2$ (b) $^8C_3$ (c) $^7P_2$ (d) $^8P_3$

107. In question No.(106) for how many number of times you can select any ball?

- (a) $^7C_2$ (b) $^8C_3$ (c) $^7P_2$ (d) $^8P_3$

108. In your college Union Election you have to choose candidates. Out of 5 candidates 3 are to be elected and you are entitled to vote for any number of candidates but not exceeding the number to be elected. You can do it in _____ ways.

- (a) 25 (b) 5 (c) 10 (d) None

109. In a paper from 2 groups of 5 questions each you have to answer any 6 questions attempting at least 2 questions from each group. This is possible in _____ number of ways.

- (a) 50 (b) 100 (c) 200 (d) None

110. Out of 10 consonants and 4 vowels how many words can be formed each containing 6 consonant and 3 vowels?

- (a) $^{10}C_6 \times ^4C_3$ (b) $^{10}C_6 \times ^4C_3 \times 9!$ (c) $^{10}C_6 \times ^4C_3 \times 10!$ (d) None

111. A boat's crew consist of 8 men, 3 of whom can row only on one side and 2 only on the other. The number of ways in which the crew can be arranged is _____.

- (a) $^3C_1 \times (4!)^2$ (b) $^3C_1 \times 4!$ (c) $^3C_3$ (d) None

112. A party of 6 is to be formed from 10 men and 7 women so as to include 3 men and 3 women. In how many ways the party can be formed if two particular women refuse to join it?

- (a) 4,200 (b) 600 (c) 3,600 (d) None

113. You are selecting a cricket team of first 11 players out of 16 including 4 bowlers and 2 wicket-keepers. In how many ways you can do it so that the team contains exactly 3 bowlers and 1 wicket-keeper?

- (a) 960 (b) 840 (c) 420 (d) 252

114. In question No.(113) would your answer be different if the team contains at least 3 bowlers and at least 1 wicket-keeper?

- (a) 2,472 (b) 960 (c) 840 (d) 420

115. A team of 12 men is to be formed out of n persons. Then the number of times 2 men 'A' and 'B' are together is _____.

- (a) ${}^nC_{12}$ (b) ${}^{n-1}C_u$ (c) ${}^{n-2}C_{10}$ (d) None

116. In question No.(115) the number of times 3 men 'C' 'D' and 'E' are together is _____.

- (a) ${}^nC_{12}$ (b) ${}^{n-1}C_u$ (c) ${}^{n-2}C_{10}$ (d) ${}^{n-2}C_{10}$

117. In question No.(115) it is found that 'A' and 'B' are three times as often together as 'C' 'D' and 'E' are. Then the value of n is _____.

- (a) 32 (b) 23 (c) 9 (d) None

118. The number of combinations that can be made by taking 4 letters of the word 'COMBINATION' is _____.

- (a) 70 (b) 63 (c) 3 (d) 136

119. If ${}^{18}C_n = {}^{18}C_{n+2}$ then the value of n is _____

- (a) 0 (b) -2 (c) 8 (d) None

120. If ${}^nC_6 \div {}^{n-2}C_3 = \frac{91}{4}$ then the value of n is _____

- (a) 15 (b) 14 (c) 13 (d) None

121. In order to pass PE-II examination minimum marks have to be secured in each of 7 subjects. In how many ways can a pupil fail?

- (a) 128 (b) 64 (c) 127 (d) 63

122. In how many ways you can answer one or more questions out of 6 questions each having an alternative?

- (a) 728 (b) 729 (c) 128 (d) 129

123. There are 12 points in a plane no 3 of which are collinear except that 6 points which are collinear. The number of different straight lines is _____.

- (a) 50 (b) 51 (c) 52 (d) None

124. In question No.(123) the number of different triangles formed by joining the straight lines is _____.

- (a) 220 (b) 20 (c) 200 (d) None

125. A committee is to be formed of 2 teachers and 3 students out of 10 teachers and 20 students. The numbers of ways in which this can be done is _____.

- (a) ${}^{10}C_2 \times {}^{20}C_3$ (b) ${}^9C_1 \times {}^{20}C_3$ (c) ${}^{10}C_2 \times {}^{19}C_3$ (d) None

126. In question No.(125) if a particular teacher is included the number of ways in which this can be done is _____.

- (a) ${}^{10}C_2 \times {}^{20}C_3$ (b) ${}^9C_1 \times {}^{20}C_3$ (c) ${}^{10}C_2 \times {}^{19}C_3$ (d) None

127. In question No.(125) if a particular student is excluded the number of ways in which this can be done is _____.

- (a) $^{10}C_2 \times ^{20}C_3$ (b) $^9C_1 \times ^{20}C_3$ (c) $^{10}C_2 \times ^{19}C_3$ (d) None

128. In how many ways 21 red balls and 19 blue balls can be arranged in a row so that no two blue balls are together?

- (a) 1540 (b) 1520 (c) 1560 (d) None

129. In forming a committee of 5 out of 5 males and 6 females how many choices you have to make so that there are 3 males and 2 females?

- (a) 150 (b) 200 (c) 1 (d) 461

130. In question No.(129) how many choices you have to make if there are 2 males?

- (a) 150 (b) 200 (c) 1 (d) 461

131. In question No.(129) how many choices you have to make if there is no female?

- (a) 150 (b) 200 (c) 1 (d) 461

132. In question No.(129) how many choices you have to make if there is at least one female?

- (a) 150 (b) 200 (c) 1 (d) 461

133. In question No.(129) how many choices you have to make if there are not more than 3 males?

- (a) 200 (b) 1 (c) 461 (d) 401

134. From 7 men and 4 women a committee of 5 is to be formed. In how many ways can this be done to include at least one woman?

- (a) 441 (b) 440 (c) 420 (d) None

135. You have to make a choice of 4 balls out of one red one blue and ten white balls. The number of ways this can be done to always include the red ball is _____.

- (a) $^{11}C_3$ (b) $^{10}C_3$ (c) $^{10}C_4$ (d) None

136. In question No.(135) the number of ways in which this can be done to include the red ball but exclude the blue ball always is _____.

- (a) $^{11}C_3$ (b) $^{10}C_3$ (c) $^{10}C_4$ (d) None

137. In question No.(135) the number of ways in which this can be done to exclude both the red and blue ball is _____.

- (a) $^{11}C_3$ (b) $^{10}C_3$ (c) $^{10}C_4$ (d) None

138. Out of 6 members belonging to party 'A' and 4 to party 'B' in how many ways a committee of 5 can be selected so that members of party 'A' are in a majority?

- (a) 180 (b) 186 (c) 185 (d) 184

139. A question paper divided into 2 groups consisting of 3 and 4 questions respectively carries the note "it is not required to answer all the questions. One question must be answered from each group". In how many ways you can select the questions?

- (a) 10 (b) 11 (c) 12 (d) 13

140. The number of words which can be formed with 2 different consonants and 1 vowel out of 7 different consonants and 3 different vowels the vowel to lie between 2 consonants is _____.

- (a) $3 \times 7 \times 6$ (b) $2 \times 3 \times 7 \times 6$ (c) $2 \times 3 \times 7$ (d) None

141. How many combinations can be formed of 8 counters marked 1 2 ...8 taking 4 at a time there being at least one odd and even numbered counter in each combination?

- (a) 68 (b) 66 (c) 64 (d) 62

142. Find the number of ways in which a selection of 4 letters can be made from the word 'MATHEMATICS'.

- (a) 130 (b) 132 (c) 134 (d) 136

143. Find the number of ways in which an arrangement of 4 letters can be made from the word 'MATHEMATICS'.

- (a) 1680 (b) 756 (c) 18 (d) 2,454

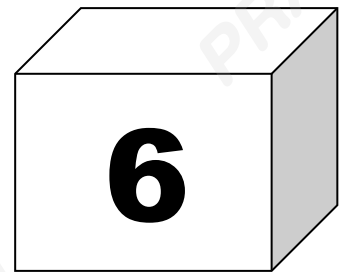
144. In a cross word puzzle 20 words are to be guessed of which 8 words have each an alternative solution. The number of possible solution is _____.

- (a) $(2 \times 8)^2$ (b) ${}^{20}C_{16}$ (c) ${}^{20}C_8$ (d) None

ANSWERS

1. (c)	19. (b)	37. (a)	55. (b)	73. (b)	91. (a)	109. (c)	127. (c)
2. (a)	20. (a)	38. (c)	56. (c)	74. (c)	92. (c)	110. (b)	128. (a)
3. (d)	21. (b)	39. (a)	57. (a)	75. (d)	93. (a)	111. (a)	129. (a)
4. (a)	22. (c)	40. (c)	58. (a)	76. (d)	94. (b)	112. (c)	130. (b)
5. (a)	23. (c)	41. (a)	59. (b)	77. (a)	95. (a)	113. (a)	131. (c)
6. (c)	24. (b)	42. (c)	60. (a)	78. (b)	96. (a)	114. (a)	132. (d)
7. (a)	25. (a)	43. (a)	61. (b)	79. (d)	97. (b)	115. (c)	133. (d)
8. (a)	26. (b)	44. (b)	62. (b)	80. (a)	98. (c)	116. (d)	134. (a)
9. (c)	27. (d)	45. (c)	63. (c)	81. (a)	99. (b)	117. (a)	135. (a)
10. (a)	28. (a)	46. (c)	64. (d)	82. (a)	100. (c)	118. (d)	136. (b)
11. (b)	29. (c)	47. (b)	65. (a)	83. (b)	101. (b)	119. (c)	137. (c)
12. (a)	30. (a)	48. (b)	66. (b)	84. (c)	102. (a)	120. (d)	138. (b)
13. (a)	31. (a)	49. (a)	67. (c)	85. (b)	103. (b)	121. (c)	139. (c)
14. (a)	32. (b)	50. (c)	68. (d)	86. (d)	104. (a)	122. (a)	140. (a)

15. (a) 33. (b) 51. (a) 69. (d) 87. (c) 105. (b) 123. (c) 141. (a)
 16. (a) 34. (a) 52. (b) 70. (a) 88. (a) 106. (a) 124. (c) 142. (d)
 17. (b) 35. (b) 53. (c) 71. (a) 89. (a) 107. (b) 125. (a) 143. (d)
 18. (a) 36. (a) 54. (a) 72. (a) 90. (b) 108. (a) 126. (b) 144. (a)



SEQUENCE AND SERIES -ARITHMETIC AND GEOMETRIC PROGRESSIONS

SEQUENCE

An ordered collection of numbers $a_1, a_2, a_3, a_4, \dots, a_n, \dots$ is a sequence if according to some definite rule or law, there is a definite value of a_n called the term or element of the sequence, corresponding to any value of the natural number n .

Example :

- 1) The sequence $\{1/n\}$ is 1, $1/2$, $1/3$, $1/4, \dots$
- 2) The sequence $\{(-1)^n\}$ is -1, 2, -3, 4, -5, $\dots$
- 3) The sequence $\{n\}$ is 1, 2, 3, $\dots$
- 4) The sequence $\{n / (n + 1)\}$ is $1/2$, $2/3$, $3/4$, $4/5, \dots$
- 5) A sequence of even positive integers is 2, 4, 6, $\dots$
- 6) A sequence of odd positive integers is 1, 3, 5, 7, $\dots$

All the above are infinite sequences.

Example:

- 1) A sequence of even positive integers within 12 i.e., is 2, 4, 6, 10.
- 2) A sequence of odd positive integers within 11 i.e., is 1, 3, 5, 7, 9. etc.

All the above are finite sequences.

SERIES

An expression of the form $a_1 + a_2 + a_3 + \dots + a_n + \dots$ which is the sum of the elements of the sequence $\{a_n\}$ is called a **series**. If the series contains a finite number of elements, it is called a **finite series**, otherwise called an **infinite series**.

ILLUSTRATIONS:

- (i) $1 + 3 + 5 + 7 + \dots$ is a series in which 1st term = 1, 2nd term = 3, and so on.
- (ii) $2 - 4 + 8 - 16 + \dots$ is also a series in which 1st term = 2, 2nd term = -4, and so on.

ARITHMETIC PROGRESSION (A.P.)

A sequence $a_1, a_2, a_3, \dots, a_n$ is called an Arithmetic Progression (A.P.) when $a_2 - a_1 = a_3 - a_2 = \dots = a_n - a_{n-1}$. That means A. P. is a sequence in which each term is obtained by adding a constant d to the preceding term. This constant ' d ' is called the **common difference** of the A.P. If 3 numbers a, b, c are in A.P., we say

$b - a = c - b$ or $a + c = 2b$; b is called the arithmetic mean between a and c .

Example 1: Find the 7th term of the A.P. 8, 5, 2, -1, -4, ...

Example 2: Which term of the AP $\frac{3}{\sqrt{7}}, \frac{4}{\sqrt{7}}, \frac{5}{\sqrt{7}}, \dots$ is $\frac{17}{\sqrt{7}}$?

Example 3: If 5th and 12th terms of an A.P. are 14 and 35 respectively, find the A.P.

Example 4: Divide 69 into three parts which are in A.P. and are such that the product of the first two parts is 483.

Example 5: Find the arithmetic mean between 4 and 10.

Example 6: Insert 4 arithmetic means between 4 and 324.

Sum of the first n terms

Let S be the Sum, a be the 1st term and ℓ the last term of an A.P. If the number of terms are n , then $t_n = \ell$. Let d be the common difference of the A.P.

or $S = n(a + \ell)/2$

Note: The above formula may be used to determine the sum of n terms of an A.P. when the first term a and the last term is given.

$$\text{Now } \ell = t_n = a + (n - 1)d$$

$$\therefore S = \frac{n(a + a + (n - 1)d)}{2}$$

$$\text{or } s = \frac{n}{2} \{2a + (n - 1)d\}$$

Note: The above formula maybe used when the first term a, common difference d and the number of terms of an A.P. are given.

Sum of 1st n natural or counting numbers

$$S = 1 + 2 + 3 + \dots + (n - 2) + (n - 1) + n$$

$$\text{Again } S = n + (n - 1) + (n - 2) + \dots + 3 + 2 + 1$$

On adding the above, we get

$$2S = (n + 1) + (n + 1) + \dots \text{ to } n \text{ terms}$$

$$\text{or } 2S = n(n + 1)$$

$$S = n(n + 1)/2$$

Then Sum of first, n natural number is $n(n + 1) / 2$

$$\text{i.e. } 1 + 2 + 3 + \dots + n = \frac{n(n + 1)}{2}$$

Sum of 1st n odd number

$$S = 1 + 3 + 5 + \dots + (2n - 1)$$

Sum of first n odd number

$$S = 1 + 3 + 5 + \dots + (2n - 1)$$

Since $S = n\{2a + (n - 1)d\} / 2$, we find

$$S = \frac{n}{2} \{2.1 + (n - 1)2\} = \frac{n}{2} (2n) = n^2$$

$$\text{or } S = n^2$$

Then sum of first, n odd numbers is n^2 , i.e. $1 + 3 + 5 + \dots + (2n - 1) = n^2$

Sum of the Squares of the first, n natural nos.

$$\text{Let } S = 1^2 + 2^2 + 3^2 + \dots + n^2$$

$$\text{We know } m^3 - (m - 1)^3 = 3m^2 - 3m + 1$$

$$\text{We put } m = 1, 2, 3, \dots, n$$

$$1^3 - 0 = 3.1^2 - 3.1 + 1$$

$$2^3 - 1^3 = 3.2^2 - 3.2 + 1$$

$$3^3 - 2^3 = 3.3^2 - 3.3 + 1$$

.....

$$+ n^3 - (n - 1)^3 = 3n^2 - 3.n + 1$$

Adding both sides term by term,

$$n^3 = 3S - 3n(n + 1) / 2 + n$$

$$\text{or } 2n^3 = 6S - 3n^2 - 3n + 2n$$

$$\text{or } 6S = 2n^3 + 3n^2 + n$$

$$\text{or } 6S = n(2n^2 + 3n + 1)$$

$$\text{or } 6S = n(n+1)(2n+1)$$

$$S = n(n+1)(2n+1)/6$$

Thus sum of the squares of the first, n natural numbers is $\frac{n(n+1)(2n+1)}{6}$

$$\text{i.e. } 1^2 + 2^2 + 3^2 + \dots + n^2 = \frac{n(n+1)(2n+1)}{6}$$

Similarly, sum of the cubes of first n natural number can be found out as $\left\{\frac{n(n+1)}{2}\right\}^2$ by taking the identity

$$m^4 - (m-1)^4 = 4m^3 - 6m^2 + 4m - 1 \text{ and putting } m = 1, 2, 3, \dots, n. \text{ Thus}$$

$$1^3 + 2^3 + 3^3 + \dots + n^3 = \left\{\frac{n(n+1)}{2}\right\}^2$$

EXERCISE 6 (A)

Choose the most appropriate option (a), (b), (c) or (d).

1. The nth element of the sequence 1, 3, 5, 7, is

- (a) n (b) $2n - 1$ (c) $2n + 1$ (d) none of these

2. The nth element of the sequence -1, 2, -4, 8 is

- (a) $(-1)^n 2^{n-1}$ (b) 2^{n-1} (c) 2^n (d) none of these

3. $\sum_{i=4}^7 \sqrt{2i-1}$ can be written as

- (a) $\sqrt{7} + \sqrt{9} + \sqrt{11} + \sqrt{13}$ (b) $2\sqrt{7} + 2\sqrt{9} + 2\sqrt{11} + 2\sqrt{13}$
(c) $2\sqrt{7} + 2\sqrt{9} + 2\sqrt{11} + 2\sqrt{13}$ (d) none of these.

4. The sum to ∞ of the series -5, 25, -125, 625, ... can be written as

- (a) $\sum_{k=1}^{\infty} (-5)^k$ (b) $\sum_{k=1}^{\infty} 5^k$ (c) $\sum_{k=1}^{\infty} -5^k$ (d) none of these

5. The first three terms of sequence when nth term t_n is $n^2 - 2n$ are

- (a) -1, 0, 3 (b) 1, 0, 2 (c) -1, 0, -3 (d) none of these

6. Which term of the progression -1, -3, -5, ... is -39

- (a) 21st (b) 20th (c) 19th (d) none of these

7. The value of x such that $8x + 4$, $6x - 2$, $2x + 7$ will form an AP is

- (a) 15 (b) 2 (c) $15/2$ (d) none of the these

8. The m^{th} term of an A. P. is n and n^{th} term is m . The r^{th} term of it is
 (a) $m + n + r$ (b) $n + m - 2r$ (c) $m + n + r/2$ (d) $m + n - r$
9. The number of the terms of the series $10 + 9\frac{2}{3} + 9\frac{1}{3} + 9 + \dots$ will amount to 155 is
 (a) 30 (b) 31 (c) 32 (d) none of these
10. The n^{th} term of the series whose sum to n terms is $5n^2 + 2n$ is
 (a) $3n - 10$ (b) $10n - 2$ (c) $10n - 3$ (d) none of these
11. The 20^{th} term of the progression 1, 4, 7, 10 is
 (a) 58 (b) 52 (c) 50 (d) none of these
12. The last term of the series 5, 7, 9, to 21 terms is
 (a) 44 (b) 43 (c) 45 (d) none of these
13. The last term of the A.P. 0.6, 1.2, 1.8, ... to 13 terms is
 (a) 8.7 (b) 7.8 (c) 7.7 (d) none of these
14. The sum of the series 9, 5, 1, ... to 100 terms is
 (a) -18,900 (b) 18,900 (c) 19,900 (d) none of these
15. The two arithmetic means between -6 and 14 is
 (a) $2/3, 1/3$ (b) $2/3, 7\frac{1}{3}$ (c) $-2/3, -7\frac{1}{3}$ (d) none of these
16. The sum of three integers in AP is 15 and their product is 80. The integers are
 (a) 2, 8, 5 (b) 8, 2, 5 (c) 2, 5, 8 (d) 8, 5, 2
17. The sum of n terms of an AP is $3n^2 + 5n$. The series is
 (a) 8, 14, 20, 26 (b) 8, 22, 42, 68 (c) 22, 68, 114, ... (d) none of these
18. The number of numbers between 74 and 25, 556 divisible by 5 is
 (a) 5,090 (b) 5,097 (c) 5,095 (d) none of these
19. The p^{th} term of an AP is $(3p - 1)/6$. The sum of the first n terms of the AP is
 (a) $n(3n + 1)$ (b) $n/12(3n + 1)$ (c) $n/12(3n - 1)$ (d) none of these
20. The arithmetic mean between 33 and 77 is
 (a) 50 (b) 45 (c) 55 (d) none of these
21. The 4 arithmetic means between -2 and 23 are
 (a) 3, 13, 8, 18 (b) 18, 3, 8, 13 (c) 3, 8, 13, 18 (d) none of these
22. The first term of an A.P is 14 and the sums of the first five terms and the first ten terms are equal in magnitude but opposite in sign. The 3^{rd} term of the AP is

(a) $6\frac{4}{11}$

(b) 6

(c) $\frac{4}{11}$

(d) none of these

23. The sum of a certain number of terms of an AP series -8, -6, -4, is 52. The number of terms is

(a) 12

(b) 13

(c) 11

(d) none of these

24. The first and the last term of an AP are -4 and 146. The sum of the terms is 7171. The number of terms is

(a) 101

(b) 100

(c) 99

(d) none of these

25. The sum of the series $3\frac{1}{2} + 7 + 10\frac{1}{2} + 14 + \dots$ to 17 terms is

(a) 530

(b) 535

(c) 535 A

(d) none of these

Exercise 6 (A)

1. (b) 2. (a) 3. (a) 4. (a) 5. (a) 6. (b) 7. (c) 8. (d)

9. (a), (b) 10 (c) 11. (a) 12. (c) 13. (b) 14. (a) 15. (b) 16. (c), (d)

17.(b) 18. (b) 19. (b) 20. (c) 21. (c) 22. (a) 23. (b) 24. (a)

25.(c)

GEOMETRIC PROGRESSION (G.P.)

If in a sequence of terms each term is constant multiple of the proceeding term, then the sequence is called a Geometric Progression (G.P). The constant multiplier is called the common ratio

Examples: 1) In 5, 15, 45, 135, ...common ratio is $15/5 = 3$

2) In 1, $1/2$, $1/4$, $1/9$... common ratio is $(1/2) / 1 = 1/2$

3) In 2, -6, 18, -54, ... common ratio is $(-6) / 2 = -3$

Example 1: If a, ar, ar^2 , ar^3 , ... be in G.P. Find the common ratio.

Example 2: Which term of the progression 1, 2, 4, 8, ... is 256?

GEOMETRIC MEAN

If a, b, c are in G.P we get $b/a = c/b \Rightarrow b^2 = ac$, b is called the geometric mean between a and c

Example 1: Insert 3 geometric means between $1/9$ and 9.

Example 2: Find the G.P where 4th term is 8 and 8th term is $128/625$

Sum of first n terms of a G P

$$S_n = a (1 - r^n) / (1 - r) \text{ when } r < 1$$

$$S_n = a(r^n - 1) / (r - 1) \text{ when } r > 1$$

So, when the last term of the G. P is known, we use this formula. **Sum of infinite geometric series**

$$\text{Also, } S_{\infty} = \frac{a}{1 - r}, \text{ if } -1 < r < 1.$$

Example 1: Find the sum of $1 + 2 + 4 + 8 + \dots$ to 8 terms.,

Example 2: Find the sum to n terms of $6 + 27 + 128 + 629 + \dots$

Example 3: Find the sum to n terms of the series

$$3 + 33 + 333 + \dots$$

Example 4: Find the sum of n terms of the series $0.7 + 0.77 + 0.777 + \dots$ to n terms

Example 5: Evaluate 0.2175 using the sum of an infinite geometric series.

Example 6: Find three numbers in G. P whose sum is 19 and product is 216.

EXERCISE 6 (b)

Choose the most appropriate option (a), (b), (c) or (d)

1. The 7th term of the series 6, 12, 24, ...is

- (a) 384 (b) 834 (c) 438 (d) none of these

2. t_8 of the series 6, 12, 24, .. .is

- (a) 786 (b) 768 (c) 867 (d) none of these

3. t_{12} of the series -128, 64, -32, ...is

- (a)-1/16 (b) 16 (c) 1/16 (d) none of these

4. The 4th term of the series 0.04, 0.2, 1, ... is

- (a) 0.5 (b) 1/2 (c) 5 (d) none of these

5. The last term of the series 1, 2, 4, ... to 10 terms is

- (a) 512 (b) 256 (c) 1024 (d) none of these

6. The last term of the series 1, -3, 9, -27 up to 7 terms is

- (a) 297 (b) 729 (c) 927 (d) none of these

7. The last term of the series $x^2, x, 1, \dots$ to 31 terms is

- (a) x^{28} (b) $1/x$ (c) $1/x^{28}$ (d) none of these

8. The sum of the series -2, 6, -18, ... to 7 terms is

RKG INSTITUTE (BY ALI SIR) 165 | 616

- (a) -1094 (b) 1094 (c) - 1049 (d) none of these

9. The sum of the series 243, 81, 27, ... to 8 terms is

- (a) 36 (b) $\left(36 \frac{13}{30}\right)$ (c) $36 \frac{1}{9}$ (d) none of these

10. The sum of the series $\frac{1}{\sqrt{3}} + 1 + \frac{3}{\sqrt{3}} + \dots$ to 18 terms is

- (a) $9841 \frac{(1+\sqrt{3})}{\sqrt{3}}$ (b) 9841 (c) $\frac{9841}{\sqrt{3}}$ (d) none of these

11. The second term of a G P is 24 and the fifth term is 81. The series is

- (a) 16, 36, 24, 54, .. (b) 24, 36, 53, ... (c) 16, 24, 36, 54, .. (d) none of these

12. The sum of 3 numbers of a G P is 39 and their product is 729. The numbers are

- (a) 3, 27, 9 (b) 9, 3, 27 (c) 3, 9, 27 (d) none of these

13. In a G. P, the product of the first three terms $27/8$. The middle term is

- (a) $3/2$ (b) $2/3$ (c) $2/5$ (d) none of these

14. If you save 1 paise today, 2 paise the next day 4 paise the succeeding day and so on, then your total savings in two weeks will be

- (a) Rs. 163 (b) Rs. 183 (c) Rs. 163.83 (d) none of these

15. Sum of n terms of the series $4 + 44 + 444 + \dots$ is

- (a) $4/9 \{10/9 (10^n - 1) - n\}$ (b) $10/9 (10^n - 1) - n$
(c) $4/9 (10^n - 1) - n$ (d) none of these

16. Sum of n terms of the series $0.1 + 0.11 + 0.111 + \dots$ is

- (a) $1/9 \{n - (1 - (0.1)^n)\}$ (b) $1/9 \{n - (1 - (0.1)^n)/9\}$
(c) $n - 1 - (0.1)^n/9$ (d) none of these

17. The sum of the first 20 terms of a G. P is 244 times the sum of its first 10 terms. The common ratio is

- (a) $\pm\sqrt{3}$ (b) ± 3 (c) $\sqrt{3}$ (d) none of these

18. Sum of the series $1 + 3 + 9 + 27 + \dots$ is 364. The number of terms is

- (a) 5 (b) 6 (c) 11 (d) none of these

19. The product of 3 numbers in G P is 729 and the sum of squares is 819. The numbers are

- (a) 9, 3, 27 (b) 27, 3, 9 (c) 3, 9, 27 (d) none of these

20. The sum of the series $1 + 2 + 4 + 8 + \dots$ to n term

- (a) $2^n - 1$ (b) $2n - 1$ (c) $1/2^n - 1$ (d) none of these

21. The sum of the infinite GP $14, -2, +2/7, -2/49, + \dots$ is

- (a) $4 \frac{1}{12}$ (b) $12 \frac{1}{4}$ (c) 12 (d) none of these

22. The sum of the infinite G. P. $1 - \frac{1}{3} + \frac{1}{9} - \frac{1}{27} + \dots$ is

- (a) 0.33 (b) 0.57 (c) 0.75 (d) none of these

23. The number of terms to be taken so that $1 + 2 + 4 + 8 + \dots$ will be 8191 is

- (a) 10 (b) 13 (c) 12 (d) none of these

24. Four geometric means between 4 and 972 are

- (a) 12, 36, 108, 324 (b) 12, 24, 108, 320 (c) 10, 36, 108, 320 (d) none of these

ANSWERS

Exercise 6 (B)

1. (a) 2. (b) 3. (c) 4. (c) 5. (a) 6. (b) 7. (c) 8. (a)
9. (d) 10. (a) 11. (c) 12. (c) 13. (a) 14. (c) 15. (a) 16. (b)
17. (a) 18. (b) 19. (c) 20. (a) 21. (b) 22. (c) 23. (b) 24. (a)

EXERCISE 6 (C)

Choose the most appropriate option (a), (b), (c) or (d).

1. Three numbers are in AP and their sum is 21. If 1, 5, 15 are added to them respectively, they form a G. P. The numbers are

- (a) 5, 7, 9 (b) 9, 5, 7 (c) 7, 5, 9 (d) none of these

2. The sum of $1 + \frac{1}{3} + \frac{1}{3^2} + \frac{1}{3^3} + \dots + \frac{1}{3^{n-1}}$ is

- (a) $\frac{2}{3}$ (b) $\frac{3}{2}$ (c) $\frac{4}{5}$ (d) none of these

3. The sum of the infinite series $1 + \frac{2}{3} + \frac{4}{9} + \dots$ is

- (a) $\frac{1}{3}$ (b) 3 (c) $\frac{2}{3}$ (d) none of these

4. The sum of the first two terms of a G.P. is $\frac{5}{3}$ and the sum to infinity of the series is 3. The common ratio is

- (a) $\frac{1}{3}$ (b) $\frac{2}{3}$ (c) $-\frac{2}{3}$ (d) none of these

5. If p, q and r are in A.P. and x, y, z are in G.P. then $x^{q-r} \cdot y^{r-p} \cdot z^{p-q}$ is equal to

- (a) 0 (b) -1 (c) 1 (d) none of these

6. The sum of three numbers in G.P. is 70. If the two extremes be multiplied each by 4 and the mean by 5, the products are in AP. The numbers are

- (a) 12, 18, 40 (b) 10, 20, 40 (c) 40, 20, 10 (d) none of these

7. The sum of 3 numbers in A.P. is 15. If 1, 4 and 19 be added to them respectively, the results are in G. P. The numbers are

- (a) 26, 5, -16 (b) 2, 5, 8 (c) 5, 8, 2 (d) none of these

8. Given x, y, z are in G.P. and $x^p = y^q = z^r$, then $1/p, 1/q, 1/r$ are in

- (a) A.P. (b) G.P. (c) Both A.P. and G.P. (d) none of these

9. If the terms $2x, (x+10)$ and $(3x+2)$ be in A.P., the value of x is

- (a) 7 (b) 10 (c) 6 (d) none of these

10. If A be the A.M. of two positive unequal quantities x and y and G be their G. M., then

- (a) $A < G$ (b) $A > G$ (c) $A \geq G$ (d) $A \leq G$

11. The A.M. of two positive numbers is 40 and their G. M. is 24. The numbers are

- (a) (72, 8) (b) (70, 10) (c) (60, 20) (d) none of these

12. Three numbers are in A.P. and their sum is 15. If 8, 6, 4 be added to them respectively, the numbers are in G.P. The numbers are

- (a) 2, 6, 7 (b) 4, 6, 5 (c) 3, 5, 7 (d) none of these

13. The sum of four numbers in G. P. is 60 and the A.M. of the first and the last is 18. The numbers are

- (a) 4, 8, 16, 32 (b) 4, 16, 8, 32 (c) 16, 8, 4, 20 (d) none of these

14. A sum of Rs. 6240 is paid off in 30 installments such that each installment is Rs. 10 more than the preceding installment. The value of the 1st installment is

- (a) Rs. 36 (b) Rs. 30 (c) Rs. 60 (d) none of these

15. The sum of $1.03 + (1.03)^2 + (1.03)^3 + \dots$ to n terms is

- (a) $103 \{(1.03)^n - 1\}$ (b) $103/3 \{(1.03)^n - 1\}$ (c) $(1.03)^n - 1$ (d) none of these

16. If x, y, z are in A.P. and $x, y, (z + 1)$ are in G.P. then

- (a) $(x - z)^2 = 4x$ (b) $z^2 = (x - y)$ (c) $z = x - y$ (d) none of these

17. The numbers $x, 8, y$ are in G.P. and the numbers $x, y, -8$ are in A.P. The value of x and y are

- (a) (-8, -8) (b) (16, 4) (c) (8, 8) (d) none of these

18. The n th term of the series $16, 8, 4, \dots$ is $1/2^{17}$. The value of n is

- (a) 20 (b) 21 (c) 22 (d) none of these

19. The sum of n terms of a G.P. whose first term is 1 and the common ratio is $1/2$, is equal to $1\frac{127}{128}$. The value of n is

- (a) 7 (b) 8 (c) 6 (d) none of these

20. t_4 of a G.P. in x , $t_{10} = y$ and $t_{16} = z$. Then

- (a) $x^2 = yz$ (b) $z^2 = xy$ (c) $y^2 = zx$ (d) none of these

21. If x, y, z are in G.P., then

- (a) $y^2 = xz$ (b) $y(z^2 + x^2) = x(z^2 + y^2)$ (c) $2y = x+z$ (d) none of these

22. The sum of all odd numbers between 200 and 300 is

- (a) 11,600 (b) 12,490 (c) 12,500 (d) 24,750

23. The sum of all natural numbers between 500 and 1000 which are divisible by 13, is

- (a) 28,405 (b) 24,805 (c) 28,540 (d) none of these

24. If unity is added to the sum of any number of terms of the A.P. 3, 5, 7, 9, ... the resulting sum is

- (a) 'a' perfect cube (b) 'a' perfect square (c) 'a' number (d) none of these

25. The sum of all natural numbers from 100 to 300 which are exactly divisible by 4 or 5 is

- (a) 10,200 (b) 15,200 (c) 16,200 (d) none of these

26. The sum of all natural numbers from 100 to 300 which are exactly divisible by 4 and 5 is

- (a) 2,200 (b) 2,000 (c) 2,220 (d) none of these

27. A person pays Rs. 975 by monthly instalment each less than the former by Rs. 5. The first instalment is Rs. 100. The time by which the entire amount will be paid is

- (a) 10 months (b) 15 months (c) 14 months (d) none of these

28. A person saved Rs. 16,500 in ten years. In each year after the first year he saved Rs. 100 more than he did in the preceding year. The amount of money he saved in the 1st year was

- (a) Rs. 1000 (b) Rs. 1500 (c) Rs. 1200 (d) none of these

29. At 10% C.I. p.a., a sum of money accumulate to Rs. 9625 in 5 years. The sum invested initially is

- (a) Rs. 5976.37 (b) Rs. 5970 (c) Rs. 5975 (d) Rs. 5370.96

30. The population of a country was 55 crore in 2005 and is growing at 2% p.a C.I. the population in the year 2015 is estimated as

- (a) 5705 (b) 6005 (c) 6700 (d) none of these

Exercise 6 (C)

1. (a) 2. (d) 3. (b) 4. (b), (c) 5. (c) 6. (b), (c) 7. (a), (b) 8. (a)
 9. (c) 10. (b) 11. (a) 12. (c) 13. (a) 14. (d) 15. (b) 16. (a)
 17. (a), (b) 18. (c) 19. (b) 20. (c) 21. (a) 22. (c) 23. (a) 24. (b)

25. (c) 26. (a) 27. (b) 28. (c) 29. (a) 30. (d)

ADDITIONAL QUESTION BANK

1. If a, b, c are in A.P. as well as in G.P. then -
(a) They are also in H.P. (Harmonic Progression) (b) Their reciprocals are in A.P.
(c) Both (a) and (b) are true (d) Both (a) and (b) are false
2. If a, b, c be respectively $p^{\text{th}}, q^{\text{th}}$ and r^{th} terms of an A.P. the value of $a(q - r) + b\{r - p\} + c(p - q)$ is _____.
(a) 0 (b) 1 (c) -1 (d) None
3. If the p^{th} term of an A.P. is q and the q^{th} term is p the value of the r^{th} term is _____.
(a) $p - q - r$ (b) $p + q - r$ (c) $p + q + r$ (d) None
4. If the p^{th} term of an A.P. is q and the q^{th} term is p the value of the $(p + q)^{\text{th}}$ term is _____.
(a) 0 (b) 1 (c) -1 (d) None
5. The sum of first n natural number is .
(a) $(n/2)(n + 1)$ (b) $(n/6)(n + 1)(2n + 1)$ (c) $[(n/2)(n + 1)]^2$ (d) None
6. The sum of square of first n natural number is _____.
(a) $(n/2)(n + 1)$ (b) $(n/6)(n + 1)(2n + 1)$ (c) $[(n/2)(n + 1)]^2$ (d) None
7. The sum of cubes of first n natural number is _____.
(a) $(n/2)(n + 1)$ (b) $(n/6)(n + 1)(2n + 1)$ (c) $[(n/2)(n + 1)]^2$ (d) None
8. The sum of a series in A.P. is 72 the first term is 17 and the common difference -2. The number of terms is _____.
(a) 6 (b) 12 (c) 6 or 12 (d) None
9. Find the sum to n terms of $(1 - 1/n) + (1 - 2/n) + (1 - 3/n) +$
(a) $\frac{1}{2}(n - 1)$ (b) $\frac{1}{2}(n + 1)$ (c) $(n - 1)$ (d) $(n + 1)$
10. If S_n the sum of first n terms in a series is given by $2n^2 + 3n$ the series is in _____.

- (a) A.P. (b) G.P. (c) H.P. (d) None

11. The sum of all natural numbers between 200 and 400 which are divisible by 7 is _____.

- (a) 7,730 (b) 8,729 (c) 7,729 (d) 8,730

12. The sum of natural numbers upto 200 excluding those divisible by 5 is .

- (a) 20,100 (b) 4,100 (c) 16,000 (d) None

13. If a, b, c be the sums of p, q, r terms respectively of an A.P. the value of $(a/p)(q-r) + (b/q)(r-p) + (c/r)(p-q)$ is _____.

- (a) 0 (b) 1 (c) -1 (d) None

14. If S_1, S_2, S_3 be the respectively the sum of terms of $n, 2n, 3n$ an A.P. the value of $S_3 \div (S_2 - S_1)$ is given by _____.

- (a) 1 (b) 2 (c) 3 (d) None

15. The sum of n terms of two A.P.s are in the ratio of $(7n-5)/(5n+17)$. Then the _____ term of the two series are equal.

- (a) 12 (b) 6 (c) 3 (d) None

16. Find three numbers in A.P. whose sum is 6 and the product is -24

- (a) -2, 2, 6 (b) -1, 1, 3 (c) 1, 3, 5 (d) 1, 4, 7

17. Find three numbers in A.P. whose sum is 6 and the sum of whose square is 44.

- (a) -2, 2, 6 (b) -1, 1, 3 (c) 1, 3, 5 (d) 1, 4, 7

18. Find three numbers in A.P. whose sum is 6 and the sum of their cubes is 232.

- (a) -2, 2, 6 (b) -1, 1, 3 (c) 1, 3, 5 (d) 1, 4, 7

19. Divide 12.50 into five parts in A.P. such that the first part and the last part are in the ratio of 2:3

- (a) 2, 2.25, 2.5, 2.75, 3 (b) -2, -2.25, -2.5, -2.75, -3
(c) 4, 4.5, 5, 5.5, 6 (d) -4, -4.5, -5, -5.5, -6

20. If a, b, c are in A.P. then the value of $(a^3 + 4b^3 + c^3)/[b(a^2 + c^2)]$ is

- (a) 1 (b) 2 (c) 3 (d) None

21. If a, b, c are in A.P. then the value of $(a^2 + 4ac + c^2)/(ab + bc + ca)$ is

- (a) 1 (b) 2 (c) 3 (d) None

22. If a, b, c are in A.P. then $(a/bc)(b+c), (b/ca)(c+a), (c/ab)(a+b)$ are in _____.

- (a) A.P. (b) G.P. (c) H.P. (d) None

23. If a, b, c are in A.P. then $a^2(b+c), b^2(c+a), c^2(a+b)$ are in _____.

- (a) A.P. (b) G.P. (c) H.P. (d) None

24. If $(b+c)^{-1}, (c+a)^{-1}, (a+b)^{-1}$ are in A.P. then a^2, b^2, c^2 are in _____.

- (a) A.P. (b) G.P. (c) H.P. (d) None

25. If a^2, b^2, c^2 are in A.P. then $(b + c), (c + a), (a + b)$ are in _____.

- (a) A.P. (b) G.P. (c) H.P. (d) None

26. If a^2, b^2, c^2 are in A.P. then $a/(b + c), b/(c + a), c/(a + b)$ are in _____.

- (a) A.P. (b) G.P. (c) H.P. (d) None

27. If $(b + c - a)/a, (c + a - b)/b, (a + b - c)/c$ are in A.P. then a, b, c are in _____.

- (a) A.P. (b) G.P. (c) H.P. (d) None

28. If $(b - c)^2, (c - a)^2, (a - b)^2$ are in A.P. then $(b - c), (c - a), (a - b)$ are in _____.

- (a) A.P. (b) G.P. (c) H.P. (d) None

29. If a, b, c are in A.P. then $(b + c), (c + a), (a + b)$ are in _____.

- (a) A.P. (b) G.P. (c) H.P. (d) None

30. Find the number which should be added to the sum of any number of terms of the A.P. 3, 5, 7, 9, 11 resulting in a perfect square.

- (a) -1 (b) 0 (c) 1 (d) None

31. The sum of n terms of an A.P. is $2n^2 + 3n$. Find the n^{th} term.

- (a) $4n + 1$ (b) $4n - 1$ (c) $2n + 1$ (d) $2n - 1$

32. The p^{th} term of an A.P. is $1/q$ and the q^{th} term is $1/p$. The sum of the pq^{th} term is _____.

- (a) $\frac{1}{2}(pq+1)$ (b) $\frac{1}{2}(pq-1)$ (c) $pq+1$ (d) $pq-1$

33. The sum of p terms of an A.P. is q and the sum of q terms is p . The sum of $p + q$ terms is

- (a) $-(p + q)$ (b) $p + q$ (c) $(p-q)^2$ (d) p^2-q^2

34. If S_1, S_2, S_3 be the sums of n terms of three A.P.s the first term of each being unity and the respective common differences 1, 2, 3 then $(S_1 + S_3) / S_2$ is _____.

- (a) 1 (b) 2 (c) -1 (d) None

35. The sum of all natural numbers between 500 and 1000, which are divisible by 13, is _____.

- (a) 28,400 (b) 28,405 (c) 28,410 (d) None

36. The sum of all natural numbers between 100 and 300, which are divisible by 4, is _____.

- (a) 10,200 (b) 30,000 (c) 8,200 (d) 2,200

37. The sum of all natural numbers from 100 to 300 excluding those, which are divisible by 4, is

- (a) 10,200 (b) 30,000 (c) 8,200 (d) 2,200

38. The sum of all natural numbers from 100 to 300, which are divisible by 5, is _____.

- (a) 10,200 (b) 30,000 (c) 8,200 (d) 2,200

39. The sum of all natural numbers from 100 to 300, which are divisible by 4 and 5, is .
 (a) 10,200 (b) 30,000 (c) 8,200 (d) 2,200
40. The sum of all natural numbers from 100 to 300, which are divisible by 4 or 5, is .
 (a) 10,200 (b) 8,200 (c) 2,200 (d) 16,200
41. If the n terms of two A.P.s are in the ratio $(3n+4) : (n+4)$ the ratio of the fourth term is ____.
 (a) 2 (b) 3 (c) 4 (d) None
42. If a, b, c, d are in A.P. then
 (a) $a^2 - 3b^2 + 3c^2 - d^2 = 0$ (b) $a^2 + 3b^2 + 3c^2 + d^2 = 0$ (c) $a^2 + 3b^2 + 3c^2 - d^2 = 0$ (d) None
43. If a, b, c, d, e are in A.P. then
 (a) $a - b - d + e = 0$ (b) $a - 2c + e = 0$ (c) $b - 2c + d = 0$ (d) all the above
44. The three numbers in A.P. whose sum is 18 and product is 192 are _____.
 (a) 4, 6, 8 (b) -4, -6, -8 (c) 8, 6, 4 (d) both (a) & (c)
45. The three numbers in A.P., whose sum is 27 and the sum of their squares is 341, are ____.
 (a) 2, 9, 16 (b) 16, 9, 2 (c) both (a) and (b) (d) -2, -9, -16
46. The four numbers in A.P., whose sum is 24 and their product is 945, are _____.
 (a) 3, 5, 7, 9 (b) 2, 4, 6, 8 (c) 5, 9, 13, 17 (d) None
47. The four numbers in A.P., whose sum is 20 and the sum of their squares is 120, are ____.
 (a) 3, 5, 7, 9 (b) 2, 4, 6, 8 (c) 5, 9, 13, 17 (d) None
48. The four numbers in A.P. with the sum of second and third being 22 and the product of the first and fourth being 85 are _____.
 (a) 3, 5, 7, 9 (b) 2, 4, 6, 8 (c) 5, 9, 13, 17 (d) None
49. The five numbers in A.P. with their sum 25 and the sum of their squares 135 are _____.
 (a) 3, 4, 5, 6, 7 (b) 3, 3.5, 4, 4.5, 5 (c) -3, -4, -5, -6, -7 (d) -3, -3.5, -4, -4.5, -5
50. The five numbers in A.P. with the sum 20 and product of the first and last 15 are _____.
 (a) 3, 4, 5, 6, 7 (b) 3, 3.5, 4, 4.5, 5 (c) -3, -4, -5, -6, -7 (d) -3, -3.5, -4, -4.5, -5
51. The sum of n terms of 2, 4, 6, 8 is
 (a) $n(n+1)$ (b) $(n/2)(n+1)$ (c) $n(n-1)$ (d) $(n/2)(n-1)$
52. The sum of n terms of $a+b, 2a, 3a-b, \dots$ is
 (a) $n(a-b)+2b$ (b) $n(a+b)$ (c) both the above (d) None
53. The sum of n terms of $(x+y)^2, (x^2+y^2), (x-y)^2, \dots$ is
 (a) $(x+y)^2 - 2(n-1)xy$ (b) $n(x+y)^2 - n(n-1)xy$ (c) both the above (d) None
54. The sum of n terms of $(1/n)(n-1), (1/n)(n-2), (1/n)(n-3), \dots$ is

- (a) 0 (b) $(1/2)(n - 1)$ (c) $(1/2)(n + 1)$ (d) None

55. The sum of n terms of 1.4, 3.7, 5.10 is

- (a) $(n/2)(4n^2+5n - 1)$ (b) $n(4n^2+5n - 1)$ (c) $(n/2)(4n^2-5n - 1)$ (d) None

56. The sum of n terms of $1^2, 3^2, 5^2, 7^2, \dots$ is

- (a) $(n/3)(4n^2-1)$ (b) $(n/2)(4n^2-1)$ (c) $(n/3)(4n^2+1)$ (d) None

57. The sum of n terms of 1, $(1 + 2)$, $(1 + 2 + 3)$ is

- (a) $(n/3)(n + 1)(n - 2)$ (b) $(n/3)(n + 1)(n + 2)$ (c) $n(n + 1)(n + 2)$ (d) None

58. The sum of n terms of the series $1^2/1 + (1^2+2^2)/2 + (1^2+2^2+3^2)/3 + \dots$ is

- (a) $(n/36)(4n^2 + 15n + 17)$ (b) $(n/12)(4n^2 + 15n + 17)$
(c) $(n/12)(4n^2 + 15n + 17)$ (d) None

59. The sum of n terms of the series $2.4.6 + 4.6.8 + 6.8.10 + \dots$ is

- (a) $2n(n^3+6n^2+11n+6)$ (b) $2n(n^3-6n^2+11n-6)$
(c) $n(n^3+6n^2+11n+6)$ (d) $n(n^3+6n^2+11n-6)$

60. The sum of n terms of the series $1.3^2+4, 4^2+7.5^2+10.6^2+ \dots$ is

- (a) $(n/12)(n + 1)(9n^2+49n+44)-8n$ (b) $(n/12)(n + 1)(9n^2+49n+44)+8n$
(c) $(n/6)(2n + 1)(9n^2+49n+44)-8n$ (d) None

61. The sum of n terms of the series $4 + 6 + 9 + 13 \dots$ is

- (a) $(n/6)(n^2+3n + 20)$ (b) $(n/6)(n + 1)(n + 2)$ (c) $(n/3)(n + 1)(n + 2)$ (d) None

62. The sum to n terms of the series 11, 23, 59, 167 is

- (a) $3^{n+1}+5n - 3$ (b) $3^{n+1}+5n + 3$ (c) $3^n+5n - 3$ (d) None

63. The sum of n terms of the series $1/(4.9)+1/(9.14)+1/(14.19)+1/(19.24)+ \dots$ is

- (a) $(n/4)(5n+4)^{-1}$ (b) $(n/4)(5n+4)$ (c) $(n/4)(5n-4)^{-1}$ (d) None

64. The sum of n terms of the series $1 + 3 + 5 + \dots$ is

- (a) n^2 (b) $2n^1$ (c) $n^2/2$ (d) None

65. The sum of n terms of the series $2 + 6 + 10 + \dots$ is

- (a) $2n^2$ (b) n^2 (c) $n^2/2$ (d) $4n^2$

66. The sum of n terms of the series $1.2 + 2.3 + 3.4 + \dots$ is

- (a) $(n/3)(n + 1)(n + 2)$ (b) $(n/2)(n + 1)(n + 2)$ (c) $(n/3)(n + 1)(n - 2)$ (d) None

67. The sum of n terms of the series $1.2.3 + 2.3.4 + 3.4.5 + \dots$ is

- (a) $(n/4)(n+1)(n+2)(n+3)$ (b) $(n/3)(n+1)(n+2)(n+3)$
(c) $(n/2)(n+1)(n+2)(n+3)$ (d) None

68. The sum of n terms of the series $1.2+3.2^2+5.2^3+7.2^4+ \dots$ is

- (a) $(n-1)2^{n+2}-2^{n+1}+6$ (b) $(n+1)2^{n+2}-2^{n+1}+6$ (c) $(n-1)2^{n+2}-2^{n+1}-6$ (d) None

69. The sum of n terms of the series $1/(3.8)+1/(8.13)+1/(13.18)+ \dots$ is

- (a) $(n/3)(5n+3)^{-1}$ (b) $(n/2)(5n+3)^{-1}$ (c) $(n/2)(5n-3)^{-1}$ (d) None

70. The sum of n terms of the series $1/1+1/(1+2)+1/(1+2+3)+ \dots$ is

- (a) $2n(n+1)^{-1}$ (b) $n(n+1)$ (c) $2n(n-1)^{-1}$ (d) None

71. The sum of n terms of the series $2^2+5^2+8^2+ \dots$ is

- (a) $(n/2)(6n^2+3n-1)$ (b) $(n/2)(6n^2-3n-1)$
(c) $(n/2)(6n^2+3n+1)$ (d) None

72. The sum of n terms of the series $1^2+3^2+5^2+ \dots$ is

- (a) $\frac{n}{3}(4n^2-1)$ (b) $n^2(2n^2+1)$ (c) $n(2n-1)$ (d) $n(2n+1)$

73. The sum of n terms of the series $1.4 + 3.7 + 5.10 + \dots$ is

- (a) $(n/2)(4n^2+5)$ (b) $(n/2)(5n^2+4n-1)$
(c) $(n/2)(4n^2+5n+1)$ (d) None

74. The sum of n terms of the series $2.3^2 + 5.4^2 + 8.5^2 + \dots$ is

- (a) $(n/12)(9n^3+62n^2+123n+22)$ (b) $(n/12)(9n^3-62n^2+123n-22)$
(c) $(n/6)(9n^3+62n^2+123n+22)$ (d) None

75. The sum of n terms of the series $1 + (1+3) + (1+3+5) + \dots$ is

- (a) $(n/6)(n+1)(2n+1)$ (b) $(n/6)(n+1)(n+2)$ (c) $(n/3)(n+1)(2n+1)$ (d) None

76. The sum of n terms of the series $1^2+(1^2+2^2)+(1^2+2^2+3^2)+ \dots$ is

- (a) $(n/12)(n+1)^2(n+2)$ (b) $(n/12)(n-1)^2(n+2)$ (c) $(n/12)(n-1)(n+2)$ (d) None

77. The sum of n terms of the series $1+(1+1/3)+(1+1/3+1/3^2)+ \dots$ is

- (a) $(3/2)(1-3^{-n})$ (b) $(3/2)[n-(1/2)(1-3^{-n})]$ (c) Both (d) None

78. The sum of n terms of the series $n.1+(n-1).2+(n-2).3+ \dots$ is

- (a) $(n/6)(n+1)(n+2)$ (b) $(n/3)(n+1)(n+2)$ (c) $(n/2)(n+1)(n+2)$ (d) None

79. The sum of n terms of the series $1 + 5 + 12 + 22 + \dots$ is

- (a) $(n^2/2)(n+1)$ (b) $n(n+1)$ (c) $(n^2/2)(n-1)$ (d) None

80. The sum of n terms of the series $4 + 14 + 30 + 52 + 80 + \dots$ is

- (a) $n(n+1)^2$ (b) $n(n-1)^2$ (c) $n(n^2-1)$ (d) None

81. The sum of n terms of the series $3 + 6 + 11 + 20 + 37 + \dots$ is

- (a) $2^{n+1} + (n/2)(n+1)-2$ (b) $2^{n+1} + (n/2)(n+1)-1$ (c) $2^{n+1} + (n/2)(n-1)-2$ (d) None

82. The n^{th} terms of the series is $1/(4.7) + 1/(7.10) + 1/(10.13) + \dots$ is

- (a) $(1/3)[(3n+1)^{-1}-(3n+4)^{-1}]$ (b) $(1/3)[(3n-1)^{-1}-(3n+4)^{-1}]$
(c) $(1/3)[(3n+1)^{-1}-(3n-4)^{-1}]$ (d) None

83. In question No.(82) the sum of the series upto n is

- (a) $(n/4)(3n+4)^{-1}$ (b) $(n/4)(3n-4)^{-1}$ (c) $(n/2)(3n+4)^{-1}$ (d) None

84. The sum of n terms of the series $1^2/1+(1^2+2^2)/(1+2)+(1^2+2^2+3^2)/(1+2+3)+ \dots$ is

- (a) $(n/3)(n+2)$ (b) $(n/3)(n+1)$ (c) $(n/3)(n+3)$ (d) None

85. The sum of n terms of the series $1^3/1+(1^3+2^3)/2+(1^3+2^3+3^3)/3+ \dots$ is

- (a) $(n/48)(n+1)(n+2)(3n+5)$ (b) $(n/24)(n+1)(n+2)(3n+5)$
(c) $(n/48)(n+1)(n+2)(5n+3)$ (d) None

86. The value of $n^2 + 2n[1+2+3+ \dots + (n-1)]$ is

- (a) n^3 (b) n^2 (c) n (d) None

87. 2^{4n-1} is divisible by

- (a) 15 (b) 4 (c) 6 (d) 64

88. $3^n - 2n - 1$ is divisible by

- (a) 15 (b) 4 (c) 6 (d) 64

89. $n(n-1)(2n-1)$ is divisible by

- (a) 15 (b) 4 (c) 6 (d) 64

90. $7^{2n} + 16n - 1$ is divisible by

- (a) 15 (b) 4 (c) 6 (d) 64

91. The sum of n terms of the series whose n^{th} term $3n^2 + 2n$ is is given by

- (a) $(n/2)(n+1)(2n+3)$ (b) $(n/2)(n+1)(3n+2)$
(c) $(n/2)(n+1)(3n-2)$ (d) $(n/2)(n+1)(2n-3)$

92. The sum of n terms of the series whose n^{th} term $n \cdot 2^n$ is is given by

- (a) $(n-1)2^{n+1}+2$ (b) $(n+1)2^{n+1}+2$ (c) $(n-1)2^n+2$ (d) None

93. The sum of n terms of the series whose n^{th} term $5 \cdot 3^{n+1} + 2n$ is given by

- (a) $(5/2) (3^{n+2} - 9) + n(n+1)$ (b) $(2/5) (3^{n+2} - 9) + n(n+1)$
(c) $(5/2) (3^{n+2} + 9) + n(n+1)$ (d) None

94. If the third term of a G.P. is the square of the first and the fifth term is 64 the series would be _____.

- (a) $4 + 8 + 16 + 32 + \dots$ (b) $4 - 8 + 16 - 32 + \dots$
(c) both (d) None

95. Three numbers whose sum is 15 are in A.P. but if they are added by 1, 4, 19 respectively they are in G.P. The numbers are _____.

- (a) 2, 5, 8 (b) 26, 5, -16 (c) Both (d) None

96. If a, b, c are the $p^{\text{th}}, q^{\text{th}}$ and r^{th} terms of a G.P. respectively the value of $a^{q-r} \cdot b^{r-p} \cdot c^{p-q}$ is _____.

- (a) 0 (b) 1 (c) -1 (d) None

97. If a, b, c are in A.P. and x, y, z in G.P. then the value of $x^{b-c} \cdot y^{c-a} \cdot z^{a-b}$ is _____.

- (a) 0 (b) 1 (c) -1 (d) None

98. If a, b, c are in A.P. and x, y, z in G.P. then the value of $(x^b \cdot y^c \cdot z^a) \div (x^c \cdot y^a \cdot z^b)$ is _____.

- (a) 0 (b) 1 (c) -1 (d) None

99. The sum of n terms of the series $7 + 77 + 777 + \dots$ is

- (a) $(7/9) [(1/9) (10^{n+1} - 10) - n]$ (b) $(9/10) [(1/9) (10^{n+1} - 10) - n]$
(c) $(10/9) [(1/9) (10^{n+1} - 10) - n]$ (d) None

100. The least value of n for which the sum of n terms of the series $1 + 3 + 3^2 + \dots$ is greater than 7000 is _____.

- (a) 9 (b) 10 (c) 8 (d) 7

101. If 'S' be the sum, 'P' the product and 'R' the sum of the reciprocals of n terms in a G.P. then 'P' is the _____ of S^n and R^{-n} .

- (a) Arithmetic Mean (b) Geometric Mean (c) Harmonic Mean (d) None

102. Sum upto ∞ of the series $8 + 4\sqrt{2} + 4 + \dots$ is

- (a) $8(2 + \sqrt{2})$ (b) $8(2 - \sqrt{2})$ (c) $4(2 + \sqrt{2})$ (d) $4(2 - \sqrt{2})$

103. Sum upto ∞ of the series $1/2 + 1/3^2 + 1/2^3 + 1/3^4 + 1/2^5 + 1/3^6 + \dots$ is

- (a) 19/24 (b) 24/19 (c) 5/24 (d) None

104. If $1 + a + a^2 + \dots = x$ and $1 + b + b^2 + \dots = y$ then $1 + ab + a^2b^2 + \dots = x$ is given by _____.

- (a) $(xy)/(x+y-1)$ (b) $(xy)/(x-y-1)$ (c) $(xy)/(x+y+1)$ (d) None

105. If the sum of three numbers in G.P. is 35 and their product is 1000 the numbers are _____.

- (a) 20, 10, 5 (b) 5, 10, 20 (c) both (d) None

106. If the sum of three numbers in G.P. is 21 and the sum of their squares is 189 the numbers are _____.

- (a) 3, 6, 12 (b) 12, 6, 3 (c) both (d) None

107. If a, b, c are in G.P. then the value of $a(b^2 + c^2) - c(a^2 + b^2)$ is _____.

- (a) 0 (b) 1 (c) -1 (d) None

108. If a, b, c, d are in G.P. then the value of $b(ab - cd) - (c + a)(b^2 - c^2)$ is _____

- (a) 0 (b) 1 (c) -1 (d) None

109. If a, b, c, d are in G.P. then the value of $(ab + bc + cd)^2 - (a^2 + b^2 + c^2)(b^2 + c^2 + d^2)$ is _____.

- (a) 0 (b) 1 (c) -1 (d) None

110. If a, b, c, d are in G.P. then a+b, b+c, c+d are in

- (a) A.P. (b) G.P. (c) H.P. (d) None

111. If a, b, c are in G.P. then $a^2 + b^2$, ab+bc, $b^2 + c^2$ are in

- (a) A.P. (b) G.P. (c) H.P. (d) None

112. If a, b, x, y, z are positive numbers such that a, x, b are in A.P. and a, y, b are in G.P. and $z = (2ab)/(a+b)$ then

- (a) x, y, z are in G.P. (b) $x \geq y \geq z$ (c) both (d) None

113. If a, b, c are in G.P. then the value of $(a-b+c)(a+b+c)^2 - (a+b+c)(a^2 + b^2 + c^2)$ is given by

- (a) 0 (b) 1 (c) -1 (d) None

114. If a, b, c are in G.P. then the value of $a(b^2 + c^2) - c(a^2 + b^2)$ is given by

- (a) 0 (b) 1 (c) -1 (d) None

115. If a, b, c are in G.P. then the value of $a^2b^2c^2(a^{-3} + b^{-3} + c^{-3}) - (a^3 + b^3 + c^3)$ is given by

- (a) 0 (b) 1 (c) -1 (d) None

116. If a, b, c, d are in G.P. then $(a-b)^2$, $(b-c)^2$, $(c-d)^2$ are in

- (a) A.P. (b) G.P. (c) H.P. (d) None

117. If a, b, c, d are in G.P. then the value of $(b-c)^2 + (c-a)^2 + (d-b)^2 - (a-d)^2$ is given by

- (a) 0 (b) 1 (c) -1 (d) None

118. If (a-b), (b-c), (c-a) are in G.P. then the value of $(a+b+c)^2 - 3(ab+bc+ca)$ is given by

- (a) 0 (b) 1 (c) -1 (d) None

119. If $a^{1/x} = b^{1/y} = c^{1/z}$ and a, b, c are in G.P. then x, y, z are in

- (a) A.P. (b) G.P. (c) H.P. (d) None

120. If $x = a + a/r + a/r^2 + \dots \infty$, $y = b - b/r + b/r^2 - \dots \infty$, and $z = c + c/r^2 + c/r^4 + \dots \infty$, then the value of $\frac{xy}{z} - \frac{ab}{c}$ is

- (a) 0 (b) 1 (c) -1 (d) None

121. If a, b, c are in A.P. a, x, b are in G.P. and b, y, c are in G.P then x^2, b^2, y^2 are in

- (a) A.P. (b) G.P. (c) H.P. (d) None

122. If a, b-a, c-a are in G.P. and $a=b/3=c/5$ then a, b, c are in

- (a) A.P. (b) G.P. (c) H.P. (d) None

123. If a, b, (c+1) are in G.P. and $a = (b-c)^2$ then a, b, c are in

- (a) A.P. (b) G.P. (c) H.P. (d) None

124. If S_1, S_2, S_3, S_n are the sums of infinite G.P.s whose first terms are 1, 2, 3 n and whose common ratios are $1/2, 1/3, \dots, 1/(n+1)$ then the value of $S_1 + S_2 + S_3 + \dots S_n$ is

- (a) $(n/2)(n+3)$ (b) $(n/2)(n+2)$ (c) $(n/2)(n+1)$ (d) $n^2/2$

125. The G.P. whose 3rd and 6th terms are 1, -1/8 respectively is

- (a) 4, -2, 1 (b) 4, 2, 1 (c) 4, -1, 1/4 (d) None

126. In a G.P. if the $(p+q)^{\text{th}}$ term is m and the $(p-q)^{\text{th}}$ term is n then the p^{th} term is _____.

- (a) $(mn)^{1/2}$ (b) mn (c) (m+n) (d) (m-n)

127. The sum of n terms of the series is $1/\sqrt{3} + 1 + 3/\sqrt{3} + \dots$

- (a) $(1/6)(3+\sqrt{3})(3^{n/2}-1)$ (b) $(1/6)(\sqrt{3}+1)(3^{n/2}-1)$
(c) $(1/6)(3+\sqrt{3})(3^{n/2}+1)$ (d) None

128. The sum of n terms of the series $5/2 - 1 + 2/5 - \dots$ is

- (a) $(1/14)(5^n + 2^n)/5^{n-2}$ (b) $(1/14)(5^n - 2^n)/5^{n-2}$ (c) both (d) None

129. The sum of n terms of the series $0.3 + 0.03 + 0.003 + \dots$ is

- (a) $(1/3)(1-1/10^n)$ (b) $(1/3)(1+1/10^n)$ (c) both (d) None

130. The sum of first eight terms of G.P. is five times the sum of the first four terms. The common ratio is _____.

- (a) $\sqrt{2}$ (b) $-\sqrt{2}$ (c) both (d) None

131. If the sum of n terms of a G.P. with first term 1 and common ratio 1/2 is $1 + 127/128$, the value of n is _____.

- (a) 8 (b) 5 (c) 3 (d) None

132. If the sum of n terms of a G.P. with last term 128 and common ratio 2 is 255, the value of n is _____.

- (a) 8 (b) 5 (c) 3 (d) None

133. How many terms of the G.P. 1, 4, 16 are to be taken to have their sum 341?

- (a) 8 (b) 5 (c) 3 (d) None

134. The sum of n terms of the series $5 + 55 + 555 + \dots$ is

- (a) $(50/81) (10^n - 1) - (5/9)n$ (b) $(50/81) (10^n + 1) - (5/9)n$
(c) $(50/81) (10^n + 1) + (5/9)n$ (d) None

135. The sum of n terms of the series $0.5 + 0.55 + 0.555 + \dots$ is

- (a) $(5/9)n - (5/81)(1 - 10^{-n})$ (b) $(5/9)n + (5/81)(1 - 10^{-n})$
(c) $(5/9)n + (5/81)(1 + 10^{-n})$ (d) None

136. The sum of n terms of the series $1.03 + 1.03^2 + 1.03^3 + \dots$ is

- (a) $(103/3)(1.03^n - 1)$ (b) $(103/3)(1.03^n + 1)$ (c) $(103/3)(1.03^{n+1} - 1)$ (d) None

137. The sum upto infinity of the series $1/2 + 1/6 + 1/18 + \dots$ is

- (a) $3/4$ (b) $1/4$ (c) $1/2$ (d) None

138. The sum upto infinity of the series $4 + 0.8 + 0.16 + \dots$ is

- (a) 5 (b) 10 (c) 8 (d) None

139. The sum upto infinity of the series $\sqrt{2} + 1/\sqrt{2} + 1/(2\sqrt{2}) + \dots$ is

- (a) $2\sqrt{2}$ (b) 2 (c) 4 (d) None

140. The sum upto infinity of the series $2/3 + 5/9 + 2/27 + 5/81 + \dots$ is

- (a) $11/8$ (b) $8/11$ (c) $3/11$ (d) None

141. The sum upto infinity of the series $(\sqrt{2} + 1) + 1 + (\sqrt{2} - 1) + \dots$ is

- (a) $(1/2)(4 + 3\sqrt{2})$ (b) $(1/2)(4 - 3\sqrt{2})$ (c) $4 + 3\sqrt{2}$ (d) None

142. The sum upto infinity of the series $(1 + 2^{-2}) + (2^{-1} + 2^{-4}) + (2^{-2} + 2^{-6}) + \dots$ is

- (a) $7/3$ (b) $3/7$ (c) $4/7$ (d) None

143. The sum upto infinity of the series $4/7 - 5/7^2 + 4/7^3 - 5/7^4 + \dots$ is

- (a) $23/48$ (b) $25/48$ (c) $1/2$ (d) None

144. If the sum of infinite terms in a G.P. is 2 and the sum of their squares is $4/3$ the series is

- (a) 1, $1/2$, $1/4$ (b) 1, $-1/2$, $1/4$ (c) -1 , $-1/2$, $-1/4$ (d) None

145. The infinite G.P. with first term $1/4$ and sum $1/3$ is

- (a) $1/4$, $1/16$, $1/64$... (b) $1/4$, $-1/16$, $1/64$... (c) $1/4$, $1/8$, $1/16$ (d) None

146. If the first term of a G.P. exceeds the second term by 2 and the sum to infinity is 50 the series is _____.

(a) 10, 8, $32/5$... (b) 10, 8, $5/2$... (c) 10, $10/3$, $10/9$ (d) None

147. Three numbers in G.P. with their sum 130 and their product 27,000 are _____.

(a) 10, 30, 90 ... (b) 90, 30, 10 ... (c) both (d) None

148. Three numbers in G.P. with their sum $13/3$ and sum of their squares $91/9$ are .

(a) $1/3$, 1, 3 (b) 3, 1, $1/3$ (c) both (d) None

149. Find five numbers in G.P. such that their product is 32 and the product of the last two is 108.

(a) $2/9$, $2/3$, 2, 6, 18 (b) 18, 6, 2, $2/3$, $2/9$ (c) both (d) None

150. If the continued product of three numbers in G.P. is 27 and the sum of their products in pairs is 39 the numbers are _____.

(a) 1, 3, 9 (b) 9, 3, 1 (c) both (d) None

151. The numbers x, 8, y are in G.P. and the numbers x, y, -8 are in A.P. The values of x, y are _____.

(a) 16, 4 (b) 4, 16 (c) both (d) None

ANSWERS

1.	(c)	31.	(a)	61.	(a)	91.	(a)	121.	(a)
2.	(a)	32.	(a)	62.	(a)	92.	(a)	122.	(a)
3.	(b)	33.	(a)	63.	(a)	93.	(a)	123.	(a)
4.	(a)	34.	(b)	64.	(a)	94.	(c)	124.	(a)
5.	(a)	35.	(b)	65.	(a)	95.	(c)	125.	(a)
6.	(b)	36.	(a)	66.	(a)	96.	(b)	126.	(a)
7.	(c)	37.	(b)	67.	(a)	97.	(b)	127.	(a)
8.	(c)	38.	(c)	68.	(a)	98.	(b)	128.	(c)
9.	(a)	39.	(d)	69.	(a)	99.	(a)	129.	(a)
10.	(a)	40.	(d)	70.	(a)	100.	(a)	130.	(c)
11.	(b)	41.	(a)	71.	(a)	101.	(b)	131.	(a)
12.	(c)	42.	(a)	72.	(a)	102.	(a)	132.	(a)
13.	(a)	43.	(d)	73.	(a)	103.	(a)	133.	(b)
14.	(c)	44.	(d)	74.	(a)	104.	(a)	134.	(a)
15.	(b)	45.	(c)	75.	(a)	105.	(c)	135.	(a)

16. (a)	46. (a)	76. (a)	106. (c)	136. (a)
17. (a)	47. (b)	77. (b)	107. (a)	137. (a)
18. (a)	48. (c)	78. (a)	108. (a)	138. (a)
19. (a)	49. (a)	79. (a)	109. (a)	139. (a)
20. (c)	50. (b)	80. (a)	110. (b)	140. (a)
21. (b)	51. (a)	81. (a)	111. (b)	141. (a)
22. (a)	52. (d)	82. (a)	112. (c)	142. (a)
23. (a)	53. (b)	83. (a)	113. (a)	143. (a)
24. (a)	54. (b)	84. (a)	114. (a)	144. (a)
25. (c)	55. (a)	85. (a)	115. (a)	145. (a)
26. (a)	56. (a)	86. (a)	116. (b)	146. (a)
27. (c)	57. (d)	87. (a)	117. (a)	147. (c)
28. (c)	58. (a)	88. (b)	118. (a)	148. (c)
29. (a)	59. (a)	89. (c)	119. (a)	149. (a)
30. (a)	60. (a)	90. (d)	120. (a)	150. (c)
151. (a)				

PAST YEARS QUESTION

2014- DECEMBER

1. If x, y, z are the terms in G.P. then the terms

- (a) A.P. (b) G.P. (c) H.P.

$x^2 + y^2, xy + yz, y^2 + z^2$ are in:

- (d) None of these

2. If $S_n = n^2p$ and $S_m = m^2p$ ($m \neq n$) is the sum of an A.P., then $S_p =$ _____
 (a) p^2 (b) **P^3** (c) $2p^3$ (d) p^4
3. The arithmetic mean of the square of first $2n$ natural numbers is:
 (a) $\frac{1}{6} (2n + 1) (4n - 1)$ (b) $\frac{1}{6} (2n - 1) (4n - 1)$
 (c) $\frac{1}{6} (2n - 1) (4n + 1)$ (d) **$\frac{1}{6} (2n + 1) (4n + 1)$**
4. If the sum of first 'n' terms of an A.P. is $6n^2 + 6n$, then the fourth term of the series:
 (a) 120 (b) 72 (c) **48** (d) 24

2015 - JUNE

[65] if S be the sum, P the product and R is the sum of reciprocals of n - terms in G.P then $P^2R^n =$ _____.

- (a) S^{2n} (b) **S^n** (c) S^{2n} (d) S^{-n}
5. The sum of the series $1 + 11 + 111 + \dots$ to n terms is _____.
 (a) $\frac{1}{27} (10^{n+1} - 9n - 10)$ (b) $10^{n+1} - 9n - 10$
 (c) **$\frac{1}{81} (10^{n+1} - 9n - 10)$** (d) None of these
6. If third term and seventh term of an A.P are eighteen and thirty respectively, then sum of first twenty terms will be:
 (a) 540 (b) 610 (c) 740 (d) **810**

2015 - DECEMBER

7. If the sum of 'n' terms of an Arithmetic Progression (A.P) is $3x^2 + 5x$ and its m^{th} term is 164, then the value of m is:
 (a) **27** (b) 28 (c) 24 (d) 26
8. If a, b, c are in Arithmetic Progression (A.P.), then the value of $a-b+c$ is:
 (a) a (b) $-b$ (c) **b** (d) c (1 mark)
9. Find the two numbers whose geometric mean is 5 and arithmetic mean is 7.5.
 (a) 10 and 5 (b) **13.09 and 1.91** (c) 12 and 3 (d) None of the above

2016-JUNE

10. The sum of n terms of the series $\log x + \log \frac{x^2}{y} + \log \frac{x^3}{y^2} + \dots$ is _____.

$$(a) \frac{n}{2} \left[2n \log \left(\frac{x}{y} \right) + \log xy \right] \quad (b) \frac{n}{2} \left[n \log xy + \log \left(\frac{x}{y} \right) \right]$$

$$(c) \frac{n}{2} \left[n \log \left(\frac{x}{y} \right) - \log xy \right] \quad (d) \frac{n}{2} \left[n \log \left(\frac{x}{y} \right) + \log xy \right]$$

11. A G. P. (Geometric Progression) consists of $2n$ terms. If the sum of the terms occupying the odd places is S_1 and that of terms in the even places is S_2 , the common ratio of the progression is:

(a) n (b) $2S_1$ (c) $\frac{S_2}{S_1}$ (d) $\frac{S_1}{S_2}$

12. If $\frac{1}{b+c}, \frac{1}{c+a}, \frac{1}{a+b}$ are in arithmetic progression then a^2, b^2, c^2 , are in

- (a) Arithmetic Progression (b) Geometric Progression
(c) Both in arithmetic and geometric Progression (d) None of these

2016 - DECEMBER

13. The income of a person is Rs. 5,00,000 in the first year and he receives an increase of Rs. 15,000 per year for next 10 years. The total amount he receives in 10 years is:

- (a) Rs. 56,75,000 (b) Rs. 72,50,000 (c) Rs. 15,67,500
(d) None of these

14. if the Sum $50 + 45 + 40 + 35 + \dots$ is zero, then the number of terms is:

- (a) 22 (b) 20 (c) 21 (d) 25

15. The number 2.353535... in $\frac{p}{q}$ form is:

- (a) $\frac{235}{99}$ (b) $\frac{234}{99}$ (c) $\frac{230}{99}$ (d) $\frac{233}{99}$

2017 - JUNE

16. The sum of n terms of the series $1 + (1 + 3) + (1 + 3 + 5) + \dots$ is

- (a) $\frac{n(n+1)(2n+1)}{6}$ (b) $\frac{n(n+1)(n+2)}{6}$
(c) $\frac{n(n+1)(2n+1)}{3}$ (d) None of these

17. The sum of first 20 terms of a GP is 1025 times the sum of first 10 terms of same GP then common ratio is:

- (a) $\sqrt{2}$ (b) 2 (c) $2\sqrt{2}$ (d) $1/2$

18. The value C such that $a, -3, b, 5, c$ are in A.P. is:

- (a) -7 (b) 1 (c) 13 (d) 9

2017 - DECEMBER

19. The sum of all numbers between 100 and 1000 which are divisible by 11 will be:

- (a) 44550 (b) 66770 (c) 55440 (d) 33440

2018-MAY

20. The sum to m terms of the series $1+11+111+\dots$ upto m terms, is equal to:

- (a) $\frac{1}{81} (10^{m+1} - 9m - 10)$ (b) $\frac{1}{27} (10^{m+1} - 9m - 10)$
(c) $10^{m+1} - 9m - 10$ (d) None of these

21. A person pays Rs. 975 in monthly instalments, each instalment is less than former by Rs. 5. The amount of 1st instalment is Rs. 100. In what time will the entire amount be paid?

- (a) 26 months (b) **15 months** (c) Both (a) & (b) (d) 18 months.

22. If the sum of n terms of an AP is $(3n^2 - n)$ and its common difference is 6, then its first term is:

- (a) 3 (b) **2** (c) 4 (d) 1

23. Insert two arithmetic means between 68 and 260.

- (a) **132, 196** (b) 130, 194 (c) 70, 258 (d) None of the above

2018 – NOVEMBER

24. If the Pth term of an A.P. is 'q' and the qth term is 'p', then its rth term is

- (a) **p + q - r** (b) P + q + r (c) p - q - r (d) p - q

25. The 3rd term of a G.P. is $\frac{2}{3}$ and the 6th term is $\frac{2}{81}$, then the 1st term is

- (a) **6** (b) $\frac{1}{3}$ (c) 9 (d) 2

26. The sum of the series - 8, - 6, - 4, ...n terms is 52. The number of terms n is

- (a) 11 (b) 12 (c) **13** (d) 10

27. The value of K, for which the terms $7K + 3, 4K - 5, 2K + 10$ are in A.P., is

- (a) 13 (b) -13 (c) 23 (d) **- 23**

2019 - JUNE

28. If the ratio of sum of n terms of two APs is $(n+1):(n-1)$, then the ratio of their mth terms is:

- (a) $(m+1):2m$ (b) $(m+1):(m-1)$
(c) $(2m-1):(m+1)$ (d) **m:(m-1)**

29. IN a GP. If the fourth term is '3' then the product of first seven terms is

- (a) 3^5 (b) **3^7** (c) 3^6 (d) 3^8

30. If $2 + 6 + 10 + 14 + 18 + \dots + x = 882$ then the value of x
(a) 78 (b) 80 (c) **82** (d) 86

31. If $y = 1 + x + x^2 + \dots + \infty$ then $x =$
(a) $\frac{y-1}{y}$ (b) $\frac{y+1}{y}$ (c) $\frac{y}{y+1}$ (d) $\frac{y}{y-1}$ (1 mark)

2019-NOVEMBER

32. If $\frac{(b+c-a)}{a}, \frac{(c+a-b)}{b}, \frac{(a+b-c)}{c}$ are in AP then a, b, c are in:
(a) AP (b) GP (c) **HP** (d) None

33. Sum up to infinity of series.
 $\frac{1}{2} + \frac{1}{3^2} + \frac{1}{2^8} + \frac{1}{3^4} + \frac{1}{2^5} + \dots$
(a) **19/24** (b) 24/19 (c) 5/24 (d) None

34. Sum the series $\frac{1}{5}, \frac{1}{5^2}, \frac{1}{5^3}, \dots, \frac{1}{5^n}$.
(a) $\frac{1}{4} \left[1 - \left(\frac{1}{5} \right)^n \right]$ (b) $\frac{1}{5} \left[1 - \left(\frac{1}{4} \right)^n \right]$ (c) both (d) None

35. Find the no. of terms of the series 25, 5, 1, $\dots, \frac{1}{3125}$
(a) 6 (b) 7 (c) 8 (d) **9**

36. If the sum of five terms of AP is 75. Find the third term of the series
(a) **35** (b) 30 (c) 15 (d) 20

37. If the AM and GM of two numbers is 6.5 and 6 the no.'s are:
(a) 3 and 2 (b) **9 and 4** (c) 81 and 16 (d) None

38. If AM and HM for two numbers are 5 and 3.2, respectively. GM will be:
(a) 20 (b) 16 (c) **4** (d) 5

2020 - NOVEMBER

39. Three numbers in G.P. with their Sum 130 and their product 27,000 are:
(a) 10, 30, 90 (b) 90, 30, 10 (c) **(a) and (b) both** (d) 10, 20, 30

40. The 20th term of arithmetic progression whose 6th term is 38 and 10th term is 66 is:
(a) 118 (b) **136** (c) 178 (d) 210

41. Divide 69 into 3 parts which are in A.P. and are such that the product of first two parts is

460:

- (a)20, 23, 26 (b) 21,23,25 (c)19, 23, 27(d)22, 23, 24

2021 - JANUARY

42. The n^{th} terms of the series $3 + 7 + 13 + 21 + 31 + \dots$ is
(a) $4n - 1$ (b) $n^2 + 2n$ (c) $n^2 + n + 1$ (d) $n^3 + 2$
43. in a geometric progression the 3^{rd} and 6^{th} terms are respectively 1 and $-1/8$. The first term (a) and common ratio are respectively.
(a) 4 and $\frac{1}{2}$ (b) 4 and $\frac{-1}{4}$ (c) 4 and $\frac{-1}{2}$ (d) 4 and $\frac{1}{4}$

2021 - JULY

44. The sum of three numbers in a geometric progression is 28. When 7, 2 and 1 are subtracted from the first, second and the third numbers respectively, then the resulting numbers are in arithmetic progression. What is the sum of squares of the original three numbers?
(a)510 (b)456 (c)400 (d)336
45. The number of terms of the series: $5+7+9+\dots$ must be taken so that the sum may be 480.
(a)20 (b)10 (c)15 (d) 25
46. if the sum of 'n' terms of an AP (Arithmetic Progression) is $2n^2$, the fifth term is _____.
(a)20 (b)50 (c)18 (d)25

2021 - DECEMBER

47. If the sum and product of three numbers in G.P. are 7 and 8 respectively, then 4^{th} term of the series is
(a)6 (b)4 (c)8 (d) 16
48. The sum of series $7 + 14 + 21 + \dots$ to 17th term is:
(a)1071 (b)971 (c)1171 (d)1271
49. The sum of first n terms an AP is $3n^2 + 5n$. The series is:
(a)8, 14, 20, 26,.....(b)8, 22, 42, 68,...(c)22, 68, 114, ...(d)8, 14, 28, 44, ...
.....
50. The largest value of n for which $\frac{1}{2} + \frac{1}{2^2} + \dots + \frac{1}{2^n} < 0.998$ is.
(a)9 (b)6 (c)7 (d) 8

2022 - JUNE

51. The nth term of the series 9,7,5 and 15,12,9 are same .find the nth term
(a)7 (b)8 (c)9 (d) 10
52. The sum of first 8 terms of G.P is five times the sum of first 4 terms .Find the common Ratio ?
(a) $\pm\sqrt{2}$ (b)16 (c) $\pm$ (d) 4

53. A person pays Rs. 975 in monthly instalments, each instalment is less than former by Rs. 5. The amount of 1st instalment is Rs. 100. In what time will the entire amount be paid?

(a) 26 months (b) **15 months** (c) Both (a) & (b) (d) 18 months.

2022 - DECEMBER

54. If Arithmetic mean between two numbers is 5 and Geometric mean is 4 then what is the value of Harmonic mean?

A. 3.2 B. 3.4 C. 3.5 D. 36

55. In a G.P. 5th term is 27 8th term is 729. Find its 11th term.

A. 729 B. 6561 C. 2187 D. 19683

56. If p^{th} term of an AP is q and its q^{th} term is p , then what will be the value of $(p + q)^{\text{th}}$ term?

A. 0 B. 1 C. $p + q - 1$ D. $2(p + q - 1)$

2023- JUNE

57. If 9th and 19th term of An arithmetic Progression are 35 and 75 .respectively ,then 20th term is.

A. 78 B. 79 C. 80 D. 81

58. How Many numbers Between 74 and 25556 are divisible by 5?

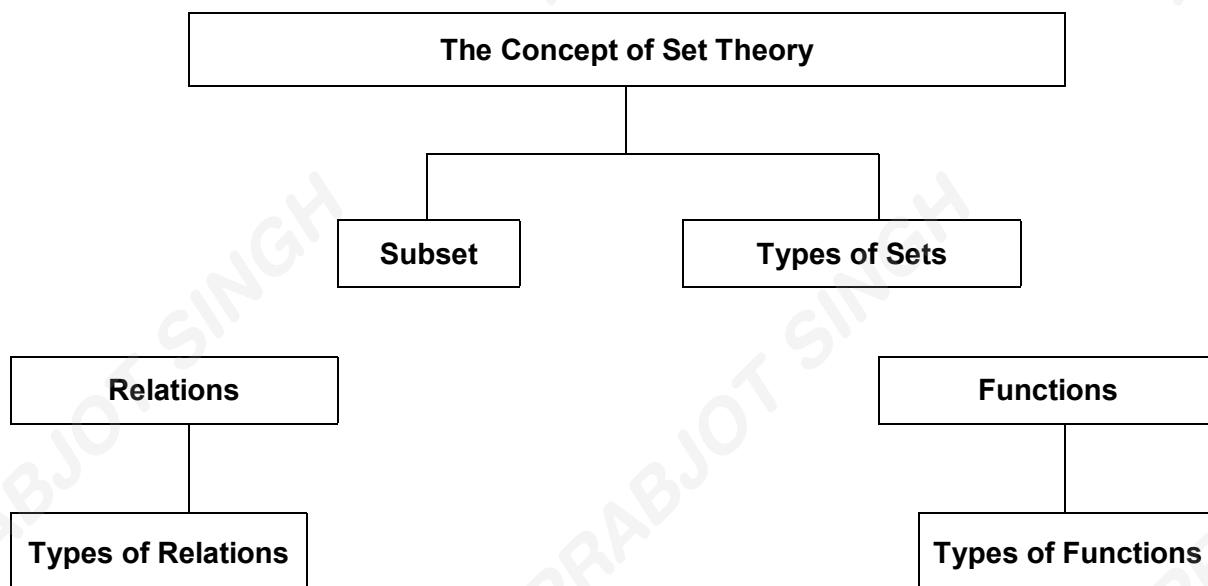
A. 5097 B. 5090 C. 5095 D. 5075

59. If 4th term ,7 term and 10 term of a GP are p, q, r ,respectively

A. $P^2 = q^2 + r^2$ B. $P^2 = qr$ C. $q^2 = pr$ D. $pqr + pq + 1 = 0$

SETS, RELATION AND FUNCTIONS

UNIT OVERVIEW



SETS

A set is defined to be a collection of well-defined distinct objects. This collection may be listed or described. Each object is called an element of the set. We usually denote sets by capital letters and their elements by small letters.

EXERCISE 7 (A)

Choose the most appropriate option or options (a) (b) (c) or (d).

1. The number of subsets of the set $\{2, 3, 5\}$ is

- (a) 3 (b) 8 (c) 6 (d) none of these

2. The number of subsets of a set containing n elements is

- (a) 2^n (b) 2^{-n} (c) n (d) none of these

3. The null set is represented by

- (a) $\{\phi\}$ (b) $\{0\}$ (c) ϕ (d) none of these

4. $A = \{2, 3, 5, 7\}$, $B = \{4, 6, 8, 10\}$ then $A \cap B$ can be written as

- (a) $\{\}$ (b) $\{\phi\}$ (c) $(A \cup B)'$ (d) None of these

5. The set $\{x | 0 < x < 5\}$ represents the set when x may take integral values only

- (a) $\{0, 1, 2, 3, 4, 5\}$ (b) $\{1, 2, 3, 4\}$ (c) $\{1, 2, 3, 4, 5\}$ (d) none of these

6. The set $\{0, 2, 4, 6, 8, 10\}$ can be written as

- (a) $\{2x | 0 < x < 5\}$ (b) $\{x : 0 < x < 5\}$ (c) $\{2x : 0 \leq x \leq 5\}$ (d) none of these

Using Q.7 to Q.10 If $P = \{1, 2, 3, 5, 7\}$, $Q = \{1, 3, 6, 10, 15\}$,

Universal Set $S = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15\}$

7. The cardinal number of $P \cap Q$ is

- (a) 3 (b) 2 (c) 0 (d) none of these

8. The cardinal number of $P \cup Q$ is

- (a) 10 (b) 9 (c) 8 (d) none of these

9. $n(P^1)$ is

- (a) 10 (b) 5 (c) 6 (d) none of these

10. $n(Q^1)$ is

- (a) 4 (b) 10 (c) 4 (d) none of these

11. The set of cubes of the natural number is

- (a) a finite set (b) an infinite set (c) a null set (d) none of these

12. The set $\{2^x \mid x \text{ is any positive rational number}\}$ is

- (a) an infinite set (b) a null set (c) a finite set (d) none of these

13. $\{1 - (-1)^x\}$ for all integral x is the set

- (a) $\{0\}$ (b) $\{2\}$ (c) $\{0, 2\}$ (d) none of these

14. E is a set of positive even number and O is a set of positive odd numbers, then $E \cup O$ is a

- (a) set of whole numbers (b) N (c) a set of rational number (d) none of these

15. If R is the set of positive rational number and E is the set of real numbers then

- (a) $R \subseteq E$ (b) $R \subset E$ (c) $E \subset R$ (d) none of these

16. If N is the set of natural numbers and I is the set of positive integers, then

- (a) $N = I$ (b) $N \subset I$ (c) $N \subseteq I$ (d) none of these

17. If I is the set of isosceles triangles and E is the set of equilateral triangles, then

- (a) $I \subset E$ (b) $E \subset I$ (c) $E = I$ (d) none of these

18. If R is the set of isosceles right angled triangles and I is set of isosceles triangles, then

- (a) $R = I$ (b) $R \supset I$ (c) $R \subset I$ (d) none of these

19. $\{n(n+1)/2 : n \text{ is a positive integer}\}$ is

- (a) a finite set (b) an infinite set (c) is an empty set (d) none of these

20. If $A = \{1, 2, 3, 5, 7\}$, and $B = \{x^2 : x \in A\}$

- (a) $n(b) = n(A)$ (b) $n(B) > n(A)$ (c) $n(A) = n(B)$ (d) $n(A) < n(B)$

21. $A \cup A$ is equal to

- (a) A (b) E (c) ϕ (d) none of these

22. $A \cap A$ is equal to

- (a) ϕ (b) A (c) E (d) none of these

23. $(A \cup B)'$ is equal to

- (a) $(A \cap B)'$ (b) $A \cup B'$ (c) $A' \cap B'$ (d) none of these

24. $(A \cap B)'$ is equal to

- (a) $(A' \cup B)'$ (b) $A' \cup B'$ (c) $A' \cap B'$ (d) none of these

25. $A \cup E$ is equal to (E is a superset of A)

- (a) A (b) E (c) ϕ (d) none of these

26. $A \cap E$ is equal to (E is a superset of A)

- (a) A (b) E (c) ϕ (d) none of these

27. $E \cup E$ is equal to (E is a superset of A)

- (a) E (b) ϕ (c) $2E$ (d) none of these

28. $A \cap E'$ is equal to (E is a superset of A)

- (a) E (b) ϕ (c) A (d) none of these

29. $A \cap \phi$ is equal to (E is a superset of A)

- (a) A (b) E (c) ϕ (d) none of these

30. $A \cup A'$ is equal to (E is a superset of A)

- (a) E (b) ϕ (c) A (d) none of these

31. If $E = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$, the subset of E satisfying $5 + x > 10$ is

- (a) $\{5, 6, 7, 8, 9\}$ (b) $\{6, 7, 8, 9\}$ (c) $\{7, 8, 9\}$ (d) none of these

32. If $A \Delta B = (A - B) \cup (B - A)$ and $A = \{1, 2, 3, 4\}$, $B = \{3, 5, 7\}$ then $A \Delta B$ is

- (a) $\{1, 2, 4, 5, 7\}$ (b) $\{3\}$ (c) $\{1, 2, 3, 4, 5, 7\}$ (d) none of these

[Hint : If A and B are any two sets, then $A - B = \{x : x \in A, x \notin B\}$.

[i.e. A - B Contains all elements of A but not in B] .

ANSWERS

Exercise 7(A)

1. b 2. a 3. c 4. a 5. b 6. c 7. b 8. c
9. a 10. b 11. b 12. a 13. c 14. b 15. b 16. a

17. b 18. c 19. b 20. c 21. a 22. b 23. c 24. b
 25. b 26. a 27. a 28. b 29. c 30. a 31. b 32. a

PRODUCT SETS

Ordered Pair : Two elements a and b , listed in a specific order, form an ordered pair, denoted by (a, b) .

Cartesian Product of sets : If A and B are two non-empty sets, then the set of all ordered pairs (a, b) such that a belongs to A and b belongs to B , is called the Cartesian product of A and B , to be denoted by $A \times B$.

Thus, $A \times B = \{(a, b) : a \in A \text{ and } b \in B\}$

If $A = \phi$ or $B = \phi$, we define $A \times B = \phi$

Illustration: Let $A = \{1, 2, 3\}$, $B = \{4, 5\}$

Then $A \times B = \{(1, 4), (1, 5), (2, 4), (2, 5), (3, 4), (3, 5)\}$

Example: If $A \times B = \{(3, 2), (3, 4), (5, 2), (5, 4)\}$, find A and B .

Solution: Clearly A is the set of all first co-ordinates of $A \times B$, while B is the set of all second co-ordinates of elements of $A \times B$.

Therefore $A = \{3, 5\}$ and $B = \{2, 4\}$

Example: Let $P = \{1, 3, 6\}$ and $Q = \{3, 5\}$

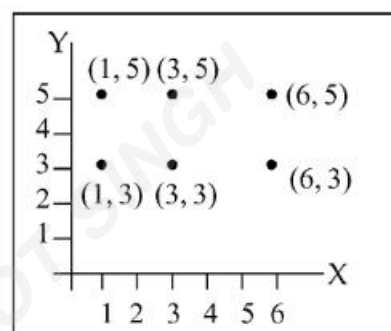
The product set $P \times Q = \{(1, 3), (1, 5), (3, 3), (3, 5), (6, 3), (6, 5)\}$.

Notice that $n(P \times Q) = n(P) \times n(Q)$ and ordered pairs $(3, 5)$ and $(5, 3)$ are not equal. and $Q \times P = \{(3, 1), (3, 3), (3, 6), (5, 1), (5, 3), (5, 6)\}$

So $P \times Q \neq Q \times P$; but $n(P \times Q) = n(Q \times P)$.

Illustration: Here $n(P) = 3$ and $n(Q) = 2$, $n(P \times Q) = 6$. Hence $n(P \times Q) = n(P) \times n(Q)$. and $n(P \times Q) = n(Q \times P) = 6$.

We can represent the product set of ordered pairs by points in the XY plane.



If $X=Y$ = the set of all natural numbers, the product set XY represents an infinite equal lattice of points in the first quadrant of the XY plane.

RELATIONS AND FUNCTIONS

Any subset of the product set $X.Y$ is said to define a **relation** from X to Y and any relation from X to Y in which no two different ordered pairs have the same first element is called a **function**. Let A and B be two non-empty sets. Then, a rule or a correspondence f which associates to each element x of A , a unique element, denoted by $f(x)$ of B , is called a function or **mapping** from A to B and we write $f : A \rightarrow B$

The element $f(x)$ of B is called the image of x , while x is called the pre-image of $f(x)$.

DOMAIN & RANGE OF A FUNCTION

Let $f : A \rightarrow B$, then A is called the domain of f , while B is called the co-domain of f .

The set $f(A) = \{f(x) : x \in A\}$ is called the range of f .

VARIOUS TYPES OF FUNCTION

One-One Function : Let $f : A \rightarrow B$. If different elements in A have different images in B , then f is said to be a one-one or an injective function or mapping.

Onto or Surjective Functions : Let $f : A \rightarrow B$. If every element in B has at least one pre-image in A , then f is said to be an onto function.

Bijection Function : A one-one and onto function is said to be bijective.

A bijective function is also known as a one-to-one correspondence.

Identity Function : Let A be a non-empty set. Then, the function I defined by

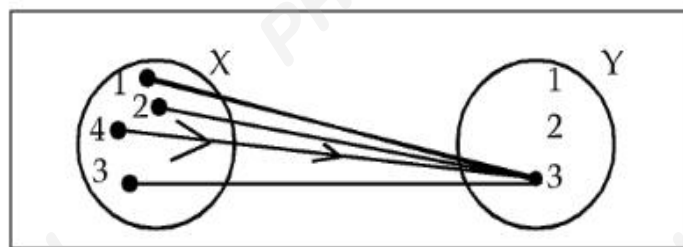
$I : A \rightarrow A : I(x) = x$ for all $x \in A$ is called an identity function on A .

It is a one-to-one onto function with domain A and range A .

Into Functions: Let $f : A \rightarrow B$. There exists even a single element in B having no pre-image in A , then f is said to be an into function.

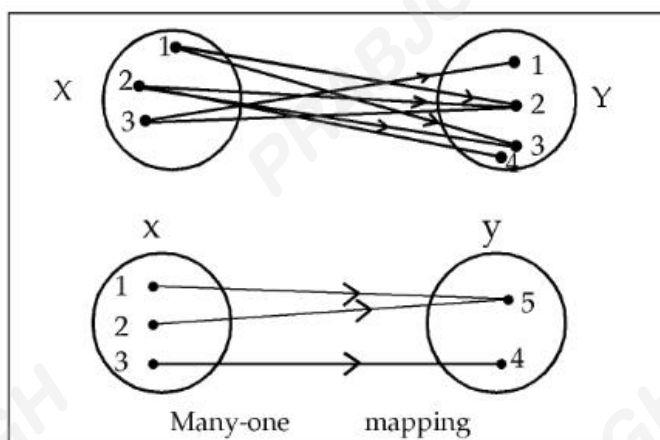
Constant Function: Let $f : A \rightarrow B$, defined in such a way that all the elements in A have the same image in B , then f is said to be a constant function.

Example: Another subset of $X.Y$ is $\{(1, 3), (2, 3), (3, 3), (4, 3)\}$



This relation is a function (a constant function). It is represented on a mapping diagram and is a many-one mapping of X into Y.

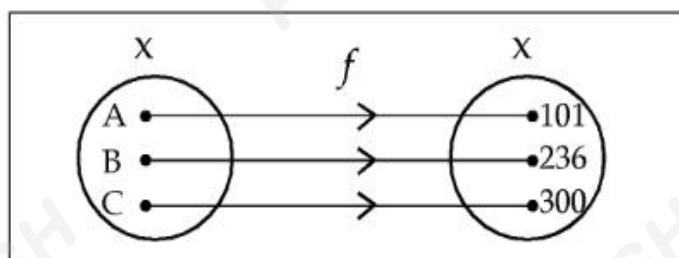
Let us take another subset $\{(4, 1), (4, 2), (4, 3)\}$ of X.Y. This is a relation but not a function. Here different ordered pairs have same first element so it is not a function.



This is an example of many-one mapping.

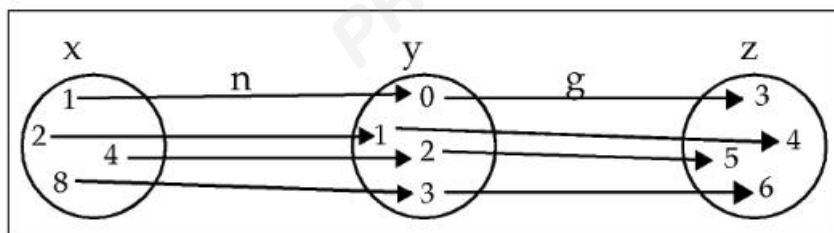
Equal Functions: Two functions f and g are said to be equal, written as $f = g$ if they have the same domain and they satisfy the condition $f(x) = g(x)$, for all x .

A function may simply pair people and the corresponding seat numbers in a theatre. It may simply associate weights of parcels with postal delivery charge or it may be the operation of squaring, adding to doubling, taking the log of etc.



The function f here assigning a locker number to each of the persons A, B and C. Names are associated with or mapped onto, locker numbers under the function f .

We can write $f : X \rightarrow Y$ or $f(x) = y$ or $f(B) = 236$



This diagram shows the effect of two functions n and g on the sets X , Y and Z

$n : X \rightarrow Y$ and $g : Y \rightarrow Z$

Inverse Function: Let f be a one-one onto function from A to B . Let y be an arbitrary element of B . Then f being onto, there exists an element x in A such that $f(x) = y$.

As f is one-one this x is unique.

Thus for each $y \in B$, there exists a unique element $x \in A$ such that $f(x) = y$.

So, we may define a function, denoted by f^{-1} as: $f^{-1} : B \rightarrow A : f^{-1}(y) = x$ if and only if $f(x) = y$.

The above function f^{-1} is called the inverse of f .

A function is invertible if and only if f is one-one onto.

Remarks: If f is one-one onto then f^{-1} is also one-one onto.

Illustration: If $f : A \rightarrow B$ then $f^{-1} : B \rightarrow A$.

EXERCISE 7 (B)

Choose the most appropriate option/options (a) (b) (c) or (d).

1. If $A = \{x, y, z\}$, $B = \{p, q, r, s\}$ which of the relation on A to B are function.

- (a) $\{(n, p), (x, q), (y, r), (z, s)\}$, (b) $\{(x, s), (y, s), (z, s)\}$
 (c) $\{(y, p), (y, q), (y, r), (z, s)\}$, (d) $\{(x, p), (y, r), (z, s)\}$

2. $\{(x, y) | x + y = 5\}$ where $x, y \in \mathbb{R}$ is a

- (a) not a function (b) a composite function (c) one-one mapping (d) none of these

3. $\{(x, y) | x = 4\}$ where $x, y \in \mathbb{R}$ is a

- (a) not a function (b) function (c) one-one mapping (d) none of these

4. $\{(x, y), y = x^2\}$ where $x, y \in \mathbb{R}$ is

- (a) not a function (b) a function (c) inverse mapping (d) none of these

5. $\{(x, y) | x < y\}$ where $x, y \in \mathbb{R}$ is

- (a) not a function (b) a function (c) one-one mapping (d) none of these

6. The domain of $\{(1, 7), (2, 6)\}$ is

- (a) (1, 6) (b) (7, 6) (c) (1, 2) (d) {6, 7}

7. The range of $\{(3, 0), (2, 0), (1, 0), (0, 0)\}$ is

- (a) {0, 0} (b) {0} (c) {0, 0, 0, 0} (d) none of these

8. The domain and range of $\{(x, y) : y = x^2\}$ where $x, y \in \mathbb{R}$ is

- (a) (reals, natural numbers) (b) (reals, positive reals)
(c) (reals, reals) (d) none of these

9. Let the domain of x be the set $\{1\}$. Which of the following functions are equal to 1

- (a) $f(x) = x^2, g(x) = x$ (b) $f(a) = x, g(x) = 1-x$
(c) $f(x) = x^2 + x + 2, g(x) = (x+1)^2$ (d) none of these

10. If $f(x) = 1/1-x$, $f(-1)$ is

- (a) 0 (b) $\frac{1}{2}$ (c) 0 (d) none of these

11. If $g(x) = (x-1)/x$, $g(-\frac{1}{2})$ is

- (a) 1 (b) 2 (c) $\frac{3}{2}$ (d) 3

12. If $f(x) = 1/1-x$ and $g(x) = (x-1)/x$, then $f \circ g(x)$ is

- (a) x (b) $1/x$ (c) $-x$ (d) none of these

13. If $f(x) = 1/1-x$ and $g(x) = (x-1)/x$, then $g \circ f(x)$ is

- (a) $x-1$ (b) x (c) $1/x$ (d) none of these

14. The function $f(x) = 2^x$ is

- (a) one-one mapping (b) one-many
(c) many-one (d) none of these

15. The range of the function $f(x) = \log_{10}(1+x)$ for the domain of real values of x when $0 \leq x \leq 9$ is

- (a) [0, 1] (b) [0, 1, 2] (c) [0, 1] (d) none of these

16. The Inverse function f^{-1} of $f(x) = 2x$ is

- (a) $1/2x$ (b) $\frac{x}{2}$ (c) $1/x$ (d) none of these

17. If $f(x) = x+3$, $g(x) = x^2$, then $f \circ g(x)$ is

- (a) $x^2 + 3$ (b) $x^2 + x + 3$ (c) $(x+3)^2$ (d) none of these

18. If $f(x) = x+3$, $g(x) = x^2$, then $f(x).g(x)$ is

- (a) $(x + 3)^2$ (b) $x^2 + 3$ (c) $x^3 + 3x^2$ (d) none of these

19. The Inverse h^{-1} when $h(x) = \log_{10}x$ is

- (a) $\log_{10}x$ (b) 10^x (c) $\log_{10}(1/x)$ (d) none of these

20. For the function $h(x) = 10^{1+x}$ the domain of real values of x where $0 \leq x \leq 9$, the range is

- (a) $10 \leq h(x) \leq 10^{10}$ (b) $0 \leq h(x) \leq 10^{10}$ (c) $0 < h(x) < 10$ (d) none of these

ANSWERS

Exercise 7(B)

1. b, d 2. c 3. a 4. b 5. a 6. c 7. b 8. b
9. a 10. b 11. d 12. a 13. b 14. a 15. a 16. b
17. a 18. c 19. b 20. a

Different types of relations

Let $S = \{a, b, c, \dots\}$ be any set then the relation R is a subset of the product set $S \times S$

i) If R contains all ordered pairs of the form (a, a) in $S \times S$, then R is called reflexive. In a reflexive relation 'a' is related to itself.

For example, 'Is equal to' is a reflexive relation for $a = a$ is true.

ii) If $(a, b) \in R \Rightarrow (b, a) \in R$ for every $a, b \in S$ then R is called symmetric For example $a=b \Rightarrow b=a$. Hence the relation 'is equal to' is a symmetric relation.

iii) If $(a, b) \in R$ and $(b, c) \in R \Rightarrow (a, c) \in R$ for every $a, b, c \in S$ then R is called transitive.

For example $a=b, b=c \Rightarrow a=c$. Hence the relation 'is equal to' is a transitive relation.

A relation which is reflexive, symmetric and transitive is called an equivalence relation or simply an equivalence. 'is equal to' is an equivalence relation.

Similarly, the relation "is parallel to" on the set S of all straight lines in a plane is an equivalence relation.

Illustration: The relation "is parallel to" on the set S is

(1) reflexive, since $a \parallel a$ for $a \in S$

(2) symmetric, since $a \parallel b \Rightarrow b \parallel a$

(3) transitive, since $a \parallel b, b \parallel c \Rightarrow a \parallel c$

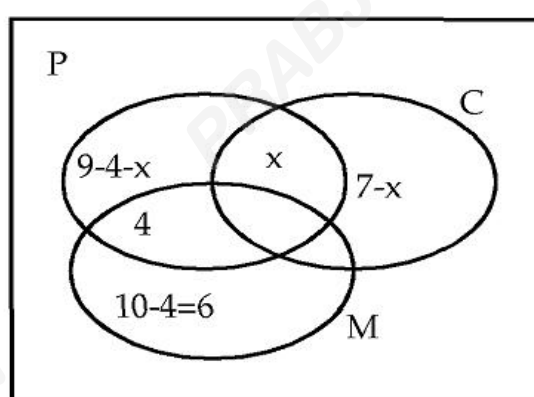
Hence it is an equivalence relation.

Domain & Range of a relation : If R is a relation from A to B , then the set of all first coordinates of elements of R is called the domain of R , while the set of all second coordinates of elements of R is called the range of R .

So, $\text{Dom}(R) = \{a : (a, b) \in R\}$ & $\text{Range}(R) = \{b : (a, b) \in R\}$

Problems and solution using Venn Diagram

1. Out of a group of 20 teachers in a school, 10 teach Mathematics, 9 teach Physics and 7 teach Chemistry. 4 teach Mathematics and Physics but none teach both Mathematics and Chemistry. How many teach Chemistry and Physics? How many teach only Physics?



Let x be the no. of teachers who teach both Physics & Chemistry.

$$9 - 4 - x + 6 + 7 - x + 4 + x = 20$$

$$\text{or } 22 - x = 20$$

$$\text{or } x = 2$$

Hence, 2 teachers teach both Physics and Chemistry and $9 - 4 - 2 = 3$ teachers teach only Physics.

2. A survey shows that 74% of the Indians like grapes, whereas 68% like bananas.

What percentage of the Indians like both grapes and bananas?

3. In a class of 60 students, 40 students like Maths, 36 like Science, and 24 like both the subjects. Find the number of students who like

(i) Maths only (ii) Science only (iii) either Maths or Science

(iv) neither Maths nor Science

EXERCISE 7 (C)

Choose the most appropriate option/options (a) (b) (c) or (d).

1. "Is smaller than" over the set of eggs in a box is

- (a) Transitive (T) (b) Symmetric (S) (c) Reflexive (R) (d) Equivalence (E)

2. "Is equal to" over the set of all rational numbers is

- (a) (T) (b) (S) (c) (R) (d) E

[By using using R = Reflexive; T = Transitive, S = Symmetric and E = Equivalence from Q.No. 2 to 8]

3. "has the same father as" over the set of children

- (a) R (b) S (c) T (d) none of these

4. "Is perpendicular to" over the set of straight lines in a given plane is

- (a) R (b) S (c) T (d) E

5. "is the reciprocal of" over the set of non-zero real numbers is

- (a) S (b) R (c) T (d) none of these

6. $\{(x, y)/x \in x, y \in y, y = x\}$ is

- (a) R (b) S (c) T (d) none of these

7. $\{(x, y) / x + y = 2x \text{ where } x \text{ and } y \text{ are positive integers}\}$, is

- (a) R (b) S (c) T (d) E

8. "Is the square of" over n set of real numbers is

- (a) R (b) S (c) T (d) none of these

9. If A has 32 elements, B has 42 elements and $A \cup B$ has 62 elements, the number of elements in $A \cap B$ is

- (a) 12 (b) 74 (c) 10 (d) none of these

10. In a group of 20 children, 8 drink tea but not coffee and 13 like tea. The number of children drinking coffee but not tea is

- (a) 6 (b) 7 (c) 1 (d) none of these

11. The number of subsets of the sets $\{6, 8, 11\}$ is

- (a) 9 (b) 6 (c) 8 (d) none of these

12. The sets $V = \{x / x+2=0\}$, $R=\{x / x^2+2x=0\}$ and $S = \{x : x^2 + x - 2 = 0\}$ are equal to one another if x is equal to

- (a) -2 (b) 2 (c) V (d) none of these

13. If the universal set $E = \{x \mid x \text{ is a positive integer } < 25\}$, $A = \{2, 6, 8, 14, 22\}$, $B = \{4, 8, 10, 14\}$ then

- (a) $(A \cap B)' = A' \cup B'$ (b) $(A \cap B)' = A' \cap B'$ (c) $(A' \cap B)' = d$ (d) none of these

14. If the set P has 3 elements, Q four and R two then the set $P \times Q \times R$ contains

- (a) 9 elements (b) 20 elements (c) 24 elements (d) none of these

15. Given $A = \{2, 3\}$, $B = \{4, 5\}$, $C = \{5, 6\}$ then $A \times (B \cap C)$ is

- (a) $\{(2, 5), (3, 5)\}$ (b) $\{(5, 2), (5, 3)\}$ (c) $\{(2, 3), (5, 5)\}$ (d) none of these

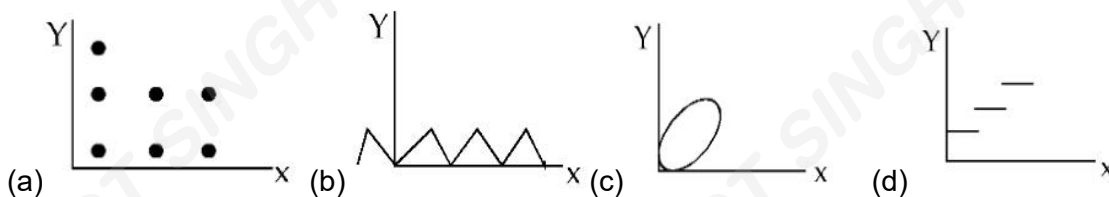
16. A town has a total population of 50,000. Out of it 28,000 read the newspaper X and 23,000 read Y while 4,000 read both the papers. The number of persons not reading X and Y both is

- (a) 2,000 (b) 3,000 (c) 2,500 (d) none of these

17. If $A = \{1, 2, 3, 5, 7\}$ and $B = \{1, 3, 6, 10, 15\}$. Cardinal number of $A - B$ is

- (a) 3 (b) 4 (c) 6 (d) none of these

18. Which of the diagram is graph of a function



19. At a certain conference of 100 people there are 29 Indian women and 23 Indian men. Out of these Indian people 4 are doctors and 24 are either men or doctors. There are no foreign doctors. The number of women doctors attending the conference is

- (a) 2 (b) 4 (c) 1 (d) none of these

20. Let $A = \{a, b\}$. Set of subsets of A is called power set of A denoted by $P(A)$. Now $n(P(A))$ is

- (a) 2 (b) 4 (c) 3 (d) none of these

21. Out of 2000 employees in an office 48% preferred Coffee (c), 54% liked (T), 64% used to smoke (S). Out of the total 28% used C and T , 32% used T and S and 30% preferred C and S , only 6% did none of these. The number having all the three is

- (a) 360 (b) 300 (c) 380 (d) none of these

22. Referred to the data of Q. 21 the number of employees having T and S but not C is

- (a) 200 (b) 280 (c) 300 (d) none of these

23. Referred to the data of Q. 21 the number of employees preferring only coffee is

- (a) 100 (b) 260 (c) 160 (d) none of these

24. If $f(x) = x + 3$, $g(x) = x^2$, then $g \circ f(x)$ is

- (a) $(x + 3)^2$ (b) $x^2 + 3$ (c) $x^2(x + 3)$ (d) none of these

25. If $f(x) = 1/(1-x)$, then $f^{-1}(x)$ is

- (a) $1-x$ (b) $(x-1)/x$ (c) $x/(x-1)$ (d) none of these

ANSWERS

Exercise 7(C)

1. a 2. a,b,c,d 3. a, b, c 4. b 5. a 6. a, b, c 7. a, b 8. d
9. a 10. b 11. c 12. a 13. a 14. c 15. a 16. b
17. a 18. b 19. c 20. b 21. a 22. b 23. c 24. a

PAST YEARS QUESTION

2014 - DECEMBER

1. Let N be the set of all Natural numbers; E be the set of all even natural numbers then the function

$f: N \rightarrow E$ defined as $f(x) = 2x$, $x \in N$ is:

- (a) One-one into **(b) One-one onto**
(c) Many-one into (d) Many-one onto

2. If $A = \{2, 3\}$, $B = \{4, 5\}$, $C = \{5, 6\}$, then $A \times (B \cap C) =$ _____

- (a) $\{(5, 2), (5, 3)\}$ **(b) $\{(2, 5), (3, 5)\}$**
(c) $\{(2, 4), (3, 5)\}$ (d) $\{(3, 5), (2, 6)\}$

3. If $S = \{1, 2, 3\}$ then the relation $\{(1, 1), (2, 2), (1, 2), (2, 1)\}$ is symmetric and

- (a) Reflexive but not transitive
(b) Reflexive as well as transitive
(c) Transitive but not reflexive
(d) Neither transitive nor reflexive

4. If $f(x) = \frac{x}{x-1}$, then $\frac{f(x/y)}{f(y/x)} =$

- (a) x/y (b) y/x
(c) $-x/y$ (d) $-y/x$

2015 - JUNE

5. If N be the set of all natural numbers and E be the set of all even natural numbers then the function $f: N \rightarrow E$, such that $f(x) = 2x$ for all $x \in N$ is

(a) **one-one onto** (b) one-one into

(c) many-one onto (d) constant

2015 - DECEMBER

6. If $A = \{x, y, z\}$, $B = \{a, b, c, d\}$, then which of the following relation from the set A to set B is a function?

(a) $\{(x, a), (x, b), (y, c), (z, d)\}$

(b) **$\{(x, a), (y, b), (z, d)\}$**

(c) $\{(x, c), (z, b), (z, c)\}$

(d) $\{a, z\}, \{b, y\}, \{c, z\}, \{d, x\}$

7. In a class of 80 students, 35% students can play only cricket, 45% students can play only table tennis and the remaining students can play both the games. In all how many students can play cricket?

(a) 55 (b) **44**

(c) 36 (d) 28

8. If $f(x) = 2x + 2$ and $g(x) = x^2$, then the value of $f \circ g(4)$ is:

(a) 18 (b) 22

(c) **34** (d) 128

2016-JUNE

9. If set $A = \left\{x: \frac{x}{2} \in \mathbb{Z}, 0 \leq x \leq 10\right\}$,

$B = \{x : x \text{ is one digit prime number}\}$

and $C = \left\{x: \frac{x}{3} \in \mathbb{N}, x \leq 12\right\}$

then $A \cap (B \cap C)$ is equal to -

(a) $\varnothing$ (b) Set A

(c) Set B (d) Set C

10. The domain (D) and range (R) of the function $f(x) = 2 - |x+1|$ is

(a) $D = \text{Real numbers}, R = (2, \infty)$

(b) $D = \text{Integers}, R = (0, 2)$

(c) $D = \text{Integers}, R = (-\infty, \infty)$

(d) **$D = \text{Real numbers}, R = (-\infty, 2)$**

2016- DECEMBER

11. If R is the set of all real numbers, then the function $f: R \rightarrow R$ defined by $f(x) = 2^x$

(a) one-one onto (b) **one-one into**

(c) many-one into (d) many-one onto

12. The inverse function f^{-1} of $f(x) = 100x$ is:

(a) $\frac{x}{100}$ (b) $\frac{1}{100x}$

(c) $\frac{1}{x}$ (d) None of these

13. The number of subsets of the set formed by the word Allahabad is:

(a) 128 (b) 16

(c) 32 (d) 64

2017-JUNE

14. The range of function f defined by $f(x) = \frac{x}{x^2+1}$ is:

(a) $\{x: \frac{-1}{2} < x < \frac{1}{2}\}$ (b) $\{x: \frac{-1}{2} \leq x < \frac{1}{2}\}$

(c) $\{x: \frac{-1}{2} \leq x \leq \frac{1}{2}\}$ (d) $\{x: x > \frac{1}{2} \text{ or } x < \frac{-1}{2}\}$

15. In a group of students 80 can speak Hindi, 60 can speak English and 40 can speak English and Hindi both, then number of students is:

(a) 100 (b) 140

(c) 180 (d) 60

16. If $f(x) = \frac{x-1}{x}$ and $g(x) = \frac{1}{1-x}$ then $(f \circ g)(x)$ is equal to:

(a) $x - 1$ (b) x

(c) $1 - x$ (d) $-x$ (1 mark)

2017 - DECEMBER

17. If $f(x) = \frac{x+1}{x+2}$, then $f\left\{f\left(\frac{1}{x}\right)\right\} =$ _____.

(a) $\frac{2x+3}{3x+5}$ (b) $\frac{2x+5}{3x+2}$

(c) $\frac{3x+2}{5x+3}$ (d) $\frac{5x+2}{2x+3}$

18. In a class of 35 students, 24 like to play cricket and 16 like to play football. Also each student likes to play at least one of the two games. How many students like to play both cricket and football?

(a) 5 (b) 11

(c) 19 (d) 8

2018-MAY

19. Let N be the set of all natural numbers; E be the set of all even natural numbers then the function;

$F: N \rightarrow E$ defined as $f(x) = 2x - 1 \quad x \in N$ is =

(a) One-one-into (b) Many-one-into

(c) One-one onto (d) Many-one-onto (1 mark)

20. In a town of 20,000 families it was found that 40% families buy newspaper A, 20% families buy newspaper B and 10% families buy newspaper C, 5% families buy A and B, 3% buy B and C and 4% buy A and C if 2% families buy all the three newspapers, then the number of families which buy A only is:

(a) **6600** (b) 6300

(c) 5600 (d) 600

21. The numbers of proper sub set of the set $\{3,4,5,6,7\}$ is:

(a) 32 (b) **31**

(c) 30 (d) 25

2018 - NOVEMBER

22. A is $\{1,2,3,4\}$ and B is $\{1,4,9,16,25\}$ if a function f is defined from set A to B where $f(x) = x^2$ then the range of f is:

(a) $\{1,2,3,4\}$ (b) **$\{1,4,9,16\}$**

(c) $\{1,4,9,16,25\}$ (d) None of these

23. If $A = \{1,2\}$ and $B = \{3,4\}$. Determine the number of relations from A and B:

(a) 3

(b) **16**

(c) 5

(d) 6

24. If $A = \{1,2,3,4,5,6,7\}$ and $B = \{2,4,6,8\}$. Cardinal number of $A - B$ is:

(a) **4**

(b) 3

(c) 9

(d) 7

25. Identity the function from the following:

(a) $\{(1,1), (1,2), (1,3)\}$ (b) $\{(1,1), (2,1), (2,3)\}$

(c) **$\{(1,2), (2,2), (3,2), (4,2)\}$** (d) None of these

2019 - JUNE

26. If $A = \{1,2, 3,4, 5, 6, 7, 8, 9\}$

$B = \{1,3, 4, 5, 7, 8\}$; $C = \{2, 6, 8\}$ then find $(A - B) \cup C$

(a) $\{2, 6\}$

(b) $\{2, 6, 8\}$

(c) **$\{2, 6, 8, 9\}$**

(d) None (1 mark)

27. $A = \{1, 2, 3, 4, \dots, 10\}$ a relation on A, $R = \{(x, y)/x + y = 10, x \in A, Y \in A, x \geq Y\}$ then domain of R^{-1} is

(a) **$\{1,2, 3, 4, 5\}$**

(b) $\{0, 3, 5, 7, 9\}$

(c) $\{1,2, 4, 5, 6, 7\}$

(d) None (1 mark)

28. The no. of subsets of the set $\{3, 4, 5\}$ is :

(a) 4

(b) 8

(c) 16

(d) 32

29. If $f(x) = x^2$ and $g(x) = \sqrt{x}$ then

(a) go $f(3) = 3$

(b) go $f(-3) = 9$

(c) go $f(9) = 3$

(d) go $f(-9) = 3$

30. If $A = \{a, b, c, d\}$; $B = \{p, q, r, s\}$ which of the following relation is a function from A to B

(a) $R_1 = \{(a, p), (b, q), (c, s)\}$

(b) $R_2 = \{(p, a), (b, r), (d, s)\}$

(c) $R_3 = \{(b, p), (c, s), (b, r)\}$

(d) $R_4 = \{(a, p), (b, r), (c, q), (d, s)\}$

2019 - NOVEMBER

31. $(A^T)^T = ?$

(a) A

(b) A^T

(c) $A^T \cdot A^T$

(d) A^{2T}

32. $f(n) = f(n - 1) + f(n - 2)$ when $n = 2, 3, 4, \dots$ $f(0) = 0, f(1) = 1$ then $f(7) = ?$

(a) 3

(b) 5

(c) 8

(d) 13

33. $f(x) = \frac{x+1}{x}$ find $f^{-1}(x)$

(a) $1/(x-1)$

(b) $1/(y-1)$

(c) $\frac{1}{y} - 1$

(d) x

2020 - NOVEMBER

34. Two finite sets respectively have x and y number of elements. The total number of subsets of the first is 56 more than the total number of subsets of the second. The value of x and y respectively.

(a) 6 and 3

(b) 4 and 2

(c) 2 and 4

(d) 3 and 6

35. The set of cubes of the natural number is:

(a) A null set

(b) A finite set

(c) An infinite set

(d) A finite set of three numbers

36. The inverse function f^{-1} of $f(y) = 3y$ is:

(a) $1/3y$

(b) $y/3$

(c) $-3y$

(d) $1/y$

2021 - JANUARY

37. The set of cubes of natural number is

(a) Null set

(b) A finite set

(c) An infinite set

(d) Singleton Set

38. In the set of all straight lines on a plane which of the following is Not 'TRUE'?

(a) Parallel to an equivalence relation

(b) Perpendicular to is a symmetric relation

(c) Perpendicular to is an equivalence relation

(d) Parallel to a reflexive relation

39. Let $F : \mathbb{R} \rightarrow \mathbb{R}$ be defined by

$$f(x) = \begin{cases} 2x & \text{for } x > 3 \\ x^2 & \text{for } 1 < x \leq 3 \\ 3x & \text{for } x \leq 1 \end{cases}$$

The value of $f(-1) + f(2) + f(4)$ is

(a) 9

(b) 14

(c) 5

(d) 6

40. The number of integers from 1 to 100 which are neither divisible by 3 nor by 5 nor by 7 is

(a) 67

(b) 55

(c) 45

(d) 33

2021 - JULY

41. The range of the function F defined by $f(x) = \sqrt{16 - x^2}$ is

- (a) $[-4, 0]$
- (b) $[-4, 4]$**
- (c) $[0, 4]$
- (d) $[+4, 4]$

42. Let $A = \mathbb{R} - \{3\}$ and $B = \mathbb{R} - \{1\}$. Let $f(x) \rightarrow B$ defined by $f(x) = \frac{x-2}{x-3}$. What is the value of $f^{-1}\left(\frac{1}{2}\right)$?

- (a) $\frac{2}{3}$
- (b) $\frac{3}{4}$
- (c) 1**
- (d) -1

43. If $F(x) = x^2 - 1$ and $g(x) = |2x + 3|$, then $F \circ g(3) - g \circ F(-3) = ?$

- (a) 71
- (b) 61**
- (c) 41
- (d) 51

44. Let U be the universal set, A and B are the subsets of U . If $n(U) = 650, n(A) = 310$

$n(A \cap B) = 95$ and $n(B) = 190$, then $n(\overline{A} \cap \overline{B})$ is equal to $n(\overline{A} \cap \overline{B})$ (where $\overline{A}$ and $\overline{B}$ are the complements of A and B respectively):

- (a) 400
- (b) 200
- (c) 300
- (d) 245**

2021 - DECEMBER

45. Out of a group of 20 teachers in a School, 10 teach Mathematics, 9 teach Physics and 7 teach Chemistry. 4 teach Mathematics and Physics but none teach both Mathematics and Chemistry. How many teach Chemistry and Physics; how many teach only Physics?

- (a) 2, 3**
- (b) 3, 2
- (c) 4, 6
- (d) 6, 4

46. If a is related to b if and only if the difference in a and b is an even integer. This relation is

- (a) symmetric, reflexive but not transitive
- (b) symmetric, transitive but not reflexive
- (c) transitive, reflexive but not symmetric
- (d) equivalence relation**

47. If $u(x) = \frac{1}{1-x}$, then $u^{-1}(x)$ is:

- (a) $\frac{1}{x-1}$
- (b) $1-x$
- (c) $1 - \frac{1}{x}$
- (d) $\frac{1}{x} - 1$

DEC 2022:

48. If $A = \{1, 2, 3, 4, 5, 7, 8, 9\}$ and $B = \{2, 4, 6, 7, 9\}$ then how many proper subset of $A \cap B$ can be created

- A. 16 **B. 15** C. 32 D. 31

15. Let $A = \{1, 2, 3\}$ and consider the relation $R = \{(1,1), (2,2), (1,0), (1,2), (2,3), (1,3)\}$.

Then R is

- A. symmetric and transitive B. reflexive but not transitive
C. reflexive but not symmetric D. neither symmetric, nor transitive

81. The number of subsets of the set $\{0, 1, 2, 3\}$ is

- A. 2 B. 4 C. 8 **D. 16**

JUNE 2023

1. Given Relation $R = \{(1, 2), (2, 3)\}$ on the sets $A = \{1, 2, 3\}$, the minimum numbers of ordered parts which when A added to R make equivalence relation is

- A. 5 B. 6 **C. 7** D. 8

49. In a Survey shows that 74% of the Indian like grapes, whereas 68% like bananas. what percentage of the Indian like both grapes and bananas if every body likes either fruit?

- (a) **42%** (b) 26%
(c) 58% (d) 48%

50. If R be a relation defined on the set of Real numbers as " xRy -($X-Y$) is divisible by 5" then x,y belong R then relation R is

- A. **Equivalence** B. Anti symmetric
C. Symmetric but not transitive D. Symmetric but not Reflexive

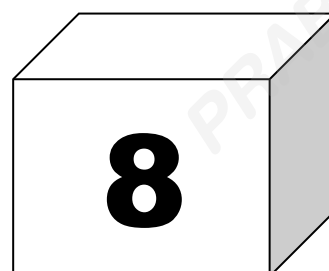
51. If $A = \{a, b, c\}$

$B = \{b, c, d\}$; $C = \{a, d, c\}$ then find $(A - B) \times (B \cap C)$ is equal to

- A. $\{(a, d), (c, d)\}$; **B. $\{(a, c), (a, d)\}$**
C. $\{(c, a), (d, a)\}$ D. $\{(a, c), (a, d), (b, d)\}$

52. If $F(x): N \rightarrow R$ is a Function defined as $F(x) = 4x+3$, $X \in N$ then $F^{-1}(x)$

- (a) $4 + \frac{x+3}{4}$ (b) $\frac{x+3}{4}$
(c) $\frac{x-3}{4}$ (d) $\frac{3x+3}{4}$



BASIC CONCEPTS OF DIFFERENTIAL AND INTEGRAL CALCULUS

SOME STANDARD RESULTS (FORMULAS)

$$(1) \frac{d}{dx}(x^n) = nx^{n-1} \quad (2) \frac{d}{dx}(e^x) = e^x \quad (3) \frac{d}{dx}(a^x) = a^x \log_e a$$

$$(4) \frac{d}{dx}(\text{constant}) = 0 \quad (5) \frac{d}{dx}(e^{ax}) = ae^{ax} \quad (6) \frac{d}{dx}(\log x) = \frac{1}{x}$$

Note: $\frac{d}{dx}\{cf(x)\} = cf'(x)$ c being constant.

In brief we may write below the above functions and their derivatives:

Table: Few functions and their derivatives

Function	derivative of the function
$f(x)$	$f'(x)$
x^n	$n x^{n-1}$
e^{ax}	ae^{ax}

$\log x$	$1/x$
a^x	$a^x \log_e a$
c (a constant)	0

We also tabulate the basic laws of differentiation.

Example: Differentiate each of the following functions with respect to x :

(a) $3x^2 + 5x - 2$ (b) $a^x + x^a + a^a$ (c) $\frac{1}{3}x^3 - 5x^2 + 6x - 2\log x + 3$

(d) $e^x \log x$ (e) $2^x x^5$ (f) $\frac{x^2}{e^x}$

(g) $e^x / \log x$ (h) $2^x \cdot \log x$ (i) $\frac{2x}{3x^3 + 7}$

Example: Find $\frac{dy}{dx}$ for $x^2y^2 + 3xy + y = 0$

Solution: $x^2y^2 + 3xy + y = 0$

Example: Find $\frac{dy}{dx}$ if $x = at^3$, $y = a/t^3$

Example: Differentiate x^x w.r.t. x

Example : (a) If $x^m y^n = (x + y)^{m+n}$ prove that $\frac{dy}{dx} = \frac{y}{x}$

(b) If $x^y = e^{x-y}$ prove that $\frac{dy}{dx} = \frac{\log x}{(1 + \log x)^2}$

Example: If $y = ae^{mx} + be^{-mx}$ prove that $\frac{d^2y}{dx^2} = m^2y$.

Example: Find the gradient of the curve $y = 3x^2 - 5x + 4$ at the point $(1, 2)$.

Example 1: The total cost function of a firm is where is the total cost and is output.

A tax at the rate of Rs. 2 per unit of output is imposed and the producer adds it to his cost. If the market demand function is given by, where Rs. p is the price per unit of output, find the profit maximising output and price for maximum profit.

Example 2: The cost function of a company is given by:

$$C(x) = 100x - 8x^2 + \frac{x^3}{3}$$

where x denotes the output. Find the level of output at which:

- (i) marginal cost is minimum
- (ii) average cost is minimum

Example 3: A computer software company wishes to start the production of floppy disks. It was observed that the company had to spend Rs. 2 lakhs for the technical informations. The cost of setting up the machine is Rs. 8,000 and the cost of producing each unit is Rs. 30, while each floppy could be sold at Rs. 45. Find:

- (i) the total cost function for producing x floppies; and
- (ii) the break-even point.

Example 4: A company decided to set up a small production plant for manufacturing electronic clocks. The total cost for initial set up (fixed cost) is Rs. 9 lakhs. The additional cost for producing each clock is Rs. 300. Each clock is sold at Rs. 750. During the first month, 1,500 clocks are produced and sold.

- (i) What profit or loss the company incurs during the first month, when all the 1,500 clocks are sold ?
- (ii) Determine the break-even point.
- (b) Total cost of producing 20 items of a commodity is Rs. 205, while total cost of producing 10 items is Rs. 135. Assuming that the cost function is a linear function, find the cost function and marginal cost function.

EXERCISE 8(A)

Choose the most appropriate option (a) (b) (c) or (d).

1. The gradient of the curve $y = 2x^3 - 3x^2 - 12x + 8$ at $x = 0$ is

- a) -12 b) 12 c) 0 d) none of these

2. The gradient of the curve $y = 2x^3 - 5x^2 - 3x$ at $x = 0$ is

- a) 3 b) -3 c) 1/3 d) none of these

3. The derivative of $y = \sqrt{x+1}$ is

- a) $\frac{1}{\sqrt{x+1}}$ b) $\frac{1}{2\sqrt{x+1}}$ c) $\frac{1}{2\sqrt{x+1}}$ d) none of these

4. If $f(x) = e^{ax^2+bx+c}$ the $f'(x)$ is

- a) e^{ax^2+bx+c} b) $e^{ax^2+bx+c}(2ax+b)$ c) $2ax+b$ d) none of these

5. If $f(x) = \frac{x^2+1}{x^2-1}$ then $f'(x)$ is

- a) $-4x/(x^2 - 1)^2$ b) $4x/(x^2 - 1)^2$ c) $x/(x^2 - 1)^2$ d) none of these

6. If $y = x(x - 1)(x - 2)$ then $\frac{dy}{dx}$ is

- a) $3x^2 - 6x + 2$ b) $-6x + 2$ c) $3x^2 + 2$ d) none of these

7. The gradient of the curve $y - xy + 2px + 3qy = 0$ at the point $(3, 2)$ is $-\frac{2}{3}$. The values of p and q are

- a) $(1/2, 1/2)$ b) $(2, 2)$ c) $(-1/2, -1/2)$ d) $(1/2, 1/6)$

8. The curve $y^2 = ux^3 + v$ passes through the point $P(2, 3)$ and $\frac{dy}{dx} = 4$ at P . The values of u and v are

- a) $(u=2, v=7)$ b) $(u=2, v=-7)$ c) $(u=-2, v=-7)$ d) $(0, -1)$

9. The gradient of the curve $y + px + qy = 0$ at $(1, 1)$ is $\frac{1}{2}$. The values of p and q are

- a) $(-1, 1)$ b) $(2, -1)$ c) $(1, 2)$ d) $(0, -1)$

10. If $xy = 1$ then $y^2 + \frac{dy}{dx}$ is equal to

- a) 1 b) 0 c) -1 d) none of these

11. The derivative of the function $\sqrt{x} + \sqrt{x}$ is

- a) $\frac{1}{2\sqrt{x+\sqrt{x}}}$ b) $1 + \frac{1}{2\sqrt{x}}$ c) $\frac{1}{2\sqrt{x+\sqrt{x}}} (1 + \frac{1}{2\sqrt{x}})$ d) none of these

12. Given $e^{-xy} - 4xy = 0$, $\frac{dy}{dx}$ can be proved to be

- a) $-y/x$ b) y/x c) x/y d) none of these

13. If $\frac{x^2}{a^2} - \frac{y^2}{a^2} = 1$, $\frac{dy}{dx}$ can be expressed as

- a) $\frac{x}{y}$ b) $\frac{x}{\sqrt{x^2 - a^2}}$ c) $\frac{1}{\sqrt{\frac{x^2}{a^2} - 1}}$ d) none of these

14. If $\log(x/y) = x + y$, $\frac{dy}{dx}$ may be found to be

- a) $\frac{y(1-x)}{x(1+y)}$ b) $\frac{y}{x}$ c) $\frac{1-x}{1+y}$ d) none of these

15. If $f(x, y) = x^3 + y^3 - 3axy = 0$, $\frac{dy}{dx}$ can be found out as

- a) $\frac{ay-x^2}{y^2+ax}$ b) $\frac{ay-x^2}{y^2-ax}$ c) $\frac{ay+x^2}{y^2+ax}$ d) none of these

16. Given $x = at^2$, $y = 2at$; $\frac{dy}{dx}$ is calculated as

- a) t b) $-1/t$ c) $1/t$ d) none of these

17. Given $x = 2t + 5$, $y = t^2 - 2$; $\frac{dy}{dx}$ is calculated as

- a) t b) $-1/t$ c) $1/t$ d) none of these

18. If $y = \frac{1}{\sqrt{x}}$ then $\frac{dy}{dx}$ is equal to

- a) $\frac{1}{2x\sqrt{x}}$ b) $\frac{-1}{x\sqrt{x}}$ c) $-\frac{1}{2x\sqrt{x}}$ d) none of these

19. If $x = 3t^2 - 1$, $y = t^3 - t$, then $\frac{dy}{dx}$ is equal to

- a) $\frac{3t^2-1}{6t}$ b) $3t^2-1$ c) $\frac{3t-1}{6t}$ d) none of these

20. The slope of the tangent to the curve $y = \sqrt{4-x^2}$ at the point, where the ordinate and the abscissa are equal, is

- a) -1 b) 1 c) 0 d) none of these

21. The slope of the tangent to the curve $y = x^2 - x$ at the point, where the line $y = 2$ cuts the curve in the 1st quadrant, is

- a) 2 b) 3 c) -3 d) none of these

22. For the curve $x^2 + y^2 + 2gx + 2hy = 0$, the value of $\frac{dy}{dx}$ at $(0,0)$ is

- a) $-g/h$ b) g/h c) h/g d) none of these

23. If $y = \frac{e^{3x} - e^{2x}}{e^{3x} + e^{2x}}$, then $\frac{dy}{dx}$ is equal to

- a) $2e^{5x}$ b) $1/(e^{5x} + e^{2x})^2$ c) $e^{5x}/(e^{5x} + e^{2x})$ d) none of these

24. If $x^y \cdot y^x = M$, where M is constant then $\frac{dy}{dx}$ is equal to

- a) $\frac{-y}{x}$ b) $\frac{-y(y+x \log y)}{x(x \log x + x)}$ c) $\frac{y+x \log y}{y \log x + x}$ d) none of these

25. Given $x = t + t^{-1}$ and $y = t - t^{-1}$ the value of $\frac{dy}{dx}$ at $t = 2$ is

- a) $3/5$ b) $-3/5$ c) $5/3$ d) none of these

26. If $x^3 - 2x^2y^2 + 5x + y - 5 = 0$ then $\frac{dy}{dx}$ at $x = 1$, $y = 1$ is equal to

- a) $4/3$ b) $-4/3$ c) $3/4$ d) none of these

27. The derivative of $x^2 \log x$ is

- a) $1+2 \log x$ b) $x(1+2 \log x)$ c) $2 \log x$ d) none of these

28. The derivative of $\frac{3-5x}{3+5x}$ is

- a) $30/(3+5x)^2$ b) $1/(3+5x)^2$ c) $-30/(3+5x)^2$ d) none of these

29. Let $y = \sqrt{2x} + 3^{2x}$ then $\frac{dy}{dx}$ is equal to

- a) $(1/\sqrt{2x}) + 2 \cdot 3^{2x} \log_e 3$ b) $1/\sqrt{2x}$
c) $2 \cdot 3^{2x} \log_e 3$ d) none of these

30. The derivative of $\log \left[e^x \left\{ \frac{x-2}{x+2} \right\}^{3/4} \right]$ is

- a) $\frac{x^2+1}{x^2+4}$ b) $\frac{x^2-1}{x^2-4}$ c) $\frac{1}{x^2-4}$ d) none of these

31. The derivative of e^{3x^2-6x+2} is

- a) $30(1-5x)^5$ b) $(1-5x)^5$ c) $6(x-1)e^{3x^2-6x+2}$ d) none of these

32. If $y = \frac{e^x+1}{e^x-1}$ then $\frac{dy}{dx}$ is equal to

- a) $\frac{-2e^x}{(e^x-1)^2}$ b) $\frac{2e^x}{(e^x-1)^2}$ c) $\frac{-2}{(e^x-1)^2}$ d) none of these

33. If $f(x) = \left\{ \frac{(a+x)}{(1+x)} \right\}^{a+1+2x}$ the value of $f'(0)$ is

- a) a^{a+1} b) $a^{a+1} \left[\frac{1-a^2}{a} + 2 \log a \right]$ c) $2 \log a$ d) none of these

34. If $x = at^2$, $y = 2at$ then $\left[\frac{dy}{dx} \right]_{t=2}$ is equal to

- a) $1/2$ b) -2 c) $-1/2$ d) none of these

35. Let $f(x) = \left(\sqrt{x} + \frac{1}{\sqrt{x}} \right)^2$ then $f'(2)$ is equal to

- a) $3/4$ b) $1/2$ c) 0 d) none of these

36. If $f(x) = x^2 - 6x + 8$ then $f'(5) - f'(8)$ is equal to

- a) $f'(2)$ b) $3f'(2)$ c) $2f'(2)$ d) none of these

37. If $y = (x + \sqrt{x^2 + m^2})^n$ then dy/dx is equal to

- a) ny b) $ny/\sqrt{x^2 + m^2}$ c) $-ny/\sqrt{x^2 + m^2}$ d) none of these

38. If $y = +\sqrt{x/m} + \sqrt{m/x}$ then $2xydy/dx - x/m + m/x$ is equal to

- a) 0 b) 1 c) -1 d) none of these

39. If $y = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \dots + \frac{x^n}{n!} + \dots$ then $\frac{dy}{dx} - y$ is proved to be

- a) 1 b) -1 c) 0 d) none of these

40. If $f(x) = x^k$ and $f'(1) = 10$ the value of k is

- a) 10 b) -10 c) 1/10 d) none of these

41. If $y = \sqrt{x^2 + m^2}$ then yy_1 (where $y_1 = dy/dx$) is equal to

- a) -x b) x c) 1/x d) none of these

42. If $y = e^x + e^{-x}$ then $\frac{dy}{dx} - \sqrt{y^2 - 4}$ is equal to

- a) 1 b) -1 c) 0 d) none of these

43. The derivative of $(x^2 - 1)/x$ is

- a) $1 + 1/x^2$ b) $1 - 1/x^2$ c) $1/x^2$ d) none of these

44. The differential coefficients of $(x^2 + 1)/x$ is

- a) $1 + 1/x^2$ b) $1 - 1/x^2$ c) $1/x^2$ d) none of these

45. If $y = e^{\sqrt{2x}}$ then $\frac{dy}{dx}$ is equal to —.

- a) $\frac{e^{\sqrt{2x}}}{\sqrt{2x}}$ b) $e^{\sqrt{2x}}$ c) $\frac{e^{\sqrt{2x}}}{\sqrt{2x}}$ d) none of these

46. If $y = \sqrt{x}^{\sqrt{x}}$ then $\frac{dy}{dx}$ is equal to _____.

- a) $\frac{y^2}{2-y \log x}$ b) $\frac{y^2}{x(2-y \log x)}$ c) $\frac{y^2}{\log x}$ d) none of these

47. If $x = (1 - t^2)/(1 + t^2)$ and $y = 2t/(1 + t^2)$ then dy/dx at $t = 1$ is _____.

- a) 1/2 b) 1 c) 0 d) none of these

48. $f(x) = x^2/e^x$ then $f'(1)$ is equal to _____.

- a) $-1/e$ b) $1/e$ c) e d) none of these

49. If $y = (x + \sqrt{x^2 - 1})^m$ then $(x^2 - 1)(dy/dx)^2 - m^2 y^2$ is proved to be

- a) -1 b) 1 c) 0 d) none of these

50. If $f(x) = \frac{4-2x}{2+3x+3x^2}$ then the values of x for which $f'(x) = 0$ is

- a) $2(1 \pm \sqrt{\frac{5}{3}})$ b) $(1 \pm \sqrt{3})$ c) 2 d) none of these

ANSWERS

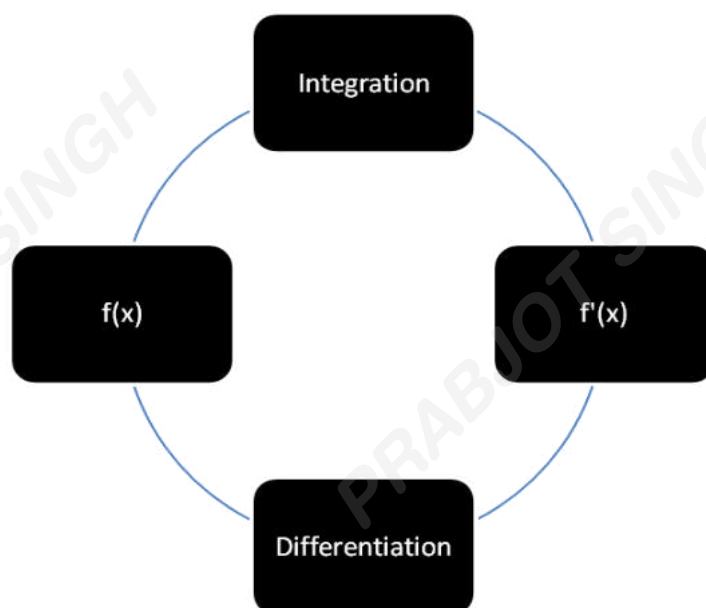
Exercise 8(a)

1. (a) 2. (b) 3. (c) 4. (b) 5. (a) 6. (a) 7. (d) 8. (b)
 9. (d) 10. (b) 11. (c) 12. (a) 13. (a) 14. (a) 15. (b) 16. (c)
 17. (a) 18. (c) 19. (a) 20. (a) 21. (b) 22. (a) 23. (d) 24. (b)
 25. (c) 26. (a) 27. (b) 28. (c) 29. (a) 30. (b) 31. (c) 32. (a)
 33. (b) 34. (a) 35. (a) 36. (b) 37. (b) 38. (a) 39. (c) 40. (a)
 41. (b) 42. (c) 43. (a) 44. (b) 45. (a) 46. (b) 47. (c) 48. (b)
 49. (c) 50. (a)

(b) INTEGRAL CALCULUS

8.B.1 INTEGRATION

Integration is the reverse process of differentiation.



We know

$$\frac{d}{dx} \left(\frac{x^{n+1}}{n+1} \right) = \frac{(n+1)x^n}{(n+1)}$$

$$\text{or } \frac{d}{dx} \left(\frac{x^{n+1}}{n+1} \right) = x^n \dots \dots (1)$$

Integration is the inverse operation of differentiation and is denoted by the symbol $\int$.

Hence, from equation (1), it follows that

$$\underline{\int x^n dx = \frac{x^{n+1}}{n+1}}$$

BASIC FORMULAS

$$\text{i) } \int x^n dx = \frac{x^{n+1}}{n+1} + c, n \neq -1 \text{ (If } n = -1, \frac{x^{n+1}}{n+1} = \frac{1}{0} \text{ which is not defined)}$$

$$\text{ii) } \int dx = x, \text{ since } \int 1 dx = \int x^0 dx = \frac{x^1}{1} = x$$

$$\text{iii) } \int e^x dx = e^x + c, \text{ since } \frac{d}{dx} e^x = e^x$$

$$\text{iv) } \int e^{ax} dx = \frac{e^{ax}}{a} + c, \text{ since } \frac{d}{dx} \left(\frac{e^{ax}}{a} \right) = e^{ax}$$

$$v) \int \frac{dx}{x} = \log x + c, \text{ since } \frac{d}{dx} \log x = \frac{1}{x}$$

$$vi) \int a^x dx = a^x / \log_e a + c, \text{ since } \frac{d}{dx} \left(\frac{a^x}{\log_e a} \right) = a^x$$

Examples: Find (a) $\int \sqrt{x} dx$, (b) $\int \frac{1}{\sqrt{x}} dx$, (c) $\int e^{-3x} dx$ (d) $\int 3^x dx$ (e) $\int x\sqrt{x} dx$

Examples: Evaluate the following integral:

$$i) \int (x + 1/x)^2 dx = \int x^2 dx + 2 \int dx + \int dx/x^2$$

$$= \frac{x^3}{3} + 2x + \frac{x^{-2+1}}{-2+1}$$

$$= \frac{x^3}{3} + 2x - \frac{1}{x} + c$$

$$ii) \int \sqrt{x} (x^3 + 2x - 3) dx = \int x^{7/2} dx + 2 \int x^{3/2} dx - 3 \int x^{1/2} dx$$

$$= \frac{x^{7/2+1}}{7/2+1} + 1 + \frac{2x^{3/2+1}}{3/2+1} - \frac{3x^{1/2+1}}{1/2+1}$$

$$= \frac{2x^{9/2}}{9} + \frac{4x^{5/2}}{5} - 2x^{3/2} + c$$

$$iii) \int e^{3x} + e^{-3x} dx = \int e^{2x} dx + \int e^{-4x} dx$$

$$= \frac{e^{2x}}{2} + \frac{e^{-4x}}{-4} = \frac{e^{2x}}{2} - \frac{1}{4e^{4x}} + c$$

$$iv) \int \frac{x^2}{x+1} dx = \int \frac{x^2-1+1}{x+1} dx$$

$$= \int \frac{(x^2-1)}{x+1} dx + \int \frac{dx}{x+1}$$

$$= \int (x-1) dx + \log(x+1) = \frac{x^2}{2} - x + \log(x+1) + c$$

$$v) \int \frac{x^3+5x^2-3}{(x+2)} dx$$

$$\text{By simple division } \int \frac{x^3+5x^2-3}{(x+2)} dx$$

$$= \int \left\{ x^2 + 3x - 6 + \frac{9}{(x+2)} \right\} dx$$

$$= \frac{x^3}{3} + \frac{3x^2}{2} - 6x + 9 \log(x+2) + c$$

Example: $\int (2x + 3)^7 dx$

IMPORTANT STANDARD FORMULAE

$$a) \int \frac{dx}{x^2 - a^2} = \frac{1}{2a} \log \frac{x-a}{x+a} + c$$

$$b) \int \frac{dx}{a^2 - x^2} = \frac{1}{2a} \log \frac{a+x}{a-x} + c$$

$$c) \int \frac{dx}{\sqrt{x^2 + a^2}} = \log|x + \sqrt{x^2 + a^2}| + c$$

$$d) \int \frac{dx}{\sqrt{x^2 - a^2}} = \log(x + \sqrt{x^2 - a^2}) + c$$

$$e) \int e^x \{f(x) + f'(x)\} dx = e^x f(x) + c$$

$$f) \int \sqrt{x^2 + a^2} dx = \frac{x}{2} \sqrt{x^2 + a^2} + \frac{a^2}{2} \log(x + \sqrt{x^2 + a^2}) + c$$

$$g) \int \sqrt{x^2 - a^2} dx = \frac{x}{2} \sqrt{x^2 - a^2} - \frac{a^2}{2} \log(x + \sqrt{x^2 - a^2}) + c$$

$$h) \int \frac{f'(x)}{f(x)} dx = \log f(x) + c$$

Examples: (a) $\int \frac{e^x}{e^{2x} - 4} dx = \int \frac{dz}{z^2 - 2^2}$ where $z = e^x$ $dz = e^x dx$

INTEGRATION BY PARTS

$$\int u v dx = u \int v dx - \int \left[\frac{d(u)}{dx} \int v dx \right] dx$$

where **u** and **v** are two different functions of **x**

Evaluate:

$$i) \int x e^x dx$$

$$ii) \int x \log x dx$$

$$iii) \int x^2 e^{ax} dx$$

METHOD OF PARTIAL FRACTION

Type I:

Examples: $\int \frac{(3x+2)dx}{(x-2)(x-3)}$

Type II:

Examples: $\int \frac{(3x+2)dx}{(x-2)^2(x-3)}$

Type III:

Examples: $\int \frac{(3x^2-2x+5)}{(x-1)^2(x^2+5)} dx$

Examples: $\int \frac{dx}{x(x^2+1)}$

Examples: Find the equation of the curve where slope at (x, y) is $9x$ and which passes through the origin.

DEFINITE INTEGRATION

Suppose $F(x)dx = f(x)$

As x changes from a to b the value of the integral changes from $f(a)$ to $f(b)$. This is as

$$\int_a^b F(x)dx = f(b) - f(a)$$

' b ' is called the upper limit and ' a ' the lower limit of integration. We shall first deal with indefinite integral and then take up definite integral.

Examples: $\int_0^2 x^5 dx$

Examples: $\int_1^2 (x^2 - 5x + 2)dx$

IMPORTANT PROPERTIES

Important Properties of definite Integral

(I) $\int_a^b f(x)dx = \int_a^b f(t)dt$ (II) $\int_a^b f(x)dx = -\int_b^a f(x)dx$

(III) $\int_a^b f(x)dx = \int_a^c f(x)dx + \int_c^b f(x)dx, a < c < b$

(IV) $\int_0^a f(x)dx = \int_0^a f(a-x) dx$

(V) When $f(x) = f(a+x) = \int_0^{na} f(x)dx = n \int_0^a f(x)dx$

(VI) $\int_{-a}^a f(x)dx = 2 \int_0^a f(x)dx$ if $f(-x) = f(x)$
 $= 0$ if $f(-x) = -f(x)$

Examples: $\int_0^2 \frac{x^2 dx}{x^2 + (2-x)^2}$

or $I = 2/2 = 1$

Examples: Evaluate $\int_{-2}^2 \frac{x^4 dx}{a^{10} - x^{10}}$ ($a > 2$)

EXERCISE 8(b) (K = CONSTANT)

Choose the most appropriate option (a) (b) (c) or (d).

1. Evaluate $\int 5x^2 dx$:

- (a) $5/3 x^3 + k$ (b) $\frac{5x^3}{3} + k$ (c) $5x^3$ (d) none of these

2. Integration of $3 - 2x - x^4$ will become

- (a) $-x^2 - x^5/5$ (b) $3x - x^2 - \frac{x^5}{5} + k$ (c) $3x - x^2 + \frac{x^5}{5} + k$ (d) none of these

3. Given $f(x) = 4x^3 + 3x^2 - 2x + 5$ and $\int f(x) dx$ is

- (a) $x^4 + x^3 - x^2 + 5x$ (b) $x^4 + x^3 - x^2 + 5x + k$
(c) $12x^2 + 6x - 2x^2$ (d) none of these

4. Evaluate $\int (x^2 - 1) dx$

- (a) $x^5/5 - 2/3x^3 + x + k$ (b) $\frac{x^3}{3} - x + k$
(c) $2x$ (d) none of these

5. $\int (1 - 3x)(1 + x) dx$ is equal to

- (a) $x - x^2 - x^3$ (b) $x^3 - x^2 + x$ (c) $x - x^2 - x^3 + k$ (d) none of these

6. $\int [\sqrt{x} - 1/\sqrt{x}] dx$ is equal to

- (a) $\frac{2}{3} x^{3/2} - 2x^{1/2} + k$ (b) $\frac{2}{3} \sqrt{x} - 2\sqrt{x} + k$ (c) $\frac{1}{2\sqrt{x}} + \frac{1}{2x\sqrt{x}} + k$ (d) none of these

7. The integral of $px^3 + qx^2 + rk + w/x$ is equal to

- (a) $px^2 + qx + r + k$ (b) $px^3/3 + px^2/2 + rx$
(c) $3px + 2q - w/x^2$ (d) none of these

8. Use method of substitution to integrate the function $f(x) = (4x + 5)^6$ and the answer is

(a) $\frac{1}{28} (4x + 5)^7 + k$ (b) $\frac{(4x + 5)^7}{7} + k$ (c) $\frac{(4x + 5)^7}{7}$ (d) none of these

9. Use method of substitution to evaluate $\int x(x^2 + 4)^5 dx$ and the answer is

(a) $(x^2 + 4)^6 + k$ (b) $\frac{1}{12} (x^2 + 4)^6 + k$

(c) $(x^2 + 4)^6 + k$ (d) none of these

10. Integrate $(x + a)^n$ and the result will be

(a) $\frac{(x+a)^{n+1}}{n+1} + k$ (b) $\frac{(x+a)^{n+1}}{n+1}$

(c) $(x + a)^{n+1}$ (d) none of these

11. $\int 8x^2/(x^3 + 2)^3 dx$ is equal to

(a) $-4/3(x^3 + 2)^2 + k$ (b) $-\frac{4}{3(x^3+2)^2} + k$

(c) $\frac{4}{3(x^3+2)^2} + k$ (d) none of these

12. Using method of partial fraction the integration of $f(x)$ when $f(x) = \frac{1}{x^2 - a^2}$ and the answer is

(a) $\log x - \frac{a}{x+a} + k$ (b) $\log(x - a) - \log(x + a) + k$

(c) $\frac{1}{2a} \log \left(\frac{x-a}{x+a} \right) + k$ (d) none of these

13. Use integration by parts to evaluate $\int x^2 e^{3x} dx$

(a) $x^2 e^{3x}/3 - 2xe^{3x}/9 + 2/27 e^{3x} + k$ (b) $x^2 e^{3x} - 2xe^{3x} + 2e^{3x} + k$

(c) $e^{3x}/3 - xe^{3x}/9 + 2e^{3x} + k$ (d) none of these

14. $\int \log x dx$ is equal to

(a) $x \log x + k$ (b) $x \log x - x^2 + k$ (c) $x \log x + k$ (d) none of these

15. $\int x e^x dx$ is

(a) $(x - 1)e^x + k$ (b) $(x - 1)e^x$ (c) $xe^x + k$ (d) none of these

16. $\int (\log x)^2 dx$ and the result is

(a) $x(\log x)^2 - 2x \log x + 2x + k$ (b) $x(\log x)^2 - 2x + k$

(c) $2x \log x - 2x + k$ (d) none of these

17. Using method of partial fraction to evaluate $\int (x+5) dx/(x+1)(x+2)^2$ we get

(a) $4 \log(x+1) - 4 \log(x+2) + 3/x + 2 + k$

(b) $4 \log(x+2) - 3/x + 2 + k$

(c) $4 \log(x+1) - 4 \log(x+2)$

(d) none of these

18. Evaluate $\int_0^1 (2x^2 - x^3) dx$ and the value is

(a) $4/3 + k$ (b) $5/12$ (c) $-4/3$ (d) none of these

19. Evaluate $\int_2^4 (3x - 2)^2 dx$ and the value is

(a) 104 (b) 100 (c) 10 (d) none of these.

20. Evaluate $\int_0^1 x e^x dx$ and the value is

(a) -1 (b) 10 (c) 10/9 (d) +1

21. $\int x^x (1 + \log x) dx$ is equal to

(a) $x^x \log x + k$ (b) $e^{x^2} + k$ (c) $\frac{x^2}{2} + k$ (d) $x^x + c$

22. If $f(x) = \sqrt{1+x^2}$ then $\int f(x) dx$ is

(a) $\frac{2}{3} x(1+x^2)^{3/2} + k$ (b) $\frac{x}{2} \sqrt{1+x^2} + \frac{1}{2} \log(x + \sqrt{x^2+1}) + k$

(c) $\frac{2}{3} x(1+x^2)^{3/2} + k$ (d) none of these

23. $\int d(x^2+1)/\sqrt{x^2+2}$ is equal to

(a) $\frac{x}{\sqrt{2}} (\sqrt{x^2+2}) + k$ (b) $\sqrt{x^2+2} + k$ (c) $1/(x^2+2)^{3/2} + k$ (d) none of these

24. $\int (e^x + e^{-x})^2 (e^x - e^{-x}) dx$ is

(a) $\frac{1}{3} (e^x + e^{-x})^3 + k$ (b) $\frac{1}{2} (e^x - e^{-x})^2 + k$

(c) $e^x + k$ (d) none of these

25. $\int_0^a [f(x) + f(-x)] dx$ is equal to

(a) $\int_0^a 2 f(x) dx$ (b) $\int_{-a}^a f(x) dx$ (c) 0 (d) $\int_{-a}^a -f(-x) dx$

26. $\int x e^x / (x+1)^2 dx$ is equal to

- (a) $e^x/(x+1) + k$ (b) $e^x/x + k$ (c) $e^x + k$ (d) none of these

27. $\int (x^4 + 3/x) dx$ is equal to

- (a) $x^5/5 + 3 \log |x|$ (b) $1/5 x^5 + 3 \log |x| + k$
(c) $1/5 x^5 + k$ (d) none of these

28. Evaluate the integral $\int (1-x)^3/x dx$ and the answer is equal to

- (a) $\log |x| - 3x + 3/2 x^2 + k$ (b) $\log x - 2 + 3x^2 + k$
(c) $\log x + 3x^2 + k$ (d) none of these

29. The equation of the curve in the form $y = f(x)$ if the curve passes through the point $(1, 0)$ and $f'(x) = 2x - 1$ is

- (a) $y = x^2 - x$ (b) $x = y^2 - y$ (c) $y = x^2$ (d) none of these

30. Evaluate $\int_1^4 (2x + 5) dx$ and the value is

- (a) 3 (b) 10 (c) 30 (d) none of these

31. $\int_1^2 \frac{2x}{1+x^2} dx$ is equal to

- (a) $\log_e(5/2)$ (b) $\log_e 5 - \log_e 2 + k$
(c) $\log_e(2/5)$ (d) none of these

32. $\int_0^4 \sqrt{3x+4} dx$ is equal to

- (a) 9/112 (b) 112/9 (c) 11/9 (d) none of these

33. $\int_0^2 \frac{x+2}{x+1} dx$ is

- (a) $2 + \log_e 2$ (b) $2 + \log_e 3$ (c) $\log_e 3$ (d) none of these

34. Evaluate $\int_1^{e^2} \frac{dx}{x(1+\log x)^2}$ and the value is

- (a) 3/2 (b) 1/3 (c) 26/3 (d) 1/2 ($\log_e 5$)

35. $\int_0^4 \frac{(x+1)(x+4)}{\sqrt{x}} dx$ is equal is

(a) $51\frac{1}{5}$ (b) $48/5$

(c) 48 (d) $55\frac{7}{15}$

36. The equation of the curve which passes through the point (1, 3) and has the slope $4x - 3$ at any point (x, y) is

(a) $y = 2x^3 - 3x + 4$ (b) $y = 2x^2 - 3x + 4$

(c) $x = 2y^2 - 3y + 4$ (d) none of these

37. The value of $\int_2^3 f(5-x)dx - \int_2^3 f(x)dx$ is

(a) 1 (b) 0 (c) -1 (d) none of these

38. $\int (x-1)e^x/x^2 dx$ is equal to

(a) $e^x/x + k$ (b) $e^{-x}/x + k$ (c) $-e^x/x + k$ (d) none of these

39. $\int \frac{e^x(x \log x + 1)}{x} dx$ is equal to

(a) $e^x \log x + k$ (b) $e^x + k$ (c) $\log x + k$ (d) none of these

40. $\int \log x^2 dx$ is equal to

(a) $x(\log x - 1) + k$ (b) $2x(\log x - 1) + k$

(c) $2(\log x - 1) + k$ (d) none of these

41. $\int_1^2 x \log x dx$ is equal to

(a) $2 \log 2$ (b) $-3/4$ (c) $2 \log 2 - 3/4$ (d) none of these

42. Evaluate $\int_1^2 \left(\frac{x^2-1}{x^2}\right) e^{x+\frac{1}{x}} dx$. The value is

(a) $e^2(\sqrt{e} - 1)$ (b) $e^2[\sqrt{e-1}] + k$ (c) $e^2\sqrt{e}$ (d) none of these

43. $\int_0^2 3x^2 dx$ is

(a) 7 (b) -8 (c) 8 (d) none of these

44. Evaluate $\int \frac{(2-x)e^x}{(1-x)^2} dx$ and the value is

- (a) $\frac{e^x}{1-x} + k$ (b) $e^x + k$ (c) $\frac{1}{1-x} + k$ (d) none of these

45. Using integration by parts $\int x^3 \log x dx$

- (a) $x^4/16 + k$ (b) $x^4/16(4 \log x - 1) + k$
 (c) $4 \log x - 1 + k$ (d) none of these

46. $\int \log (\log x)/x dx$ is

- (a) $\log (\log x - 1) + k$ (b) $\log x - 1 + k$
 (c) $[\log (\log x - 1)] \log x + k$ (d) none of these

47. $\int (\log x)x dx$ is equal to

- (a) $\frac{x^2}{2} \left[(\log x)^2 - \log x + \frac{1}{2} \right] + k$ (b) $(\log x)^2 - \log x + \frac{1}{2} + k$
 (c) $\frac{x^2}{2} \left[(\log x)^2 + \frac{1}{2} \right] + k$ (d) none of these

48. Evaluate $\int \left(\frac{e^x - e^{-x}}{e^x + e^{-x}} \right) dx$ and the value is

- (a) $\log_e |e^x + e^{-x}|$ (b) $\log_e |e^x + e^{-x}| + k$
 (c) $\log_e |e^x - e^{-x}| + k$ (d) none of these

49. By the method of partial fraction $\int \frac{3x}{(x^2-x-2)} dx$ is

- (a) $2 \log_e |x-2| + \log_e |x+1| + k$ (b) $2 \log_e |x-2| - \log_e |x+1| + k$
 (c) $\log_e |x-2| + \log_e |x+1| + k$ (d) none of these

50. If $f'(x) = x - 1$, the equation of a curve $y = f(x)$ passing through the point $(1, 0)$ is given by

- (a) $y = x^2 - 2x + 1$ (b) $y = x^2/2 - x + 1$
 (c) $y = x^2/2 - x + 1/2$ (d) none of these

ANSWERS

Exercise 8(b)

1. (b) 2. (b) 3. (b) 4. (b) 5. (c) 6. (a) 7. (d) 8. (a)
9. (b) 10. (a) 11. (b) 12. (c) 13. (a) 14. (d) 15. (a) 16. (a)
17. (a) 18. (b) 19. (a) 20. (d) 21. (d) 22. (b) 23. (a) 24. (a)
25. (b) 26. (a) 27. (b) 28. (d) 29. (a) 30. (c) 31. (b) 32. (b)
33. (b) 34. (d) 35. (d) 36. (b) 37. (b) 38. (a) 39. (a) 40. (b)
41. (c) 42. (a) 43. (c) 44. (a) 45. (b) 46. (c) 47. (a) 48. (b)
49. (a) 50. (c)

ADDITIONAL QUESTION BANK

(a) Differential Calculus

1. If $y=x^3$ then dy/dx is

- (a) $x^4/4$ (b) $-x^4/4$ (c) $3x^2$ (d) $-3x^2$

2. If $y=x^{2/3}$ then dy/dx is

- (a) $(2/3)x^{-1/3}$ (b) $(3/5)x^{5/3}$ (c) $(-3/5)x^{5/3}$ (d) None

3. If $y=x^{-8}$ then dy/dx is

- (a) $-8x^{-9}$ (b) $8x^{-9}$ (c) $-8x^9$ (d) $8x^9$

4. If $y=5x^2$ then dy/dx is

- (a) $10x$ (b) $5x$ (c) $2x$ (d) None

5. If $y = 2x^2 + x$ then dy/dx is

- (a) $4x + 1$ (b) $2(x-1)$ (c) $x + 1$ (d) $x - 1$

6. If $y=4x^3-7x^4$ then dy/dx is

- (a) $2x(-14x^2+6x)$ (b) $2x(14x^2-6x)$ (c) $2x(14x^2+6x)$ (d) None

7. If $y = (4/3)x^3 - (6/7)x^7 + 4x^{-3}$ then dy/dx is

- (a) $4x^2 - 6x^6 - 12x^{-4}$ (b) $4x^2 + 6x^6 - 12x^{-4}$ (c) $4x^2 + 6x^6 + 12x^{-4}$ (d) None

8. If $y = 9x^4 - 7x^3 + 8x^2 - 8x^{-1} + 10x^{-3}$ then dy/dx is

- (a) $36x^3 - 21x^2 + 16x + 8x^{-2} - 30x^{-4}$ (b) $36x^3 - 21x^2 + 16x - 8x^{-2} + 30x^{-4}$
(c) $36x^3 + 21x^2 + 16x + 8x^{-2} + 30x^{-4}$ (d) None

9. If $y = [(1-x)/x]^2$ then dy/dx is

- (a) $2(x^{-3} + x^{-2})$ (b) $2(-x^{-3} + x^{-2})$ (c) $2(x^{-3} - x^{-2})$ (d) None

10. If $y = (3x^2 + 1)(x^3 + 2x)$ then dy/dx is

- (a) $15x^4 + 21x^2 + 2$ (b) $15x^3 + 21x^2 + 2$ (c) $15x^3 + 21x + 2$ (d) None

11. If $y = (3x^2 + 5)(2x^3 + x + 7)$ then dy/dx is

- (a) $30x^4 + 39x^2 + 42x + 5$ (b) $30x^4 + 39x^3 + 42x^2 + 5$
(c) $30x^4 + 39x^3 + 42x^2 + 5x$ (d) None

12. If $y = 2x^{3/2}(x^{1/2} + 2)(x^{1/2} - 1)$ then dy/dx is

- (a) $4x + 5x(x-6)^{1/2}x^{1/2}$ (b) $4x + 5x(x-3)^{1/2}x^{1/2}$
(c) $4x + 5x(x-2)^{1/2}x^{1/2}$ (d) None

13. If $y = (x^2 - 1)/(x^2 + 1)$ then dy/dx is

- (a) $4x(x^2 + 1)^{-2}$ (b) $4x(x^2 + 1)^2$ (c) $4x(x^2 - 1)^{-2}$ (d) None

14. If $y = (x+1)(2x-1)/(x-3)$ then dy/dx is

- (a) $2(x^2 - 6x - 1)/(x-3)^2$ (b) $2(x^2 + 6x - 1)/(x-3)^2$
(c) $2(x^2 + 6x + 1)/(x-3)^2$ (d) None

15. If $y = (x^{1/2} + 2)/x^{1/2}$ then dy/dx is

- (a) $-x^{-3/2}$ (b) $x^{-3/2}$ (c) $x^{3/2}$ (d) None

16. If $y = (3x^2 - 7)^{1/2}$ then dy/dx is

- (a) $3x(3x^2 - 7)^{-1/2}$ (b) $6x(3x^2 - 7)^{-1/2}$ (c) $3x(3x^2 - 7)^{1/2}$ (d) None

17. If $y = (3x^3 - 5x^2 + 8)^3$ then dy/dx is

- (a) $3(3x^3 - 5x^2 + 8)^2 (9x^2 - 10x)$ (b) $3(3x^3 - 5x^2 + 8)^2 (9x^2 + 10x)$

(c) $3(3x^3-5x^2+8)^2 (10x^2-9x)$ (d) None

18. If $y=(6x^5-7x^3+9)^{-1/3}$ then dy/dx is

- (a) $(-1/3)(6x^5-7x^3+9)^{-4/3}(30x^4-21x^2)$ (b) $(1/3)(6x^5-7x^3+9)^{-4/3}(30x^4-21x^2)$
(c) $(-1/3)(6x^5-7x^3+9)^{4/3}(30x^4-21x^2)$ (d) None

19. If $y=[(x^2+a^2)^{1/2}+(x^2+b^2)^{1/2}]^{-1}$ then dy/dx is

- (a) $x(a^2-b^2)^{-1}[(x^2+a^2)^{1/2}-(x^2+b^2)^{1/2}]$
(b) $(a^2-b^2)^{-1}[(x^2+a^2)^{1/2}-(x^2+b^2)^{1/2}]$
(c) $x(a^2-b^2)^{-1}[(x^2+a^2)^{1/2}+(x^2+b^2)^{1/2}]$
(d) $(a^2-b^2)^{-1}[(x^2+a^2)^{1/2}+(x^2+b^2)^{1/2}]$

20. If $y=\log 5x$ then dy/dx is

- (a) x^{-1} (b) x (c) $5x^{-1}$ (d) $5x$

21. If $y=x^{-1/2}$ then dy/dx is

- (a) $(-1/2)x^{-3/2}$ (b) $(1/2)x^{-3/2}$ (c) $(1/2)x^{3/2}$ (d) None

22. If $y=-3x^{-7/3}$ then dy/dx is

- (a) $7x^{-10/3}$ (b) $-7x^{-10/3}$ (c) $(-7/3)x^{-10/3}$ (d) None

23. If $y=7x^4+3x^3-9x+5$ then dy/dx is

- (a) $28x^3+9(x+1)(x-1)$ (b) $28x^3+9(x+1)^2$
(c) $28x^3+9(x-1)^2$ (d) None

24. If $y=x+4x^{-1}-2x^{-7}$ then dy/dx is

- (a) $1-4x^{-2}+14x^{-8}$ (b) $1+4x^{-2}-14x^{-8}$ (c) $1+4x^{-2}+14x^{-8}$ (d) None

25. If $y=(x-x^{-1})^2$ then dy/dx is

- (a) $2x-2x^{-3}$ (b) $2x+2x^{-3}$ (c) $2x+2x^3$ (d) $2x-2x^3$

26. If $y=(x^{1/3}-x^{-1/3})^3$ then dy/dx is

- (a) $1-x^{-2}+x^{-2/3}-x^{-4/3}$ (b) $1+x^{-2}+x^{-2/3}-x^{-4/3}$
(c) $1+x^{-2}+x^{-2/3}+x^{-4/3}$ (d) None

27. If $y=(x+a)(x+b)(x+c)$ then dy/dx is

- (a) $3x^2+2ax+2bx+2cx+ab+bc+ca$ (b) $2x^2+3ax+3bx+3cx+ab+bc+ca$

(c) $3x^2+2ax+2bx+2cx+2ab+2bc+2ca$ (d) None

28. If $y=(3x^2+5x)(7x+4)^{-1}$ then dy/dx is

- (a) $(21x^2+24x+20)(7x+4)^{-2}$ (b) $(21x^2+20x+24)(7x+4)^{-2}$
(c) $(21x^2+24x+4)(7x+4)^{-2}$ (d) None

29. If $y=(2x+1)(3x+1)(4x+1)^{-1}$ then dy/dx is

- (a) $(24x^2+12x+1)(4x+1)^{-2}$ (b) $(24x^2+12x+3)(4x+1)^{-2}$
(c) $(24x^2+12x+5)(4x+1)^{-2}$ (d) None

30. If $y=(5x^4-6x^2-7x+8)/(5x-6)$ then dy/dx is

- (a) $(75x^4-120x^3-30x^2+72x+2)(5x-6)^{-2}$
(b) $(75x^4-120x^3+30x^2-72x+2)(5x-6)^{-2}$
(c) $(75x^4-120x^3-30x^2+72x-2)(5x-6)^{-2}$ (d) None

31. If $y=(ax^2+bx+c)^{1/2}$ then dy/dx is

- (a) $(1/2)(2ax+b)(ax^2+bx+c)^{-1/2}$
(b) $(-1/2)(2ax+b)(ax^2+bx+c)^{-1/2}$
(c) $(1/2)(ax+2b)(ax^2+bx+c)^{-1/2}$ (d) None

32. If $y=(2x^4+3x^3-5x+6)^{-1/3}$ then dy/dx is

- (a) $(-1/3)(2x^4+3x^3-5x+6)^{-4/3}(8x^3+9x^2-5)$
(b) $(1/3)(2x^4+3x^3-5x+6)^{-4/3}(8x^3+9x^2-5)$
(c) $(1/3)(2x^4+3x^3-5x+6)^{4/3}(8x^3+9x^2-5)$ (d) None

33. If $y=\log[(x-1)^{1/2}-(x+1)^{1/2}]$ then dy/dx is

- (a) $(1/2)(x^2-1)^{-1/2}$ (b) $(-1/2)(x^2-1)^{-1/2}$ (c) $(1/2)(x^2-1)^{1/2}$ (d) None

34. If $y=\log\sqrt{x+\sqrt{x^2+a^2}}$ then dy/dx is

- (a) $(1/2)(x^2+a^2)^{-1/2}$ (b) $(-1/2)(x^2+a^2)^{-1/2}$
(c) $(1/2)(x^2+a^2)^{1/2}$ (d) None

35. If $x=3at/(1+t^3)$, $y=3at^2/(1+t^3)$, then dy/dx is

- (a) $(2t-t^4)/(1-2t^3)$ (b) $(2t-t^4)/(1+2t^3)$ (c) $(2t+t^4)/(1+2t^3)$ (d) None

36. If $y=\log[e^{3x}(5x-3)^{1/3}(4x+2)^{-1/3}]$ then dy/dx is

- (a) $3 + (1/3)[5/(5x-3) - 4/(4x+2)]$
 (c) $3 + (1/3)[5/(5x-3) + 4/(4x+2)]$

- (b) $3 - (1/3)[5/(5x-3) - 4/(4x+2)]$
 (d) None

37. If $y = x^{x^x}$ then the value of dy/dx is

- (a) $x^{x^x} [x^{x-1} + \log x \cdot x^x (1 + \log x)]$
 (c) $x^{x^x} [x^{x-1} + \log x \cdot x^x (1 - \log x)]$

- (b) $x^{x^x} [x^{x-1} + \log x \cdot (1 + \log x)]$
 (d) $x^{x^x} [x^{x-1} + \log x \cdot (1 - \log x)]$

38. If $x^y = e^{x^y}$ then dy/dx is

- (a) $\log x / (1 - \log x)^2$ (b) $\log x / (1 + \log x)^2$ (c) $\log x / (1 - \log x)$ (d) $\log x / (1 + \log x)$

39. If $y = (x+a)(x+b)(x+c)(x+d)/(x-a)(x-b)(x-c)(x-d)$ then the value of dy/dx is

- (a) $(x+a)^{-1} + (x+b)^{-1} + (x+c)^{-1} + (x+d)^{-1} - (x-a)^{-1} - (x-b)^{-1} - (x-c)^{-1} - (x-d)^{-1}$
 (b) $(x+a)^{-1} - (x+b)^{-1} + (x+c)^{-1} - (x+d)^{-1} + (x-a)^{-1} - (x-b)^{-1} + (x-c)^{-1} - (x-d)^{-1}$
 (c) $(x-a)^{-1} + (x-b)^{-1} + (x-c)^{-1} + (x-d)^{-1} - (x+a)^{-1} - (x+b)^{-1} - (x+c)^{-1} - (x+d)^{-1}$
 (d) None

40. If $y = x(x^2 - 4a^2)^{1/2} (x^2 - a^2)$ then dy/dx is

- (a) $(x^4 - 2a^2x^2 + 4a^4)(x^2 - a^2)^{-3/2} (x^2 - 4a^2)^{-1/2}$
 (b) $(x^4 + 2a^2x^2 - 4a^4)(x^2 - a^2)^{-3/2} (x^2 - 4a^2)^{-1/2}$
 (c) $(x^4 + 2a^2x^2 + 4a^4)(x^2 - a^2)^{-3/2} (x^2 - 4a^2)^{-1/2}$ (d) None

41. If $y = (2-x)(3-x)^{1/2} (1+x)^{-1/2}$ then the value of $[dy/dx]/y$ is

- (a) $(x-2)^{-1} + (1/2)(x-3)^{-1} - (1/2)(1+x)^{-1}$
 (b) $(x-2)^{-1} + (x-3)^{-1} - (1+x)^{-1}$
 (c) $(x-2)^{-1} - (1/2)(x-3)^{-1} + (1/2)(1+x)^{-1}$ (d) None

42. If $y = \log[e^x(x-2)/(x+3)]^{3/4}$ then dy/dx is

- (a) $1 + (3/4)(x-2)^{-1} - (3/4)(x+3)^{-1}$ (b) $1 - (3/4)(x-2)^{-1} + (3/4)(x+3)^{-1}$
 (c) $1 + (3/4)(x-2)^{-1} + (3/4)(x+3)^{-1}$ (d) None

43. If $y = e^{5/x} (2x^2 - 1)^{1/2}$ then the value of $[dy/dx]/y$ is

- (a) $(2x^3 - 10x^2 + 5)x^{-2} (2x^2 - 1)^{-1/2}$ (b) $(2x^3 - 5x^2 + 10)x^{-2} (2x^2 - 1)^{-1/2}$
 (c) $(2x^3 + 10x^2 - 5)x^{-2} (2x^2 - 1)^{-1/2}$ (d) None

44. If $y = x^2 e^{5x} (3x+1)^{-1/2} (2x-1)^{-1/3}$ then the value of $[dy/dx]/y$ is

- (a) $5 + 2x^{-1} - (3/2)(3x+1)^{-1} - (2/3)(2x-1)^{-1}$
 (b) $5 + 2x^{-1} - (2/3)(3x+1)^{-1} - (3/2)(2x-1)^{-1}$

(c) $5+2x^{-1}-(2/3)(3x+1)^{-1}+(3/2)(2x-1)^{-1}$ (d) None

45. If $y=x^{1/2}(5-2x)^{2/3}(4-3x)^{-3/4}(7-4x)^{-4/5}$ then the value of $[dy/dx]/y$ is

(a) $(1/2)x^{-1}-(4/3)(5-2x)^{-1}+(9/4)(4-3x)^{-1}+(16/5)(7-4x)^{-1}$

(b) $(1/2)x^{-1}-(3/4)(5-2x)^{-1}+(9/4)(4-3x)^{-1}+(16/5)(7-4x)^{-1}$

(c) $(1/2)x^{-1}+(4/3)(5-2x)^{-1}+(9/4)(4-3x)^{-1}+(16/5)(7-4x)^{-1}$

(d) None

46. If $y=x^x$ then the value of $[dy/dx]/y$ is

(a) $\log x + 1$

(b) $\log x - 1$

(c) $\log(x+1)$

(d) None

47. If $y=(1+x)^{2x}$ then the value of $[dy/dx]/y$ is

(a) $2[x(x+1)^{-1}+\log(x+1)]$

(b) $x(x+1)^{-1}+\log(x+1)$

(c) $2[x(x+1)^{-1}-\log(x+1)]$

(d) None

48. If $y=x^{1/x}$ then the value of $[dy/dx]/y$ is

(a) $x^{-2}(1-\log x)$

(b) $x^2(1-\log x)$

(c) $x^{-2}(1+\log x)$

(d) None

49. If $y=(x^x)^x$ then dy/dx is

(a) $x^{x^2+1}(1+2\log x)$

(b) $x^{x^2+1}(1+\log x)$

(c) $x^{x^2+1}(1-\log x)$

(d) None

50. If $y=x^{\log x}$ then dy/dx is

(a) $2x^{\log x-1} \cdot \log x$

(b) $x^{\log x-1} \cdot \log x$

(c) $2x^{\log x+1} \cdot \log x$

(d) None

51. If $y=x^{\log(\log x)}$ then the value of $[dy/dx]/y$ is given by

(a) $x^{-1}[1+\log(\log x)]$

(b) $x^{-1}[1-\log(\log x)]$

(c) $x[1+\log(\log x)]$

(d) $x[1-\log(\log x)]$

52. If $y=x^a+a^x+x^a+a^a$ a being a constant then dy/dx is

(a) $ax^{a-1}+a^x \log a + x^x(\log x + 1)$

(b) $ax^{a-1}+a^x \log a + x^x(\log x - 1)$

(c) $ax^{a-1}+a^x \log a - x^x(\log x + 1)$

(d) None

53. If $x(1+y)^{1/2}+y(1+x)^{1/2}=0$ then dy/dx is

(a) $-(1+x^2)^{-1}$

(b) $(1+x^2)^{-1}$

(c) $-(1+x^2)^{-2}$

(d) $(1+x^2)^{-2}$

54. If $x^2-y^2+3x-5y=0$ then dy/dx is

(a) $(2x+3)(2y+5)^{-1}$

(b) $(2x+3)(2y-5)^{-1}$

(c) $(2x-3)(2y-5)^{-1}$

(d) None

55. If $x^3 - xy^2 + 3y^2 + 2 = 0$ then dy/dx is

- (a) $(y^2 - 3x^2)/[2y(3-x)]$ (b) $(y^2 - 3x^2)/[2y(x-3)]$
(c) $(y^2 - 3x^2)/[2y(3+x)]$ (d) None

56. If $ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0$ then dy/dx is

- (a) $-(ax + hy + g)/(hx + by + f)$ (b) $(ax + hy + g)/(hx + by + f)$
(c) $(ax - hy + g)/(hx - by + f)$ (d) None

57. If $y = x^{x^{x^{\dots}}}$ then dy/dx is

- (a) $y^2/[x(1 - y \log x)]$ (b) $y^2/(1 - y \log x)$
(c) $y^2/[x(1 + y \log x)]$ (d) $y^2/(1 + y \log x)$

58. The slope of the tangent at the point (2, -2) to the curve $x^2 + xy + y^2 - 4 = 0$ is given by

- (a) 0 (b) 1 (c) -1 (d) None

59. If $x^2 + y^2 - 2x = 0$ then dy/dx is

- (a) $(1-x)/y$ (b) $(1+x)/y$ (c) $(x-1)/y$ (d) None

60. If $x^2 + 3xy + y^2 - 4 = 0$ then dy/dx is

- (a) $-(2x+3y)/(3x+2y)$ (b) $(2x+3y)/(3x+2y)$
(c) $-(3x+2y)/(2x+3y)$ (d) $(3x+2y)/(2x+3y)$

61. If $x^3 + 5x^2y + xy - 5 = 0$ then dy/dx is

- (a) $-(3x^2 + 10xy + y)/[x(5x+1)]$ (b) $(3x^2 + 10xy + y)/[x(5x+1)]$
(c) $-(3x^2 + 10xy + y)/[x(5x-1)]$ (d) None

62. If $(x+y)^{m+n} - x^m y^n = 0$ then dy/dx is

- (a) y/x (b) $-y/x$ (c) x/y (d) $-x/y$

63. Find the fourth derivative of $\log[(3x+4)^{1/2}]$

- (a) $-243(3x+4)^{-4}$ (b) $243(3x+4)^{-4}$ (c) $-243(4x+3)^{-4}$ (d) None

64. If $y = [x + (1+x^2)^{1/2}]^m$ then the value of the expression $(1+x^2)d^2y/dx^2 + xdy/dx - m^2y$ is

- (a) 0 (b) 1 (c) -1 (d) None

65. If $y = x^m e^{nx}$ then d^2y/dx^2 is

- (a) $m(m-1)x^{m-2}e^{nx} + 2mnx^{m-1}e^{nx} + n^2x^me^{nx}$

- (b) $m(1-m)x^{m-2}e^{nx} + 2mnx^{m-1}e^{nx} + n^2x^me^{nx}$
 (c) $m(m+1)x^{m+2}e^{nx} + 2mnx^{m-1}e^{nx} + n^2x^me^{nx}$ (d) None

66. If $y = (\log x)/x$ then d^2y/dx^2 is

- (a) $(2\log x - 3)/x^3$ (b) $(3\log x - 2)/x^3$ (c) $(2\log x + 3)/x^3$ (d) None

67. If $y = ae^{mx} + be^{-mx}$ then d^2y/dx^2 is

- (a) m^2y (b) my (c) $-m^2y$ (d) $-my$

68. If $y = ae^{2x} + bxe^{2x}$ where a and b are constants the value of the expression $d^2y/dx^2 - 4dy/dx + 4y$ is _____.

- (a) 0 (b) 1 (c) -1 (d) None

69. If $y = a[x + (x^2 - 1)^{1/2}]^n + b[x - (x^2 - 1)^{1/2}]^n$ the value of the expression $(x^2 - y)d^2y/dx^2 + xdy/dx - n^2y$ is .

- (a) 0 (b) 1 (c) -1 (d) None

70. If $y = (x+1)^{1/2} - (x-1)^{1/2}$ the value of the expression $(x^2 - 1)d^2y/dx^2 + xdy/dx - y/4$ is given by

- (a) 0 (b) 1 (c) -1 (d) None

71. If $y = \log[x + (1 + x^2)^{1/2}]$ the value of the expression $(x^2 + 1)d^2y/dx^2 + xdy/dx$ is _____.

- (a) 0 (b) 1 (c) -1 (d) None

72. If $x = at^2$ and $y = 2at$ then d^2y/dx^2 is

- (a) $1/(2at^3)$ (b) $-1/(2at^3)$ (c) $2at^3$ (d) None

73. If $x = (1-t)/(1+t)$ and $t = (2t)/(1+t)$ then d^2y/dx^2 is

- (a) 0 (b) 1 (c) -1 (d) None

(b) Integral Calculus

1. Integrate w.r.t x , $5x^2$

- (a) $(5/3)x^3 + k$ (b) $(3/5)x^3 + k$ (c) $5x + k$ (d) $10x$

2. Integrate w.r.t x , $(3 - 2x - x^4)$

- (a) $3x - x^2 - x^5/5 + k$ (b) $3x + x^2 - x^5/5 + k$ (c) $3x + x^2 + x^5/5 + k$ (d) None

3. Integrate w.r.t x, $(4x^3+3x^2-2x+5)$

- (a) $x^4+x^3-x^2+5x+k$ (b) $x^4-x^3+x^2-5x+k$ (c) $x^4+x^3-x^2+5+k$ (d) None

4. Integrate w.r.t x, $(x^2-1)^2$

- (a) $x^5/5-(2/3)x^3+x+k$ (b) $x^5/5+(2/3)x^3+x+k$
(c) $x^5/5+(3/2)x^3+x+k$ (d) None

5. Integrate w.r.t x, $(x^{1/2}-x/2+2x^{-1/2})$

- (a) $(2/3)x^{3/2}-(1/4)x^2+4x^{1/2}+k$ (b) $(3/2)x^{3/2}-(1/4)x^2+4x^{1/2}$
(c) $(2/3)x^{3/2}+(1/4)x^2+4x^{1/2}$ (d) None

6. Integrate w.r.t x, $(1-3x)(1+x)$

- (a) $x-x^2-x^3+k$ (b) $x-x^2+x^3+k$ (c) $x+x^2+x^3+k$ (d) None

7. Integrate w.r.t x, $(x^4+1)/x^2$

- (a) $x^3/3-1/x+k$ (b) $1/x-x^3/3+k$ (c) $x^3/3+1/x+k$ (d) None

8. Integrate w.r.t x, $(3x^{-1}+4x^2-3x+8)$

- (a) $3\log x-(4/3)x^3+(3/2)x^2-8x+k$ (b) $3\log x+(4/3)x^3-(3/2)x^2+8x+k$
(c) $3\log x+(4/3)x^3+(3/2)x^2+8x+k$ (d) None

9. Integrate w.r.t x, $(x-1/x)^3$

- (a) $x^4/4-(3/2)x^2+3\log x+x^{-2}/2+k$ (b) $x^4/4+(3/2)x^2+3\log x+x^{-2}/2+k$
(c) $x^4/4-(2/3)x^2+3\log x+x^{-2}/2+k$ (d) None

10. Integrate w.r.t x, $(x^2-3x+x^{1/3}+7)x^{-1/2}$

- (a) $(2/5)x^{5/2}-2x^{3/2}+(6/5)x^{5/6}-14x^{1/2}+k$ (b) $(5/2)x^{5/2}-2x^{3/2}+(5/6)x^{5/6}+14x^{1/2}+k$
(c) $(2/5)x^{5/2}+2x^{3/2}+(6/5)x^{5/6}+14x^{1/2}+k$ (d) None

11. Integrate w.r.t x, $(ax^2+bx^3+cx^{-7})x^2$

(a) $(1/4)ax^4+b\log x-(1/4)cx^{-4}+k$

(b) $4ax^4+b\log x-4cx^{-4}+k$

(c) $(1/4)ax^4+b\log x+(1/4)cx^{-4}+k$

(d) None

12. Integrate w.r.t x, $x^{6/5}$

(a) $(5/11)x^{11/5}+k$

(b) $(11/5)x^{11/5}+k$

(c) $(1/5)x^{1/5}+k$

(d) None

13. Integrate w.r.t x, $x^{4/3}$

(a) $(3/7)x^{7/3}+k$

(b) $(7/3)x^{7/3}+k$

(c) $(1/3)x^{1/3}+k$

(d) None

14. Integrate w.r.t x, $x^{-1/2}$

(a) $2x^{1/2}+k$

(b) $(1/2)x^{1/2}+k$

(c) $-(3/2)x^{-3/2}+k$

(d) None

15. Integrate w.r.t x, $(x^{1/2}-x^{-1/2})$

(a) $(2/3)x^{3/2}-2x^{1/2}+k$

(b) $(3/2)x^{3/2}-(1/2)x^{1/2}+k$

(c) $-(1/2)x^{-1/2}-(3/2)x^{-3/2}+k$

(d) None

16. Integrate w.r.t x, $(7x^2-3x+8-x^{1/2}+x^{-1}+x^{-2})$

(a) $(7/3)x^3-(3/2)x^2+8x-2x^{1/2}+\log x-x^{-1}+k$

(b) $(3/7)x^3-(2/3)x^2+8x-(1/2)x^{1/2}+\log x+x^{-1}+k$

(c) $(7/3)x^3+(3/2)x^2+8x+2x^{1/2}+\log x+x^{-1}+k$

(d) None

17. Integrate w.r.t x, $x^{-1}[ax^3+bx^2+cx+d]$

(a) $(1/3)ax^3+(1/2)bx^2+cx+d\log x+k$

(b) $3ax^3+2bx^2+cx+d\log x+k$

(c) $2ax+b-dx^{-2}+k$

(d) None

18. Integrate w.r.t x, $x^{-3}[4x^6+3x^5+2x^4+x^3+x^2 + 1]$

(a) $x^4+x^3+x^2+x+\log x-(1/2)x^{-2}+k$

(b) $x^4+x^3+x^2+x+\log x+(1/2)x^{-2}+k$

(c) $x^4+x^3+x^2+x+\log x+2x^{-2}+k$

(d) None

19. Integrate w.r.t x, $[2^x+(1/2)e^{-x}+4x^{-1}-x^{-1/3}]$

(a) $2^x/\log 2-(1/2)e^{-x}+4\log x-(3/2)x^{2/3}+k$

(b) $2^x/\log 2+(1/2)e^{-x}+4\log x+(3/2)x^{2/3}+k$

(c) $2^x/\log 2-2e^{-x}+4\log x-(2/3)x^{2/3}+k$

(d) None

20. Integrate w.r.t x, $(4x+5)^6$

(a) $(1/28)(4x+5)^7+k$

(b) $(1/7)(4x+5)^7+k$

(c) $7(4x+5)^7+k$

(d) None

21. Integrate w.r.t x, $x(x^2+4)^5$

(a) $(1/12)(x^2+4)^6+k$

(b) $(1/6)(x^2+4)^6+k$

(c) $6(x^2+4)^6+k$

(d) None

22. Integrate w.r.t x, $(x+a)^n$

(a) $(x+a)^{n+1}/(n+1)+k$

(b) $(x+a)^n/n+k$

(c) $(x+a)^{n-1}/(n-1)+k$

(d) None

23. Integrate w.r.t x, $(x^3+2)^2 3x^2$

(a) $(1/3)(x^3+2)^3+k$

(b) $3(x^3+2)^3+k$

(c) $3x^2(x^3+2)^3+k$

(d) $9x^2(x^3+2)^3+k$

24. Integrate w.r.t x, $(x^3+2)^{1/2}x^2$

(a) $(2/9)(x^3+2)^{3/2}+k$

(b) $(2/3)(x^3+2)^{3/2}+k$

(c) $(9/2)(x^3+2)^{3/2}+k$

(d) None

25. Integrate w.r.t x, $(x^3+2)^{-3} 8x^2$

(a) $-(4/3)(x^3+2)^{-2}+k$

(b) $(4/3)(x^3+2)^{-2}+k$

(c) $(2/3)(x^3+2)^{-2}+k$

(d) None

26. Integrate w.r.t x, $(x^3+2)^{-1/4}x^2$

- (a) $(4/9)(x^3+2)^{3/4}+k$ (b) $(9/4)(x^3+2)^{3/4}+k$ (c) $(3/4)(x^3+2)^{3/4}+k$ (d) None

27. Integrate w.r.t x, $(x^2+1)^{-n}3x$

- (a) $(3/2)(x^2+1)^{1-n}/(1-n)+k$ (b) $(3/2)(x^2+1)^{n-1}/(1-n)$
(c) $(2/3)(x^2+1)^{1-n}/(1-n)+k$ (d) None

28. Integrate w.r.t x, $(x^2 + 1)^{-3}x^3$

- (a) $-(1/4)(2x^2+1)/(x^2+1)^2+k$ (b) $(1/4)(2x^2 + 1)/(x^2 + 1)^2+k$
(c) $-(1/4)(2x^2 + 1)/(x^2 + 1)+k$ (d) $(1/4)(2x^2+1)/(x^2+1) +k$

29. Integrate w.r.t x, $1/[x\log x\log(\log x)]$

- (a) $\log[\log(\log x)]+k$ (b) $\log(\log x) +k$ (c) $\log x+k$ (d) x^{-1}

30. Integrate w.r.t x, $1/[x(\log x)^2]$

- (a) $-1/\log x+k$ (b) $1/\log x+k$ (c) $\log x$ (d) None

31. Integrate w.r.t x, $x(x^2+3)^{-2}$

- (a) $-(1/2)(x^2+3)^{-1}+k$ (b) $(1/2)(x^2+3)^{-1}+k$ (c) $2(x^2+3)^{-1}+k$ (d) None

32. Integrate w.r.t x, $(3x+7)(2x^2+3x-2)^{-1}$

- (a) $(3/4)\log(2x^2+3x-2)+(19/20)\log[(2x-1)/\{2(x+2)\}] +k$
(b) $(3/4)\log(2x^2+3x-2)+\log[(2x-1)/\{2(x+2)\}] +k$
(c) $(3/4)\log(2x^2+3x-2)+(19/20)\log[2(2x-1)(x+2)] +k$ (d) None

33. Integrate w.r.t x, $1/(2x^2-x-1)$

- (a) $(1/3)\log[2(x-1)/(2x+1)]+c$ (b) $-(1/3)\log[2(x-1)/(2x+1)]+c$
(c) $(1/3)\log[2(1-x)/(2x+1)]$ (d) None

34. Integrate w.r.t x, $(x+1)(3+2x-x^2)^{-1}$

- (a) $-(1/2)\log(3+2x-x^2)+(1/2)\log[(x+1)/(x-3)]+c$
(b) $(1/2)\log(3+2x-x^2)+(1/2)\log[(x+1)/(x-3)] +c$
(c) $-(1/2)\log(3+2x-x^2)+(1/2)\log[(x-3)/(x+1)]+c$ (d) None

35. Integrate w.r.t x, $(5x^2+8x+4)^{-1/2}$

- (a) $(1/\sqrt{5})\log[\{\sqrt{5}x+4/\sqrt{5}+(5x^2+8x+4)^{1/2}\}] +c$
(b) $\sqrt{5}\log[\{\sqrt{5}x+4/\sqrt{5}+(5x^2+8x+4)^{1/2}\}] +c$
(c) $(1/\sqrt{5})\log[\{\sqrt{5}x+4/\sqrt{5}+(5x^2+8x+4)^{-1/2}\}]+c$ (d) None

36. Integrate w.r.t x, $(x+1)(5x^2+8x-4)^{-1/2}$

- (a) $(1/5)(5x^2+8x-4)^{1/2}+[1/(5\sqrt{5})]\log[5\{x+4/5+(x^2+8x/5-4/5)^{1/2}(1/6)\}]+c$
(b) $(1/5)(5x^2+8x-4)^{1/2}+[1/(5\sqrt{5})]\log[5\{x+4/5+(x^2+8x/5-4/5)^{-1/2}(1/6)\}]+c$
(c) $(1/5)(5x^2+8x-4)^{1/2}+[1/(5\sqrt{5})]\log[5\{x+4/5+(x^2+8x/5-4/5)^{1/2}\}]+c$
(d) None

37. Integrate w.r.t x, $(x^2-1)(x^4-x^2+1)^{-1}$

- (a) $[1/(2\sqrt{3})]\log[(x^2-\sqrt{3}x+1)/(x^2+\sqrt{3}x+1)] +c$
(b) $[1/(2\sqrt{3})]\log[(x^2+\sqrt{3}x+1)/(x^2-\sqrt{3}x+1)]+c$
(c) $[3/(2\sqrt{3})]\log[(x^2-\sqrt{3}x+1)/(x^2+\sqrt{3}x+1)]+c$
(d) None

38. Integrate w.r.t x, x^2e^{3x}

- (a) $(1/3)(x^2e^{3x})-(2/9)(xe^{3x})+(2/27)e^{3x}+c$
(b) $(1/3)(x^2e^{3x})+(2/9)(xe^{3x})+(2/27)e^{3x}+c$
(c) $(1/3)(x^2e^{3x})-(1/9)(xe^{3x})+(1/27)e^{3x}+c$ (d) None

39. Integrate w.r.t x $\log x$

- (a) $x(\log x - 1) + c$ (b) $x(\log x + 1) + c$ (c) $\log x - 1 + c$ (d) $\log x + 1 + c$

40. Integrate w.r.t x , $x^n \log x$

- (a) $x^{n+1}(n+1)^{-1}[\log x - (n+1)^{-1}] + c$ (b) $x^{n-1}(n-1)^{-1}[\log x - (n-1)^{-1}] + c$
(c) $x^{n+1}(n+1)^{-1}[\log x + (n+1)^{-1}] + c$ (d) None

41. Integrate w.r.t x , $xe^x(x+1)^{-2}$

- (a) $e^x(x+1)^{-1} + c$ (b) $e^x(x+1)^{-2}$ (c) $xe^x(x+1)^{-1} + c$ (d) None

42. Integrate w.r.t x , xe^x

- (a) $e^x(x-1) + k$ (b) $e^x(x+1)$ (c) $xe^x(x-1) + k$ (d) None

43. Integrate w.r.t x , $x^2 e^x$

- (a) $e^x(x^2 - 2x + 2) + k$ (b) $e^x(x^2 + 2x + 2)$ (c) $e^x(x+2)^2 + k$ (d) None

44. Integrate w.r.t x , $x \log x$

- (a) $(1/4)x^2 \log(x^2/e) + k$ (b) $(1/2)x^2 \log(x^2/e) + k$
(c) $(1/4)x^2 \log(x/e) + k$ (d) None

45. Integrate w.r.t x , $(\log x)^2$

- (a) $x(\log x)^2 - 2x \log x + 2x + k$ (b) $x(\log x)^2 + 2x \log x + 2x + k$
(c) $x(\log x)^2 - 2 \log x + 2x + k$ (d) $x(\log x)^2 + 2 \log x + 2x + k$

46. Integrate w.r.t x , $e^x(1+x)(2+x)^{-2}$

- (a) $e^x(2+x)^{-1} + k$ (b) $-e^x(2+x)^{-1} + k$ (c) $(1/2)e^x(2+x)^{-1} + k$ (d) None

47. Integrate w.r.t x, $e^x(1+x\log x)x^{-1}$

- (a) $e^x\log x+k$ (b) $-e^x\log x+k$ (c) $e^xx^{-1}+k$ (d) None

48. Integrate w.r.t x, $x(x-1)^{-1}(2x+1)^{-1}$

- (a) $(1/3)[\log(x-1)+(1/2)\log(2x+1)]+k$ (b) $(1/3)[\log(x-1)+\log(2x+1)]+k$
(c) $(1/3)[\log(x-1)-(1/2)\log(2x+1)]+k$ (d) None

49. Integrate w.r.t x, $(x-x^3)^{-1}$

- (a) $(1/2)\log[x^2/(1-x^2)]+k$ (b) $(1/2)\log[x^2/(1-x)^2]+k$
(c) $(1/2)\log[x^2/(1+x)^2]+k$ (d) None

50. Integrate w.r.t x, $x^3[(x-a)(x-b)(x-c)]^{-1}$ given that $1/A=(a-b)(a-c)/a^3$, $1/B=(b-a)(b-c)/b^3$, $1/C=(c-a)(c-b)/c^3$

- (a) $x+A\log(x-a)+B\log(x-b)+C\log(x-c)+k$
(b) $A\log(x-a)+B\log(x-b)+C\log(x-c)+k$
(c) $1+A\log(x-a)+B\log(x-b)+C\log(x-c)+k$ (d) None

51. Integrate w.r.t x, $(25-x^2)^{-1}$ from lower limit 3 to upper limit 4 of x

- (a) $(3/4)\log(1/5)+k$ (b) $(1/5)\log(3/2)$ (c) $(1/5)\log(4/3)+k$ (d) $(3/4)\log 5+k$

52. Integrate w.r.t x, $(2x+3)^{1/2}$ from lower limit 3 to upper limit 11 of x

- (a) 33 (b) 100/3 (c) 98/3 (d) None

ANSWERS

(a) Differential calculus

1. (c) 2. (a) 3. (a) 4. (a) 5. (a) 6. (a)
7. (a) 8. (a) 9. (b) 10. (a) 11. (a) 12. (a)
13. (a) 14. (a) 15. (a) 16. (a) 17. (a) 18. (a)

19. (a) 20. (a) 21. (a) 22. (a) 23. (a) 24. (a)
25. (a) 26. (a) 27. (a) 28. (a) 29. (a) 30. (a)
31. (a) 32. (a) 33. (a) 34. (a) 35. (a) 36. (a)
37. (a) 38. (b) 39. (a) 40. (a) 41. (a) 42. (a)
43. (a) 44. (a) 45. (a) 46. (a) 47. (a) 48. (a)
49. (a) 50. (a) 51. (a) 52. (a) 53. (a) 54. (a)
55. (a) 56. (a) 57. (a) 58. (b) 59. (a) 60. (a)
61. (a) 62. (a) 63. (a) 64. (a) 65. (a) 66. (a)
67. (a) 68. (a) 69. (a) 70. (a) 71. (a) 72. (a)
73. (a)

(b) Integral calculus

1. (a) 2. (a) 3. (a) 4. (a) 5. (a) 6. (a)
7. (a) 8. (b) 9. (a) 10. (a) 11. (a) 12. (a)
13. (a) 14. (a) 15. (a) 16. (a) 17. (a) 18. (a)
19. (a) 20. (a) 21. (a) 22. (a) 23. (a) 24. (a)
25. (a) 26. (a) 27. (a) 28. (a) 29. (a) 30. (a)
31. (a) 32. (a) 33. (a) 34. (a) 35. (a) 36. (a)

37. (a) 38. (a) 39. (a) 40. (a) 41. (a) 42. (a)
 43. (a) 44. (a) 45. (a) 46. (a) 47. (a) 48. (a)
 49. (a) 50. (a) 51. (b) 52. (c)

PAST YEARS QUESTION

2014 - DECEMBER

[74] The value of definite integral $\int_0^2 |1 - x| dx =$ _____.

- (a) 0 (b) 1/2
 (c) 3/2 (d) 1 (1 mark)

[75] If $y = 1 + \frac{x}{1} + \frac{x^2}{2} + \dots + \frac{x^n}{n} + \dots$, then the value of $\frac{dy}{dx} - y =$ _____

- (a) 1 (b) 0
 (c) 2 (d) -1 (1 mark)

2015 - JUNE

[76] The value of $\int_0^{1/2} \frac{dx}{\sqrt{3-2x}}$ is

- (a) 1 (b) $1 - \sqrt{3/2}$
 (c) $\sqrt{3} - \sqrt{2}$ (d) $\sqrt{2} - \sqrt{3}$ (1 mark)

[77] The value of $\int_0^2 x e^{x^2} dx$ is

- (a) 1 (b) e -1
 (c) (e/2) -1 (d) $\frac{1}{2}(e^4 - 1)$ (1 mark)

[78] If $x^p y^q = (x + y)^{p+q}$, then $\frac{dy}{dx}$ is equal to _____

- (a) $\frac{q}{p}$ (b) $\frac{x}{y}$
 (c) $\frac{y}{x}$ (d) $\frac{p}{q}$ (1 mark)

[79] If $e^{xy} - 4xy = 4$ then $\frac{dy}{dx} =$ _____

- (a) $\frac{y}{x}$ (b) $\frac{-y}{x}$
 (c) $\frac{x}{y}$ (d) $\frac{-x}{y}$ (1 mark)

2015 - DECEMBER

[80] If $u = 3t^4 + 5t^3 + 2t^2 + t + 4$, then the value of $\frac{du}{dt}$ at $t = -1$ is:

- (a) 0 (b) 1
(c) 2 (d) 5 (1 mark)

[81] The value of $\int_1^2 \frac{1-x}{1+x} dx$ is equal to: $\int_1^2 \frac{1-x}{1+x}$

- (a) $\log \frac{3}{2} - 1$ (b) $2 \log \frac{3}{2} - 1$
(c) $\frac{1}{2} \log \frac{3}{2} - 1$ (d) $\frac{1}{2} \log \frac{2}{3} - 1$ (1 mark)

[82] The slope of the tangent to the curve $y = \frac{x-1}{x+2}$ at $x = 2$ is:

- (a) $\frac{3}{16}$ (b) $-\frac{3}{16}$
(c) $\frac{1}{4}$ (d) $-\frac{1}{4}$ (1 mark)

2016 - JUNE

[83] $\int_0^2 \frac{3^{\sqrt{x}}}{\sqrt{x}} dx$ is equal to _____

- (a) $\frac{2\sqrt{2}}{\log_e 3}$ (b) 0
(c) $\frac{2}{\log_e 3} (3^{\sqrt{2}} - 1)$ (d) $\frac{3^{\sqrt{2}}}{\sqrt{2}}$ (1 mark)

[84] $\int \frac{x}{(x^2+1)(x^2+2)} dx$ is equal to _____

- (a) $\log \left(\frac{x^2+1}{x^2+2} \right) + c$ (b) $\frac{1}{2} \log \left(\frac{x^2+1}{x^2+2} \right) + c$
(c) $\frac{1}{2} \log \left(\frac{x^2+2}{x^2+1} \right) + c$ (d) $-\log \left(\frac{x^2+1}{x^2+2} \right) + c$ (1 mark)

[85] If $y = \sqrt{\frac{1-x}{1+x}}$, then $\frac{dy}{dx}$ is equal to -

- (a) $\frac{y}{x^2-1}$ (b) $\frac{y}{1-x^2}$
(c) $\frac{y}{1+x^2}$ (d) $\frac{y}{y^2-1}$ (1 mark)

2016 - DECEMBER

[86] Differential Co-efficient of $\log_e(\sqrt{x-1} + \sqrt{x+1})$ with respect to x is:

- (a) $\frac{1}{2\sqrt{x^2-1}}$ (b) $\frac{1}{2\sqrt{x^2+1}}$
(c) $\frac{1}{2(x^2-1)}$ (d) $\frac{1}{\sqrt{x-1} + \sqrt{x+1}}$ (1 mark)

[87] If $f(x) = \log_e \left(\frac{x-1}{x+1} \right)$, then the value of x at which $f(x) = 1$, is

- (a) 0 (b) 1
(c) $\pm$ (d) $\pm \sqrt{2}$ (1 mark)

[88] $\int_1^e \frac{e^x(x \log_e x + 1)}{x} dx$ is equal to:

- (a) $e + 1$ (b) e^e
(c) $e - 1$ (d) $e^x + 1$ (1 mark)

2017 - JUNE

[89] The equation of the curve which passes through the point (1,2) and has the slope $3x - 4$ at any point (x, y) is:

- (a) $2y = 3x^2 - 8x + 9$ (b) $y = 6x^2 - 8x + 9$
(c) $y = x^2 - 8x + 9$ (d) $2y = 3x^2 - 8x + c$ (1 mark)

[90] The value of $\int_1^2 \frac{x}{x^2+1} dx$ is equal to:

- (a) $\log_e\left(\frac{5}{2}\right)$ (b) $\frac{1}{2}\log_e\left(\frac{5}{2}\right)$
(c) $\log_e(5) - \log_e 2 + c$ (d) None of these. (1 mark)

[91] If $x = at^3 + bt^2 - t$ and $y = at^2 - 2bt$, then the value of $\frac{dy}{dx}$ at $t = 0$ is :

- (a) $2b$ (b) $-2b$
(c) $\frac{1}{2b}$ (d) $-\frac{1}{2b}$ (1 mark)

2017 - DECEMBER

[92] The value of $\int e^x[f(x) + f'(x)]dx =$ _____

- (a) $e^x f(x) + c$ (b) $e^x f'(x) + c$
(c) $\left[\frac{f'(x)}{f(x)}\right] + c$ (d) $e^x \left[\frac{f'(x)}{f'(x)}\right] + c$ (1 mark)

[93] If $x^y = e^{x-y}$ then $\frac{dy}{dx}$ is equal to:

- (a) $\frac{2\log x}{(1+\log x)^2}$ (b) $\frac{\log x}{(1+\log x)}$
(c) $\frac{\log x}{(1+\log x)^2}$ (d) None of the above
(1 mark)

[94] If $y = 1 + \frac{x}{1} + \frac{x^2}{2} + \frac{x^3}{3} + \dots \dots \dots \infty$ then the value of $\frac{dy}{dx}$ is equal to:

- (a) x (b) y
(c) 1 (d) 0 (1 mark)

[95] $\int x \cdot e^{x^2} dx$ is equal to:

- (a) $2e^{x^2} + c$ (b) $e^{x^2} + c$
(c) $\frac{1}{2} \cdot e^{x^2} + c$ (d) $xe^{x^2} + c$ (1 mark)

[96] If $x = at^2$, $y = 2at$ then the value of $\frac{dy}{dx}$ at $t = 2$ is:

- (a) 2 (b) 4
(c) $\frac{1}{2}$ (d) $\frac{1}{4}$ (1 mark)

[97] If $y = \log x^x$ then $\frac{dy}{dx}$ is equal to:

- (a) $\log ex$ (b) $\log \frac{e}{x}$
(c) $\log \frac{x}{e}$ (d) 1 (1 mark)

2018- MAY

[98] The value of $\int_1^2 \frac{1-x}{1+x} dx$ is equal to:

- (a) $\log \frac{3}{2} - 1$ (b) $2 \log \frac{3}{2} - 1$
(c) $\frac{1}{2} \log \frac{3}{2} \times$ (d) $\frac{1}{2} \log \frac{2}{3} - 1$ (1 mark)

[99] $\int_0^2 \frac{3^{\sqrt{x}}}{\sqrt{x}} dx$ is equal to

- (a) $\frac{2\sqrt{2}}{\log_e 3}$ (b) 0
(c) $\frac{2(3\sqrt{2}-1)}{\log_e 3}$ (d) $\frac{3\sqrt{2}}{\sqrt{2}}$ (1 mark)

[100] The value of $\int_0^2 \frac{\sqrt{x}}{\sqrt{x}+\sqrt{2-x}} dx$ is:

- (a) 0 (b) 3
(c) 2 (d) 1 (1 mark)

[101] The cost function for the production of x units of a commodity is given by $C(x) = 2x^3 + 15x^2 + 36x + 15$. The cost will be minimum. When 'x' is equal to:

- (a) 3 (b) 2
(c) 1 (d) 4 (1 mark)

2018 - NOVEMBER

[102] Let $x = at^3$, $y = \frac{a}{t^2}$. Then $\frac{dy}{dx} =$

- (a) $\frac{-1}{t^6}$ (b) $\frac{-3a}{t^6}$
(c) $\frac{1}{3at^6}$ (d) None of the above (1 mark)

[103] $\int x(x^2+4)^5 dx$ is equal to

- (a) $(x^2+4)^6 + c$ (b) $\frac{1}{12} (x^2+4)^6 + c$
(c) $\frac{1}{6} (x^2+4)^6 + c$ (d) None of the above

(1 mark)

[104] $\int_{-1}^3 (1+3x-x^3) dx$ is equal to

- (a) -4 (b) 4
(c) 3 (d) -3 (1 mark)

[105] $xy = 1$ then $y^2 + \frac{dy}{dx} = ?$

- (a) 1 (b) 0
(c) 2 (d) None of the above (1 mark)

2019 - JUNE

[106] If the given cost function of commodity is given by $C = 150x - 5x^2 + \frac{x^3}{6}$, where C stands for cost and x stands for output, if the average cost is equal to the marginal cost then the output x = _____.

- (a) 5
(b) 10
(c) 15
(d) 20 (1 mark)

[107] If $2^x - 2^y = 2^{x-y}$ then $\frac{dy}{dx}$ at $x = y = 2$

- (a) 1
(b) 2
(c) 4
(d) 5 (1 mark)

[108] $\int_2^3 \frac{\sqrt{x}}{\sqrt{5-x}+\sqrt{x}} dx =$

- (a) 1
(b) 1/2
(c) 2
(d) 3/2 (1 mark)

[109] $\int e^x (x^2 + 2x) dx =$

- (a) $x^x \cdot e^2 + c$
(b) $e^x \cdot x + c$
(c) $-e^x x^2 + c$
(d) $-e^x \cdot x + c$ (1 mark)

[110] $\int \log(a^x) dx =$

- (a) $\log a \left(\frac{x^2}{2} \right) + c$
(b) $\log a \left(\frac{x}{2} \right) + c$
(c) $x \log a^x - x + c$
(d) $x \log a^x + c$ (1 mark)

2019 - NOVEMBER

[111] $\int a^x dx$

- (a) $x^x(1 + \log x)$
(b) $1 + \log x$
(c) $x \cdot \log x$

(d) $\frac{a^x}{\log a} + c$ 0 mark)

[112] $\int x \cdot e^x dx$.

(a) $e^x (x-1) + c$

(b) $e^x \cdot x + e^x + c$

(c) $\log x + e^x + c$

(d) $\frac{x^2}{e^x} + c$ (1 mark)

[113] $\int (4x + 3)^6 dx$.

(a) $\frac{1}{28} (4x + 3)^7 + c$

(b) $\frac{1}{7} (4x + 3)^7 + c$

(c) $\frac{1}{6} (4x + 3)^6 + c$

(d) $\frac{4x}{5} + \frac{3}{5} + c$ (1 mark)

[114] $\int_1^1 (2x^2 - x^3) dx$.

(a) $4/3$

(b) 1

(c) 2

(d) $2/3$ (1 mark)

[115] $\frac{d}{dx} (x \cdot \log x)$

(a) $x (1 + \log x)$

(b) $1 + \log x$

(c) $e^x \cdot x \cdot \log x$

(d) $x^2 (\log x)$ (1 mark)

[116] Differentiate x^x w.r.t x .

(a) $x^x (1 + \log x)$

(b) y/x

(c) $-y/x$

(d) $y + x^x \log x$ (1 mark)

[117] $\int x^2 \cdot e^x dx$

(a) $2x \cdot e^x$

(b) $e^x (x^2 - 2x)$

(c) $x^2 \cdot e^x - e^x \cdot (2x) + 2$

(d) $e^x (x-1)$ (1 mark)

2020 - NOVEMBER

[118] $\int x e^x dx$ is equal

(a) $e^x (x+1) + c$

(b) $e^x (x+2) + c$

(c) $e^x(x-1) + c$

(d) None (1 mark)

[119] $\int e^x (x \log x + 1) x^{-1} dx$ is equal to

(a) $e^x + c$

(b) $e^x \log x + c$

(c) $\frac{e^x}{\log x} + c$

(d) $e^x (\log x)^2 + c$ (1 mark)

[120] If $y = x(x-1)(x-2)$ then dy/dx is:

(a) $-6x$

(b) $3x^2 - 6x + 2$

(c) $6x + 4$

(d) $3x^2 - 6x$ (1 mark)

[121] The average cost function of a good is $2Q + 6 + \frac{13}{Q}$ where Q is the quantity produced.

The approx cost at $Q = 15$ is:

(a) 42 §

(b) 36

(c) 66

(a) 130 (1 mark)

[122] $\int_2^8 \frac{\sqrt{x}}{\sqrt{x} + \sqrt{10-x}} dx$ is equal to

(a) 4

(b) 3

(c) 2

(d) None (1 mark)

2021 - JANUARY

[123] The cost function of production is given by $C(x) = \frac{x^3}{2} - 15x^2 + 36x$ where x,

Denotes the number of items produced.

The level of output for which marginal cost is minimum and the level of output for which the average cost is minimum are given by, respectively.

(a) 10 and 15

(b) 10 and 12

(c) 12 and 15

(d) 15 and 10 (1 mark)

[124] $\int_1^2 e^x \left(\frac{1}{x} - \frac{1}{x^2} \right) dx =$

(a) $e^{\left(\frac{e}{2} - 1\right)}$

(b) $a(e-1)$

(c) a

(d) $e^2(e-i)$ (1 mark)

2021 - JULY

[125] In a market there are 30 shops to allocate to people. If they allocate X shops then their monthly expenses, in rupees, is given by $p(x) = -8x^2 + 400x - 1,000$, then the number of shops should they allocate to minimize the expenses:

(a) 0

(b) 30

(c) 25

(d) 10 (1 mark)

[126] The cost function $C(x) = 125 + 500x - x^2 + \frac{x^3}{3}$, $0 \leq x \leq 100$ and the demand function for the items is given by, $p(x) = 1500 - x$ then the marginal profit when 18 items are sold is:

(a) 751

(b) 571

(c) 676

(d) 876 (1 mark)

[127] If $f(x) = 3e^{x^4}$ then $f'(x) - 4x^3f(x) + \left(\frac{1}{3}\right)f(0) - f'(0)$ is equal to:

(a) 0

(b) ex^2

(c) 1

(d) -1 (1 mark)

[128] The value of $\int_{-2}^2 f(x) dx$, where $f(x) = 1 + n$, $x \leq 0$, $f(x) = 1 - 2x$, $n \geq 0$ is:

(a) 20

(b) -2

(c) -4

(d) 0 (1 mark)

2021 - DECEMBER

[129] The cost for producing x units is $500 - 20x^2 + x^3 / 3$. The marginal cost is minimum at $x =$ _____.

(a) 5

(b) 10

(c) 40

(d) 50 (1 mark)

[130] If $y = \frac{x^4}{e^x}$ then $\frac{dy}{dx}$ is equal to:

(a) $x^3 (4 - x) / (e^x)^2$

(b) $x^3 (4 - x) / e^x$

(c) $x^2(4-x)/e^x$

(d) $x^3 (4x - 1) / e^x$ (1 mark)

[131] The speed of a train at a distance x (from the starting point) is given by $3x^2 - 5x + 4$. What is the rate of change (of distance) at $x = 1$?

(a) -1

(b) 0

(c) 1

(d) 2 (1 mark)

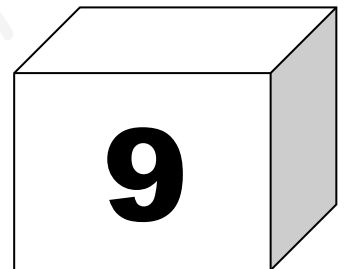
[132] Integrate with respect to x , $1 / [x(\log x)^2]$.

(a) $- 1 / \log x + k$

(b) $1/\log x + k$

(c) $\log x$

(d) x (1 mark)



NUMBER SERIES, CODING DECODING AND ODD MAN OUT SERIES

SERIES

Series Classified into Two Types, Namely

A. Number Series

B. Alphabet Series

A. NUMBER SERIES

Case 1: Missing terms of the series

In this type the questions we have to identify the missing term of the series real according to a specific pattern of the series rule to form its code. The students are required to detect the missing number of the series and answer the questions accordingly.

Example 1: Find the missing term of the series 2, 7, 16, _____ 46, 67, 92

Example 2: Find the wrong terms of the series 9, 29, 65, 126, 217, 344

Example 3: Find the missing term of the series 1, 9, 25, 49, 81, 121, ...

B. ALPHABET SERIES

Alphabet series consists of letters of the alphabet placed in a specific pattern. For example, the series are in the following order of the numbers.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1

Example 4: Find the next term of the series BKS, DJT, FIU, HHV?

C. LETTER SERIES:

This type of question usually consist of a series of small letters which follow a certain pattern. However some letters are missing from the series. These missing letters are then given in a proper sequence as one of the alternatives.

Example 5: aab, _____, aaa, bba, _____

(a) baa (b) abb (c) bab (d) aab

CODING AND DECODING

Before transmitting, the data is encoded and at receiver side encode data is decoded in order to obtain original data by determining common key in encoded data.

The Coding and Decoding is classified into seven types according to the on what way it is doing. They are type

Type 1: Letter Coding

Type 2: Number Coding

Type 1: Letter Coding

In this type the real alphabets in a word are replaced by certain other alphabets according to a specific rule to form its code. The candidate is required to detect the common rule and answer the questions accordingly.

Case1: To form the code for another word

Example 6: If in a certain language MYSTIFY is coded as NZTUJGZ, how is MENESIS coded in that language?

Example 7: If TAP is coded as SZO, then how is FRIEND coded?

Example 8: In a certain code, MENTION is written as LNEITNO. How is PRESENT written in that code?

Case 2: To find the word by analysing the given code (DECODING)

Example 9: If in a certain language CARROM is coded as BZQQNL, which word will be coded as HORSE?

Type 2: Number Coding

In these questions, either numerical code values are assigned to a word or alphabetical code letters are assigned to the numbers. The candidate is required to analyse the code as per the directions.

Case 1: When a numerical code values are assigned to words.

Example 10: If in a certain language A is coded as 1, B is coded as 2, and so on, how is AICCI is coded in that code?

Example 11: If PAINT is coded as 74128 and EXCEL is coded as 93596, then how would you encode ANCIENT?

Case 2: Number to letter coding.

Example 12: In a certain code, 2 is coded as P, 3 as N, 9 as Q, 5 as R, 4 as A and 6 as B. How is 423599 coded in that code?

ODD MAN OUT

Classification means 'to assort the items' of a given group on the basis of a certain common quality they possess and then spot the stranger or 'odd one out'.

These questions are based on words, letters and numerals. In these types of problems, we consider the defining quality of particular things. In these questions, four or five elements are given, out of which one does not belong to the group. You are required to find the 'odd one'.

Example 13: January, May, July, November

- (a) January (b) May (c) July (d) November

Example 14: 10, 14, 16, 18, 23, 24 and 26

- (a) 26 (b) 17 (c) 23 (d) 9

Example 15: 6, 9, 15, 21, 24, 26, 30

- (a) 9 (b) 26 (c) 24 (d) 30

Example 16: 1, 5, 14, 30, 51, 55, 91

- (a) 5 (b) 55 (c) 51 (d) 91

Example 17: 16, 25, 36, 62, 144, 196, 225

- (a) 36 (b) 62 (c) 196 (d) 144

EXERCISE 9(A)

(Note: Questions are taken from previous exam questions papers of Competitive exams like SSC, RRB, MAT, UPSC etc.)

Choose the most appropriate (a) or (b) or (c) or (d).

1) 6, 11, 21, 36, 56 ?

- (a) 42 (b) 51 (c) 81 (d) 91

2) 10, 100, 200, 310 ?

- (a) 400 (b) 410 (c) 420 (d) 430

3) 11, 13, 17, 19, 23, 25, 27

- (a) 33 (b) 27 (c) 29 (d) 49

4) 6, 12, 21, 33 ?

- (a) 33 (b) 38 (c) 40 (d) 48

5) 2, 5, 9, 14, ? , 27

- (a) 20 (b) 16 (c) 18 (d) 24

6) 6, 11, 21, ? , 56, 81

- (a) 42 (b) 36 (c) 91 (d) 51

7) 10, 18, 28, 40, 54, ? , 88

- (a) 70 (b) 86 (c) 87 (d) 98

8) 120, 99, ? , 63, 48, 35

- (a) 80 (b) 36 (c) 45 (d) 40

9) 22, 24, 28, 36, ? , 84

- (a) 44 (b) 52 (c) 38 (d) 54

10) 4832, 5840, 6848, 7856 ?

- (a) 8864 (b) 8815 (c) 8846 (d) 8887

11) 10, 100, 200, 310, 430?

- (a) 560 (b) 540 (c) 550 (d) 590

12) 28, 33, 31, 36, 34 ?

(a) 38 (b) 39 (c) 40 (d) 42

13) 120, 80, 40, 45, ?, 5

(a) 15 (b) 20 (c) 25 (d)

14) 2, 15, 41, 80, 132, ?

(a) 184 (b) 144 (c) 186 (d) 196

15) 6, 17, 39, ?, 116

(a) 72 (b) 75 (c) 85 (d) 80

16) 1, 4, 10, 22, ?, 94

(a) 46 (b) 48 (c) 49 (d) 47

17) 4, 9, 25, 48, ? , 169, 289, 361

(a) 120 (b) 121 (c) 122 (d) 164

18) 4, 12, 36, ? , 324

(a) 107 (b) 109 (c) 108 (d) 110

19) 1, 1, 4, 8, 9, ? , 16, 64

(a) 27 (b) 28 (c) 32 (d) 40

20) 5760, 960, 192, ? 16, 8

(a) 47 (b) 48 (c) 52 (d) 50

21) 1, 2, 6, 7, 21, 22, 66, ? , 201

(a) 69 (b) 68 (c) 67 (d) 69

22) 48, 24, 96 , ? 192

(a) 48 (b) 47 (c) 44 (d) 54

23) 165, 195, 255, 285, ? , 435

(a) 345 (b) 390 (c) 335 (d) 395

24) 2, 3, 3, 5, 10, 13, 39, ? , 172, 177

(a) 42 (b) 44 (c) 43 (d) 40

25) 7, 26, 63, 214, 215, ? , 511

(a) 342 (b) 343 (c) 441 (d) 421

26) 3, 7, 15, 31, ? 127

- (a) 62 (b) 63 (c) 64 (d) 65

27) 8, 28, 116, 584, ?

- (a) 1752 (b) 3502 (c) 3504 (d) 3508

28) 6, 13, 28, 59, ?

- (a) 122 (b) 114 (c) 113 (d) 112

29) 2, 7, 27, 107, 427, ?

- (a) 1707 (b) 4027 (c) 4207 (d) 1207

30) 5, 2, 7, 9, 16, 25, 41, ?

- (a) 65 (b) 66 (c) 67 (d) 68

31) In a certain language, MADRAS is coded NBESBT, how DELHI is coded in that code?

- (a) EMMJI (b) EFMIJ (c) EMFIJ (d) JIFEM

32) If RAMAN is written as 12325 and DINESH as 675489 how HAMAM is written?

- (a) 92323 (b) 92233 (c) 93233 (d) 93292

33) If RED is coded as 6720 then GREEN would be coded as

- (a) 9207716 (b) 167129 (c) 1677209 (d) 1672091

34) If A = 1, FAT = 27, FAITH = ?

- (a) 44 (b) 45 (c) 46 (d) 36

35) If BROTHER is coded 2456784, SISTER coded as 919684, what is coded for BORBERS?

- (a) 2542889 (b) 2542898 (c) 2454889 (d) 2524889

36) If DELHI is coded 73541 and CALCUTTA as 82589662, How can CALICUT be coded?

- (a) 5279431 (b) 5978213 (c) 8251896 (d) 8543962

37) If CLOCK is coded 34235 and TIME is 8679, what will be code of MOTEL?

- (a) 72894 (b) 77684 (c) 72964 (d) 27894

38) If PALE is coded as 2134 and EARTH is coded as 41590, how is PEARL is code?

- (a) 29530 (b) 24153 (c) 25430 (d) 254313

39) If LOSE is coded as 1357 and GAIN is coded as 2468, what do figure 82146 stands for?

(a) NGLAI (b) NGLIA (c) GNLIA (d) GNLIA

40) If MEKLF is coded as 91782 and LLLJK as 88867, how can IHJED is coded as?

(a) 97854 (b) 64512 (c) 54310 (d) 75632

41) If in a certain code language NAME is written as 4258 then what is coded as MEAN ?

(a) 2458 (b) 5842 (c) 8524 (d) 5824

42) If GOLD is written as IQNF, how WIND can be written as code?

(a) VHMC (b) VHCM (c) XJOE (d) DNIW

43) If ROSE is written as TQUG, how BISCUIT can be written in that code?

(a) DKUEWKV (b) CJTDVJU (c) DKVEWKV (d) DKUEWKY

LETTER: C Z N V R S W F D

CODE DIGIT: 8 6 4 7 2 9 3 5 1

(Q. No. 44-46) In each of the following questions find out the correctly coded alternative from amongst the given four alternatives (a), (b), (c), (d).

44) ZDRCVF

(a) 612875 (b) 619875 (c) 612845 (d) 612835

45) WNCSZV

(a) 348267 (b) 318267 (c) 348957 (d) 348967

46) RDNFVS

(a) 21679 (b) 216549 (c) 214579 (d) 218579

47) If DELHI is coded as CCIDD, how would you encode BOMBAY?

(a) AJMTVT (b) AMJXVS (c) MJXVSU (d) WXYZAX

48) In a certain code, RIPPLE is written as 613382 and LIFE is written as 8192. How is PILLER written in that code?

(a) 318826 (b) 318286 (c) 618826 (d) 338816

49) If PALAM could be given the code number 43, what code number can be given to SANTACRUZ?

(a) 123 (b) 85 (c) 120 (d) 125

49) **Directions: The number in each question below is to be codified in the following code:**

Digit	7	2	1	5	3	9	8	6	4
Letter	W	L	M	S	I	N	D	J	B

49) 184632

- (a) MDJBSI (b) MDJBIL (c) MDJBWL (d) MDBJIL

50) In a certain code '256' means 'you are good', '637' means 'we are bad' and '358' means 'good and bad'. Which of the following represents 'and' in that code?

- (a) 2 (b) 5 (c) 8 (d) 3

Directions: Find odd man out of the following (51-60):

51) 3, 5, 7, 15, 17, 19

- (a) 15 (b) 17 (c) 19 (d) 7

52) 10, 14, 16, 18, 23, 24, 26

- (a) 26 (b) 23 (c) 24 (d) 18

53) 1, 4, 9, 16, 24, 25, 36

- (a) 9 (b) 24 (c) 25 (d) 36

54) 41, 43, 47, 53, 61, 71, 73, 75

- (a) 75 (b) 73 (c) 71 (d) 53

55) 16, 25, 36, 73, 144, 196, 225

- (a) 36 (b) 73 (c) 196 (d) 225

56) 1, 4, 9, 16, 19, 36, 49

- (a) 19 (b) 9 (c) 49 (d) 16

57) 1, 5, 14, 30, 49, 55, 91

- (a) 49 (b) 30 (c) 55 (d) 91

58) 835, 734, 642, 751, 853, 981, 532

- (a) 751 (b) 853 (c) 981 (d) 532

59) 4, 5, 7, 10, 14, 18, 25, 32

- (a) 7 (b) 14 (c) 18 (d) 33

60) 52, 51, 48, 43, 34, 27, 16

- (a) 27 (b) 34 (c) 43 (d) 48

ANSWERS

EXERCISE-9 A

1. (c)	2. (d)	3. (b)	4. (d)	5. (a)	6. (b)	7. (a)	8. (a)	9. (b)	10. (a)
11. (a)	12. (b)	13. (b)	14. (d)	15. (a)	16. (a)	17. (b)	18. (c)	19. (a)	20. (b)
21. (c)	22. (a)	23. (a)	24. (c)	25. (b)	26. (b)	27. (d)	28. (a)	29. (a)	30. (c)
31. (b)	32. (a)	33. (c)	34. (a)	35. (a)	36. (c)	37. (a)	38. (b)	39. (c)	40. (d)
41. (a)	42. (a)	43. (a)	44. (d)	45. (c)	46. (b)	47. (a)	48. (a)	49. (d)	50. (c)
51. (a)	52. (b)	53. (b)	54. (a)	55. (b)	56. (a)	57. (c)	58. (a)	59. (c)	60. (b)

PAST YEAR QUESTIONS AND ANSWERS

2018 - MAY

1. In a certain code, RIPPLE is written as 613382 and LIFE is written as 8192. How is PILLER written in that code?

- (a) 318826 (b) 318286 (c) 618826 (d) 338816

2. In a certain code '256' means 'you are good', '637' means 'we are bad' and '358' means 'good and bad'. Which of the following represents 'and' in that code?

- (a) 2 (b) 5 (c) 8 (d) 3

3. If LOSE is coded as 1357 and GAIN is coded as 2468, what do figure 82146 for?

- (a) NGLAI (b) NGLIA (c) GNLIA (d) GNLA

2018 - NOVEMBER

4. If PLAY is coded as 8123 and RHYME is coded as 49367. What will be code of MALE?

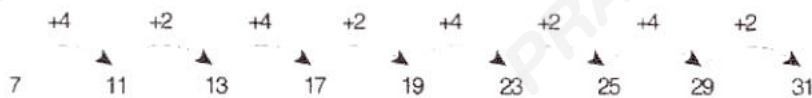
- (a) 6217 (b) 6198 (c) 6395 (d) 6285

5. Find out the next number in the following series 7, 11, 13, 17, 19, 23, 25, 29?

- (a) 30 (b) 31 (c) 32 (d) 33

Answer:

(b)



6. If HONEY is coded as JQPGA, which word is code as VCTIGVU?

- (a) CARPETS (b) TRAPET (c) TARGETS (d) UMBRELU

7. Find odd man out of the following series 15, 21, 63, 81, 69

- (a) 15 (b) 21 (c) 63 (d) 81

8. Find odd man out of the following series 7, 9, 13, 17, 19

- (a) 7 (b) 9 (c) 19 (d) 13

2019-JUNE

9. Find the next number in the series:

7, 23, 47, 119, 167

- (a) 211 (b) 223 (c) 287 (d) 319

Which of the following is odd one 4, 12, 44, 176, 890

- (a) 4 (b) 12 (c) 44 (d) 176

10. If in a Certain language, MADRAS is coded as NBESBT, How DELHI is coded in that code?

- (a) EMMJI (b) EFMJI (c) EMFIJ (d) JIFEM

11. Which of the following is odd one?

- (a) CEHL (b) KMPT (c) OQT× (d) NPSV

2019 - NOVEMBER

12. Complete the series.

4, 16, 36, 64, 100 _____.

- (a) **144** (b) 121 (c) 49 (d) 120

13. In a certain code MADRAS is NBESBT now DELHI is coded as:

- (a) EMMJI (b) JIFEM (c) **EFMIJ** (d) CDKGH

14. Find the odd man out 5, 10, 17, 27, 37:

- (a) 5 (b) 17 (c) **27** (d) 10

15. Complete the series

4, 16 _____ 256, 1024

- (a) **32** (b) 48 (c) 64 (d) 46

16. SYSTEM is coded as 131625 then TERMS will be coded as?

- (a) 62251 (b) **62451** (c) 64251 (d) 62415

17. Find the odd one out: 1, 5, 14, 30, 49, 55, 91

- (a) **49** (b) 30 (c) 55 (d) 91

2020 - NOVEMBER

18. Find the missing value in the series 0, 2, 3, 6, 10, 17, 28, ?, 75.

- (a) 58 (b) **46** (c) 48 (d) 54

19. Find the missing value in $\frac{3}{8}, \frac{8}{19}, \frac{18}{41}, ?, \frac{78}{173}$.

- (a) $\frac{37}{84}$ (b) $\frac{40}{87}$ (c) $\frac{39}{86}$ (d) **$\frac{38}{85}$**

20. Which of the following is the odd one: 6, 9, 15, 21, 24, 26, 30.

- (a) 30 (b) 24 (c) **26** (d) 9

21. If health is written as IFBMUL, then how will NORTH be written in that code?

22. Find the wrong term in:

G4T, J10R, M20P, P43N, S90L

- (a) M20P (b) P43N (c) **J10R** (d) G4T

23. Find the next term 1, 5, 21, 57, ... :

- (a) 105 (b) 138 (c) **121** (d) 101

2021 - JANUARY

24. Find the next term $\frac{1}{2}, \frac{3}{4}, \frac{5}{8}, \frac{7}{16}, ?$

- (a) **9/32** (b) 10/17 (c) 11/34 (d) 12/35

25. Find the missing term: P 3 C, R 5 F, T 8 I, V 12 L, ?

- (a) Y170 (b) X17M (c) **X170** (d) X160 (1 mark)

26. Find out the odd man out in the Sequence 8, 25, 64, 125, 216.

- (a) **25** (b) 64 (c) 125 (d) 216

27. In a certain Code Language BEAT is written as YVZG, then what will be Code for MILD?

- (a) ONRW (b) NOWR (c) ONWR (d) **NROW**

28. In a certain code RIPPLE is written as 613382, and LIFE is written as 8192. How will RIFFLE be written in that code?

- (a) 618892 (b) 689912 (c) **619982** (d) 629981

2021 - JULY

29. Choose the missing term in the series.

1, 1, 8, 4, 27, _____ 64, 16

- (a) **27** (b) 11 (c) 9 (d) 125

30. If DELHI is coded as EFMII then JAIPUR is coded as _____

- (a) JQVSBK (b) QVSKBJ (c) BJQVSK (d) **KBJQVS** (1 mark)

31. If FRAME is coded as 0618011305 then ARISE is coded as _____.

- (a) **0118091905** (b) 0119091805 (c) 0118190905 (d) 0118091805

32. The wrong term in the series 225, 196, 169, 144, 121, 100, 77, 64, is:

- (a) 121 (b) **77** (c) 100 (d) 169

33. If CLOCK is coded as 34235 and TIME as 8679, then MOTEL is coded as:

(a) 27894

(b) 72964

(c) **72894**

(d) 77684

2021 - DECEMBER

34. If MOUSE, is coded as 34651 and KEY is coded as 217, then how will YES be coded?

(a) **715**

(b) 517

(c) 175

(d) 571

35. What comes at the last place in R, U, X, A, D

(a) E

(b) F

(c) **G**

(d) H

36. The missing term of the series 4, 13, ..., 49 76 is

(a) 26

(b) **28**

(c) 30

(d) 32

37. Find the odd one from the following:

(a) Zebra

(b) Giraffe

(c) Horse

(d) **Tiger**

38. In a certain code, MENTION is written as LNEITNO. How is PRESENT written in that code?

(a) NTSEREO

(b) OERESTN

(c) ERESTNO (d) ROESTNE

39. If in a certain code "THANKS" is written as "SKNTHA" then how is "STUPID" written?

(a) DIPUTS

(b) DISPUT

(c) DIPUST

(d) **DIPSTU**

2022-JUNE

40. 7, 26, 63, 124, 215, 342 _____ ?

(a) **511**

(b) 672

(c) 508

(d) 556

41. LOTOS is coded as 14682 and STRANGE is coded as 2690753 .how will you code GESTURE .

(a) 5236893

(b) 7326793

(c) 5346893

(d) **5326893**

42. If in a certain code "THANKS" is written as "SKNTHA" then how is "STUPID" written?

(a) DIPUTS

(b) DISPUT

(c) DIPUST

(d) **DIPSTU**

43. 4, 6, 9, 13.5 _____ , 30.375,

(a) **20.25**

(b) 40.450

(c) 70.75

(d) 60.25

44. EARTH is coded as 16235 and VENUS is coded as 91784 .how will you code SATURN .

(a) 423827

(b) **4638267**

(c) 463877

(d) 413827

45. Find out the Next Term – 7, 11, 27, 63, 127, _____ ?

(a) 511

(b) **227**

(c) 5100

(d) 255

46. Find out the Next Term – 3, 7, 15, 31, ?, 127,

- (a)511 (b)227 (c)5100 (d)255
47. Find out the Next Term -6,13,28, 59, _____ ?
- (a) 122 (b)114 (c)113 (d)112

49. If 'FROZEN' is decoded as 'OFAPSG'. Tick the right option that depicts 'MOLTEN' written in this way?

- A. OFPOMN B. OFSMPN C. OFUMPN D. OFUNPN

DEC 2022

50. Find the odd man out:

- 34, 105, 424, 2123, 12756,
- A. 12756 B. 2125 C. 121 D. 34

51. Find the missing number in the following series?

3, 5, 5, 19, 7, 41, 9, ?, 41, 109

- A. 71 B. 61 C. 69 D. 79

52. In certain code language, if TOUR is written as 1294, CL.EAR is written 5078 and SPARE is written as 90847, find the code for CARE?

- A. 1247 B. 4847 C. 5247 D. 5847

53. Find the next number in the given sequence?

11, 17, 39, 85, ?, 281, 447

- A. 133 B. 143 C. 153 D. 163

54. If ROSE is coded as 6821, CHAIR is coded as 73456 and PREACH is coded as 961473, what will be the code for SEARCH?

- A. 246173 B. 214673 C. 216473 D. 214763

JUNE 2023

55. The number in place of question marks in 7,26,63,124, 215, ?, 511,____ is the next number in the given sequence?

- A.342 B. 343 C. 441 D. 421

56. In certain code language, MENTOR written as , LNEITNO . How is PRESENT written in that code ?

- A.QFSETUM B.ONESERP C.QRESTNO D.
OERESTN

57. Find the odd man out:

41, 43, 47, 53,61,71,83,95

A.95 B.83 C. 71 D.53

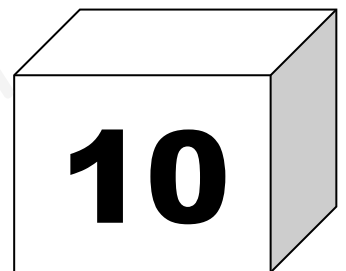
58. Find the Next number in the series Q1F,S2E,U6D, W21C,---?

(a)Y66B (b) Y44B **(c)Y88B** (d) Z66B

59. Find the odd man out:

190,145,136,352,460,324,631,244,

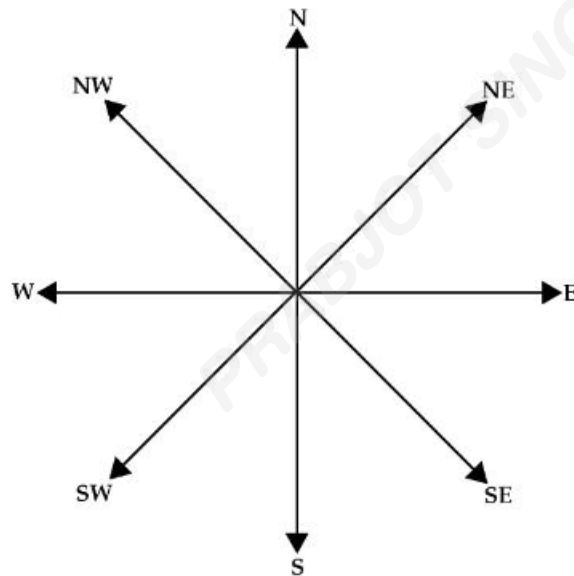
A.136 B.244 C.460 **D.324**



DIRECTION SENSE TEST

♦ In this test, the questions consist of a sort of direction puzzle. A successive follow-up of direction is formulated and the students is required to ascertain the final direction. The test is meant to judge then ability to trace and follow correctly and sense the direction correctly.

♦ The adjoining figure shows the four main directions (North N, South S, East E, and West W) and four cardinal directions (North East (NE), North West (NW), South East (SE), South West (SW) to help the students know the directions.



Always Remember:

Left + left	Down
Left + right	Up
Right + left	Up
Right + right	Down
Up + left	Left
Up + right	Right
Down + left	Right
Down + right	Left

Examples:

1. A man starts from a point and walks 2 km towards North, turns towards his right and walks 2 km, turns right again and walks. What is the direction now be is facing?

- (a) South (b) South-East

- (c) North (d) West

2. Ramu walks 5 kms starting from her house towards west then turns right and walks 3 km. Thereafter she takes left turn and walks 2 km. Further, she turn left and walks 3 km. Finally, she turns right and walks 3 kms. In what direction she is now from her house?

- (a) West (b) North
(c) South (d) East

3. Gopal started walking 2 km straight from his school. Then he turned right and walked 1 km. Again he turned right and walked 1 km to reach his house. If his house is south-east from his school, then in which direction did Gopal start walking from the school?

- (a) East (b) West
(c) South (d) North

4. A man starts from a point, walks 2 km towards north, turns towards his right and walks 2 km, turns right again and walks. What is the direction now he is facing?

- (a) South (b) East
(c) North (d) West

5. Janki started from her house and walked 2 km towards North. Then she took a right turn and covered one kilometre. Then she took again a right turn and walked for 2 kms. In what direction is she going?

- (a) North (b) East
(c) South (d) West

EXERCISE- 10(A)

(Note: Questions are taken from previous exam questions papers of Competitive exams like SSC, RRB, MAT, UPSC etc.)

Choose the appropriate answer (a) or (b) or (c) or (d)

1. Mohan starts from point A and walks 1 km towards south, turns left and walks 1km. Then he turns left again and walks 1 km. Now he is facing.

- (a) East (b) West (c) North (d) South-west

2. Suresh starts from a point, walks 2 miles towards south, turns right and walks 1 ½ miles, turns left and walks V miles and then he turns back. What is the direction he is facing now?

- (a) East (b) West (c) South (d) North

3. A man starts from a point, walks 4 miles towards north and turns left and walks 6 miles,

turns right and walks for 3 miles and again turns right and walks 4 miles and takes rest for 30 minutes. He gets up and walks straight 2 miles in the same direction and turns right and walks one mile. What is the direction he is facing?

- (a) North (b) South (c) South-east (d) West

4. Arun started from point A and walked 10 km East to point B, then turned to North and walked 3 km to point C and then turned West and walked 12 kms to point D, then again turned South and walked 3 kms to point E. In which direction is he from his straight point?

- (a) East (b) South (c) West (d) North

5. A starts from a point and walks 5 kms north, then turns left and walks 3 kms. Then again turns left and walks 5 km. Point out the direction in which he is going now.

- (a) North (b) South (c) East (d) West

6. A rat run 20 towards East and turns to right runs 10 and turns to right runs 9 and again turns to left runs 5 and then turns to left runs 12 and finally turns to left and runs 6. Now what direction is the rat facing?

- (a) East (b) North (c) West (d) South

7. A driver left his village and drove North for 20 km, after which he stopped for breakfast. Then he turned left and drove another 30 km, when he stopped for lunch. After some rest, he again turned left and drove 20 kms before stopping for evening tea. Once more he turned left and drove 30 kms to reach the town where he had supper. After evening tea in which direction did he drive?

- (a) West (b) East (c) North (d) South

8. A man is facing East, then he turns left and goes 10 m, then turns right and goes 5 m then goes 5 m to the South and from there 5 m to West. In which direction is he from his original place?

- (a) East (b) West (c) North (d) South

9. From her home Prerna wishes to go to school. From home she goes towards North and then turns left and then turns right, and finally she turns left and reaches school. In which direction her school is situated with respect to her home?

- (a) North-East (b) North-West (c) South-East (d) South-West

10. A child walks 25 feet towards North, turns right and walks 40 feet, turns right again and walks 45 feet. He then turns left and walks 20 feet. He turns left again walks 20 feet. Finally, he turns to his left to walks another 20 feet. In which direction is the child from his starting point?

- (a) North (b) South (c) West (d) East

11. Raju facing North and moves 20 km, then he turned to his right and moves 20 km and then he moves 10 km in North-East, then he turned to his right and moves 20 km and then he turned to his right and moves 20 km and again he turned to his left and moves 20 km. Now in which direction Rahu is facing?

- (a) South-East (b) North-East (c) South-West (d) North-West

12. K is a place which is located 2 km away in the north-west direction from the capital P. R is another place that is located 2 km away in the south-west direction from K. M is another place and that is located 2 km away in the north-west direction from R. T is yet another place that is located 2 km away in the south-west direction from M. In which direction is T located in relation to P?

- (a) South-west (b) North-west (c) West (d) North

13. Babu is Rahim's neighbour and his house is 200 meters away in the north-west direction. Joseph is Rahim's neighbour and his house is located 200 meter away in the south-west direction. Gopal is Joseph's neighbour and he stays 200 meters away in the south-east direction. Roy is Gopal's neighbour and his house is located 200 meters away in the north-east direction. Then where is the position of Roys' house in relation to Babu's ?

- (a) South-east (b) south-west (c) North (d) North-east

14. A tourist drives 10 km towards west and turns to left and takes a drive of another 4 km. He then drives towards east another 4 km and then turns to his right and drives 5 km . Afterwards he turns to his left and travels 6 km. In which direction is je from the starting point?

- (a) North (b) East (c) West (d) South

15 . A man started walking West. He turned right, then right again and finally turned left. Towards which direction was he walking now?

- (a) North (b) South (c) West (d) East

16. One evening, Raja started to walk toward the Sun. After walking a while, he turned to his right and again to his right. After walking a while, he again turned right. In which direction is he facing?

- (a) South (b) East (c) West (d) North

17. Five boys A, B, C, F, E, are sitting in a park in a circle. A is facing South-West, D is facing South-East, B and E are right opposite A and D respectively and C is equidistant between D and B. Which direction is C facing?

- (a) West (b) South (c) North (4) East

18. If a man on a moped starts from a point and rides 4 km South then turns left and rides 2 km and turn again to the right to ride to go more towards which direction is he moving ?

- (a) North (b) West (c) East (d) South

19. A man starts from a point, walk 8 km towards North, turns right and walks 12 km, turns left and walks 7 km turns and walks 20 km towards South, turns right and walks 12 km. In which direction is he from the starting point?

- (a) North (b) South (c) West (d) East

20. Daily in the morning the shadow of Gol Gumbaz falls on Bara Kaman and in the evening the shadow of Bara Kaman falls on Gol Gumbaz exactly. So in which direction is Gol Gumbaz to Bara Kaman?

- (a) Easter side (b) Western side (c) Northern side (d) Southern side

21. Ashok went 8 km South and turned West and walked 3 km again he turned North and walked 5 kms. He took a final turn to East and walked 3 kms . In which direction was Ashok from the starting point?

- (a) East (b) North (c) West (d) South

22. If X stands on his head with his face towards south, to which direction will his left hand point ?

- (a) East (b) West (c) North (d) South

23. I drove East for 5 miles then drove North 3 miles, then turned to my left and drove for 2 miles and again turned to my left. Which direction am I going now?

- (a) South (b) North (c) West (d) North-west

24. If A stands on his head with his face towards north. In which direction will his left hand point ?

- (a) North-East (b) North (c) East (d) North-West

25. A car travelling from south covers a distance of 8 km, then turns right and runs another 9 kms and again turns to the right and was stopped. Which direction does it face now?

- (a) South (b) North (c) West (d) East

26. A taxi driver commenced his journey from a point and drove 10 km toward north and turned to his left and drove another 5 km. After waiting to meet a friend here, he turned to his right and continued to drive another 10 km. He has covered a distance of 25 km so far, but in which direction would he be now?

- (a) South (b) North (c) East (d) South-east

27. A walks 3 kms northward and then he turns left and goes 2 km. He again turns left and goes 3 km. He turns right and walks straight. In which direction is he walking now?

- (a) East (b) West (c) North (d) South

28. Awalks southeards, then turns right, then left and then right. In which direction is he from the starting point?

- (a) South (b) East (c) West (d) North

29. A man starts from a point, walks 15 metres towards East, turns left and walks 10 metres, turns right again and walks. Towards which direction is he now waking?

- (a) North (b) East (c) West (d) South

30. A boy starts walking towards West, he turns right and again he turns right and then turns left at last. Towards which direction is he walking now?

- (a) West (b) North (c) West (d) East

31. I stand with my right hand extended side-ways towards South. Towards which direction will my back be ?

- (a) North (b) West (c) East (d) South

32. If a person moves 4 km towards west, then turns right and moves 3 km and then turns right and moves 6 km, which is the directions in which he is now moving ?

- (a) East (b) West (c) North (d) South

33. If Mohan sees the rising sun behind the temple and the setting sun behind the railway station from his house, what is the direction of the temple from the railway station?

- (a) South (b) North (c) East (d) West

34. Laxman went 15 km to North then he turned West and covered 10 kms. Then he turned south and covered 5 kms. Finally turning to East he covered 10 kms. In which direction he is from his house?

- (a) East (b) West (c) North (d) South

35. A man starts from a point, walks 4 miles North, turns to his right and walks 2 miles, again turns to his right and walks 2 miles, again turns to his right and walks 2 miles. In

which direction would he be now?

- (a) North (b) South (c) East (d) West

36. I started walking down a road in the morning facing the Sun. After walking for sometime I turned to my left. Then I turned to my right. In which direction was I going then ?

- (a) East (b) West (c) North (d) South

37. Lakshmi walked 2 furlongs north from her house and took a turn to left and continued to walk another one kilometre and finally she turned left and reached the school. Which direction is she facing now?

- (a) West (b) North (c) South (d) North

38. You are going straight, first eastwards, then turn to the right, then right again, then left. In which direction would you be going now?

- (a) East (b) West (c) South (d) North

39. If Ahmed travels towards North from his house, then to left, then to South covering equal distances in each direction to reach Sohan's house, in which direction is Ahmed's house now?

- (a) East (b) South (c) North (d) West

40. You go North, turn right, then right again and then go to the left. In which direction are you now?

- (a) South (b) East (c) West (d) North

41. Roopa starts from a point and walks 15 metre towards west, turns left and walks 12 metre, turns right again and walks. What is the direction she is now facing?

- (a) South (b) West (c) East (d) North

42. A man starts his journey facing the sun early morning. He then turns right and walks 2 km. He then walks 3 km after turning right again. Which is the direction he is facing now?

- (a) North-East (b) North (c) West (d) South

43. Roy walks 2 km to East, then turns North-West and walks 3 km. Then he turns South and walks 5 km. Then again he turns West and walks 2 km. Finally he turns North and walks 6 km. In which direction, is he from the starting point?

- (a) South-West (b) South-East (c) North-West (d) North-East

44. Seeta starts from a point, walks 2 km towards north, turns towards her right and walks 2 km, turns right again and walks. What is the direction she is facing now?

- (a) East (b) West (c) South (d) North

45. Shyam was facing East. He walked 5 km forward and then after turning to his right walked 3 km. Again he turned to his right and walked 4 km. After this he turned back. Which direction was he facing at that time?

- (a) East (b) West (c) North (d) South

46. Raju is standing facing north. He goes 30 metres ahead and turns left and goes for 15 metres. Now he turns right and goes for 50 metres and finally turns to his right and walks. In which direction is he heading?

- (a) North (b) East (c) South (d) West

47. Sanmitra starts from his house and walks 3 km towards north. Then he turns right and walks 2 km and then turns right and walks 5 km, then turns right and walks 2 km and then again turns right and walks 2 km. Which direction is he facing now?

- (a) North (b) South (c) West (d) East

48. Raju is Ramu's neighbour and he stays 100 metres away towards southeast. Venu is Raju's neighbour and he stays 100 metres away towards southwest. Khader is Venu's neighbour and he stays 100 metres away towards, north-west. Then where is the position of Khader's home in relation to Ramu's?

- (a) South-East (b) South-West (c) North-West (d) East

49. Ramesh walked 3 km, towards West and turned to his left and walked 2 km. He, then turned to his right and walked 3 km. Finally, he turned to his right again and walked another 2 km. In which direction is Ramesh from his starting point now?

- (a) East (b) West (c) North (d) South

50. Deepa starts walking north towards and after a while she turns to her right. After walking some distance, she turns to his left and walks a distance of 1 km. She then urns to her left again. In which direction she moving now?

- (a) North (b) West (c) East (d) South

51 . Raman starts walking in the morning facing the Sun. After sometime, he turned to the left later again he turned to his left. At what direction is Raman moving now?

- (a) East (b) West (c) South (d) North

52. A starts walking towards North turns left, again turns left, turns right, again turns right once again turns left. In which direction is A walking now?

- (a) East (b) South (c) West (d) South-East

53. X walks southwards and then turns right, then left and then right,. In which direction is he moving now?

- (a) South (b) North (c) West (d) South-West

54. A man started to walk East. After moving a distance, he turned to his right. After moving a distance, he turned to his right again. After moving a little he turned in the end to his left. In which direction was he going now.?

- (a) North (b) South (c) East (d) West

ANSWERS: EXERCISE 10(A)

1. (c)	2. (d)	3. (b)	4. (c)	5. (b)
6. (b)	7. (b)	8. (c)	9. (b)	10. (d)
11. (a)	12. (c)	13. (a)	14. (d)	15. (a)
16. (a)	17. (d)	18. (d)	19. (b)	20. (a)
21. (d)	22. (b)	23. (a)	24. (c)	25. (a)
26. (b)	27. (b)	28. (a)	29. (b)	30. (b)
31. (b)	32. (a)	33. (c)	34. (c)	35. (a)
36. (a)	37. (d)	38. (c)	39. (a)	40. (b)
41. (b)	42. (c)	43. (c)	44. (c)	45. (a)
46. (b)	47. (a)	48. (c)	49. (b)	50. (b)
51. (b)	52. (a)	53. (c)	54. (b)	

Previous years question

2018-MAY

1. Laxman went 15 km to North then he turned West and covered 10 kms. Then he turned South and covered 5 km. Finally turning to East he covered 10 km. In which direction he is from his house.
(a) East (b) West (c) North (d) South
2. A man is facing East, then he turns left and goes 10 meter then turns right and goes 5 meter then goes 5 meter to the South and from there, 5 meter to West. In which direction is he from his original place?
(a) South (b) North (c) West (d) South-west
3. X walks south words and then turns right, then left and then right. In which direction is he moving now?
(a) East (b) West (c) South (d) North (1 mark)
4. Raman starts walking in the morning facing the Sun. After sometime, he turned to the left, later again he turned to his left. In what direction is Raman moving now?
(a) North (b) West (c) East (d) South
5. I stand with my right hand extended side-ways towards south. Towards which direction will my back be?
(a) South (b) East (c) West (d) North

2018 - NOVEMBER

7. Anoop Starts walking towards South. After walking 15 metres, he turns towards North. After walking 20 metres, he turns towards East and walks 10 metres. He then turns towards south and walks 5 metres. In which direction is he from the original position.
(a) North (b) South (c) East (d) West
8. Rahim started from point X and walked straight 5 km west, then turned left and walked straight 2 km, then again turned left and walked straight 7 km. In which direction is he from the point X?
(a) North-East (b) South-West

(c) South-East

(d) North-West

9. A man started to walk East, After moving a distance, he turned to his right. After moving a distance, he turned to his right again. After moving a little he turned in the end to his left. In which direction was he going now?

(a) East

(b) West

(c) North

(d) South

10. [Manu wants to go to the market. He starts from his house towards North and reaches a crossing after 30m. He turns towards East, goes 10m till the second crossing and turns again, moves towards South straight for 30m where marketing complex exits. In which direction is the market from his house?

(a) North

(b) South

(c) East

(d) West

2019-JUNE

11. Sangeeta leaves from her home. She first walks 30 meters in northwest direction and then 30m in south west direction, next she walks 30 metres in south-east direction. Finally she turns towards her house. In which direction is she moving now?

(a) North – West

(b) North - East

(c) South – East

(d) South – West

12. When a person faces north and walks 25m right then turns left and walks 20m, and again turns right and walks 25m, and turns right, and walks.25m, and turns right and walks 40m, in which direction is he now from his starting point?

(a) North – West

(b) North - East

(c) South – East

(d) South - West

13. Madhuri moved a distance of 75 meters toward north. She then turned to her left and walked for about 25m, turned left again and walked 80m. Finally, she turned to her right at an angle of 45°. In which direction was she moving now?

(a) South – East

(b) South - West

(c) North – West

(d) North - East

14. A person facing North moves 70° in clockwise direction. He again moved 300° in clockwise direction. In which direction is he facing now?

(a) North – West

(b) South - East

(c) North – East

(d) South - West

2019 - NOVEMBER

15. Mohan started from a point and walked towards west. He took left to reach Sohan's house. In which direction should he move to reach his house:

- (a) North east (b) South east
(c) South west (d) North west

16. A man stands on a point and starts walking towards north. He then turns left, then turns right, and then left. In which direction he is moving now?

- (a) West (b) North (c) East (d) South

17. A man started from a point facing north, then turned left, then again left, and then right. In which direction he is facing now?

- (a) East (b) West (c) North (d) South

18. Rohan is driving cycle from house towards north, he turns left and then left again. Which direction he is facing now?

- (a) East (b) West (c) North (d) South

19. Sun rises behind the tower and sets behind the railway station. In which direction is the tower from railway station?

- (a) North (b) South (c) East (d) West

Answer:

(c) Since the sun rises behind the tower. So tower is in east direction, railway station is in west direction since sun sets behind it. So tower is in east direction from the railway station.

2020 - NOVEMBER

20. One day, Ram left home and cycled 10 km southward, turned right and cycled 5 km and turned right and cycled 10 km and turned left and cycled 10 km. How many kilometers will he have to cycle to reach his home straight?

- (a) 10 (b) 15 (c) 20 (d) 25

21. A man is facing west he turns 45 degrees in the clockwise direction and then another 180 degrees in the same direction and then 270 degrees in the anticlockwise direction. Which direction is he facing now?

- (a) South-west (b) North-west (c) West (d) South

22. If you are facing North-east and move 10m forward, man left and move 7.5m, then you are -

- (a) North of your initial position (b) South of your initial position
(c) East of your initial position (d) None of the option (1 mark)

23. A man can walk by having long, medium and short steps. He can cover 60 meters by 100 long steps, 100 meters by 200 medium steps and 80 meters by 200 short steps, he walks

taking 5000 long steps, then he turns left and walk by taking 6000 medium steps. He then turns right and walk by taking 2500 short steps. How far (in meters) is tie away from his starting point?

- (a) 5000 m (b) 4000 m (c) 6000 m (d) 7000 m

2021 - JANUARY

24. A man is facing west. He turns 45° in the clockwise direction and then another 180° in the same direction and then 270° in the anti-clockwise direction. Which is the facing now?

- (a) **South-West** (b) North-West (c) West (d) South

25. One day Ram left home and bi-Cycled 10 km southwards, turned right and travelled 5km and turned right and went 10km he turned left and went 10km how many kilometers he has to cycle to reach his home straight?

- (a) 10 (b) 15 (c) 20 (d) 25

26. Ms. N walks 10km towards North from there she walks 6km towards South. Then she walks 3km towards East. How far and in which direction is she with reference to her starting point?

- (a) 4 km West (b) 6 km West (c) 3 km East **(d) 5 km North/East** (

2021 - JULY

27. There are four towns P, Q, R and T. Q is to the South-West of P, R is to the East of Q and South-East of P and T is to the North of R in line with QP. In which direction of P is T located?

- (a) North **(b) North-East** (c) East (d) South-East

28. One morning after Sunrise, Vikram and Shailesh were standing in a down with their back towards each other. Vikram's shadow fell exactly towards left hand side. Which direction was Shailesh facing?

- (a) South-West (b) West **(c) South** (d) East-South

29. A and B start moving towards each other from two places 200m apad. After walking 60m, B turns left and goes 20m, then he turns right and goes 40 m. He then turns right again and comes back to the road on which he had started walking. If A and B walk with the same speed, what is the distance between them now?

- (a) 80 m (b) 70 m **(c) 40 m** (d) 60 m (1 mark)

30. There are four towns P,Q,R,T, Q is to the south west, of P, R is to the east of Q and south-east of P and T is to the north of R in line with QP In which direction P is located?

- (a) North **(b) North-East** (c) East (d) South-East

31. Five Friends A; B, C, D, E are staying in the same locality. B's house is to the East of A's house and to the North of C's house. C's house is to the West of D's house. D's house is in which direction with respect to A's house?

- (a) North-East (b) South-East
(c) North-West (d) South-West

2021 - DECEMBER

32. A person walks 1 km (kilometre) towards West and then he turns to South and walks 5 km. Again, he turns to West and walks 2 km. After this he turns to North and walks 9 km. How far is he from his starting point?

- (a) 3 km (b) 4 km (c) 5 km (d) 7 km

33. Daily in the morning the shadow of a Clock Tower installed on Railway Station falls on high rise Mall and in the evening the shadow of the same Mall falls on the Clock Tower installed on Railway Station exactly. So in which direction is Clock Tower to Mall?

- (a) Eastern side (b) Western side (c) Northern Side (d) Southern side

34. R's office is 4 km. in East direction from his home and club is 4km. in North direction from his home. On midway from office to club, R starts moving towards his home. In which direction is he facing his back?

- (a) South-East (b) North-West (c) North-East (d) South-West

Answer:

35. A man starts from a point, walks 4 miles towards North and turns left and walks 6 miles, turns right and walks for 3 miles and again turns right and walks 4 miles and takes rest for 30 minutes. He gets up and walks straight 2 miles in the same direction and turns right and walks one mile. What is the direction he is facing?

- (a) North (b) South (c) South-East (d) West

36. The hour hand of a clock is in west direction when time is 3'0 clock What is the direction of minutes hand when time is 6:45?

- (a) East (b) West (c) North (d) South

JUNE 2022

37. A sign Board pointing direction Towards North due to heavy wind .the point of sign word shows west instead of North . if a person Moves to same direction of pointer ,he Moves 100 meter than turn left and moves 100 meter than again turn left and move 100 meter than he turn right & moves 100 meter .in which direction he is now ?

- (a) East (b) West (c) North (d) South

38. If Ramu faces West and Moves 5 Km in the direction then takes a left turn and moves 10 km then take another left and moves 15 km in same direction then moves 10 km in the North direction and reaches Point A. What is the distance the starting point and A and in

which direction is Ramu facing now.

- (a) 10 Km north (b) 5 Km ,South (c) 10 km ,South **(d) 5 km north**

DEC 2022

39. Radha moves towards South-East a distance of 7 km, then she moves towards West and travels a distance of 14 km. From here she moves towards North-West a distance of 7 km and finally she moves a distance of 4 km towards east. How far is she now from the starting point?
- A. 3 km B. 4 km C. 10 km D. 11 km
40. P, Q, R and S are playing a game of carrom. P, R and S, Q are partners, 'S' is to the right of 'R'. If 'R' is facing West, then 'Q' is facing which direction?
- A. South B. North C. East D. West
41. One morning a boy starts walking in a particular direction for 5Km and then takes a left turn and walks another 5Km then after he again takes left turn and walks another 5Km and at last he takes right turn and walks 5Km. Now he sees his shadow in front of him. What direction he did start initially?
- A. South B. North C. West D. East
42. It is a 3'o'clock in a watch. If the minute hand points towards the North-East then the hour hand will point towards the
- A. South B South – West C North – West D. South - East.
43. A man is facing west. He turns 45 degree in the clockwise direction and then another 180 degree in the same direction and then 270 degree in the anticlockwise direction. Find which direction he is facing now?
- A. South-East B. West C. South D. South-West

JUNE 2023

44. Deepika starts walking straight towards East .After walking 65 m , she turns to the left and walk 25m straight again she turns to the left and walk a distance of 40 m .at what distance and in which direction currently she is from the initial point?
- A.35.35 in north east B.35.35 m in south east C.25 m north D. 25 m in west
45. Mr ,Kartik puts his time piece on the table in such a way that at 6: PM , Hours hands points to North , in which direction the minute hand will point at 9: 15 PM.
- A. South-East B. East C. West D. South-West

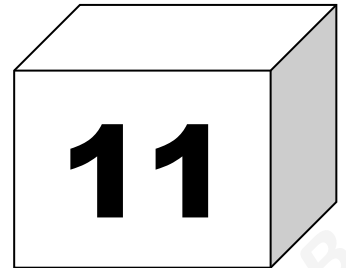
46. Shrikant is Facing East and turns 120 degree in the clockwise direction and then Turn 180

degree degree in the anticlockwise direction. Find which direction Shrikant is facing now?

- A. East B. North –East C. North D. South-West

47. Sunita walks a distance of 2 km towards East and moves 1 km, then, then turns left and moves 2 km and then turn again and moves 1 km, then halts, at what distance sunita is now from the starting point.?

- A. 0km B. 1Km C. 2Km D. 6Km



SEATING ARRANGEMENT

The process of making a group of people to sit as per a prefixed manner is called Seating Arrangement these questions, some conditions are given on the basis of which students are required to arrange objects, either in a row or in a circular order.

INTRODUCTION

BASED ON VARIOUS PATTERN OF SITTING ARRANGEMENTS ARE CLASSIFIED INTO

- 1) Linear Arrangements
- 2) Circular Arrangements
- 3) Polygon Arrangements

EXERCISE 11.A

(Note: Questions are taken from previous exam questions papers of Competitive exams like SSC, RRB, MAT, UPSC etc.)

Choose the appropriate answer (a) or (b) or (c) or (d)

1. Five boys A, B, C, D and E are sitting in a row A is to the right of B and E is to the left of B but to the right of C. A is to the left of D. Who is second from the left end? (U.P.B.Ed 2013)

- (a) D (b) A (c) E (d) B

2. There are five different houses, A to E, in a row. A is to the right of B and E is to the left of C and right of A, B is to the right of D. Which of the houses is in the middle? IB CA (IO) 2013)

- (a) A (b) B (c) C (d) D

3. Five friends P, Q, R, S and T are sitting in a row facing North. Here, S is between T and Q and Q is to the immediate left of R. P is to the immediate left of T. Who is in the middle? (SSC (Multi Task) 2014)

- (a) S (b) T (c) Q (d) R

4. Six children A, B, C, D, E and F are standing in a row. B is between F and D. E is between A and C. A does not stand next to either F or D. C does not stand next to D. F is between which of the following pairs of children? (SSC (FCI) 2012)

- (a) B and E (b) B and C (c) B and D (d) B and A

5. There are eight books kept one over the other. Two books are on Organisation Behaviour, two books on TQM, three books on Industrial Relations and one book is on Economics. Counting from the top, the second, fifth and sixth books are on Industrial Relations. Two books on Industrial Relations are between two books on TQM. One book of Industrial Relations is between two books on Organizational Behaviour while the book above the book of Economics is a book of TQM. Which book is the last book from the top? (MAT 2011)

- (a) Economics (b) TQM
(c) Industrial Relations (d) Organizational Behaviour

6. Five boys are standing in a row facing East. Pavan is left of Tavan, Vipin and Chavan to the left of Nakul. Chavan is between Tavan and Vipin. Vipin is fourth from the left, then how far is Tavan to the right? (CLAT 2014)

- (a) First (b) Second (c) Third (d) Fourth

7. Six persons M, N, O, P, Q and R are sitting in two row with three persons in each row. Both the row are in front of each other. Q is not at the end of any row. P is second the left of R. O is the neighbour of Q and diagonally opposite to P. N is the neighbour of R. Who is in front N? (UPSC (CSAT) 2011)

- (a) R (b) Q (c) P (d) M

8. Six persons A, B, C, D, E and F are sitting in two row, three in each row. (MAT 2011)

- (I) E is not at the end of any row
(II) D is second to the left of F
(III) C, the neighbor of E, is sitting diagonally opposite
(IV) B is the neighbor of F.

Which of the following are in one of the two rows?

- (a) D, B and F (b) C, E and B (c) A, E and F (d) F, B

Direction (Q.No.9): Read the following information carefully and answer that question that follows.

Five boys A₁, A₂, A₃, A₄ and A₅ are sitting in a stair in the following way. (RRB (TC/CC) 2010)

I. A₅ is above A₁.

II. A₄ is under A₂

III. A₂ is under A₁

IV. A₄ is between A₂ and A₃.

9. Who is at the lowest position of the stair?

- (a) A₁ (b) A₃ (c) A₅ (d) A₂

10. Five children are sitting in a row. S is sitting next to P but not T. K is sitting next to R, who is sitting on the extreme left and T is not sitting next to K. Who is/are adjacent to S? (NIFT (UG) 2014)

- (a) K and P (b) R and P (c) Only P (d) P and T

11. Five senior citizens are living in a multi-storeyed building. Mr. Muan lives in a flat above Mr. Ashokan, Mr. Lokesh in a flat below Mr. Gaurav, Mr. Ashokan lives in a flat below Mr. Gaurav and Mr. Rakesh lives in a flat below Mr. Lokesh. Who lives in the topmost flat? (MAT 2013).

- (a) Mr. Lokesh (b) Mr. Gaurav (c) Mr. Muan (d) Mr. Rakesh

12. In a gathering seven members are sitting in a row. 'C' is sitting left to 'B' but on the right to 'D'. 'A' is sitting right to 'B', 'F' is sitting right to 'E' but left to 'D'. 'H' is sitting left to 'E'. Find the person sitting in the middle (SSC (10+2) 2013)

- (a) C (b) D (c) E (d) F

Directions (No: 13-17): Study the following information carefully to answer the given questions.

A to H are seated in straight line facing North. C sits fourth left of G. D sits second to right of G. Only two people sit between D and A. B and F are immediate neighbours of each other. B is not an immediate neighbour of A. H is not neighbour of D. (GIC 2012)

13. Who amongst the following sits exactly in the middle of the persons who sit fifth from the left and the person who sit sixth from the right?

- (a) C (b) H (c) E (d) F

14. Who amongst the following sits third to the right of C?

- (a) B (b) F (c) A (d) E

15. Which of the following represents persons seated at the two extreme ends of the line?

- (a) C, D (b) A, B (c) B, G (d) D, H

16. What is the position of H with respect to F?

- (a) Third to the left (b) Immediate right (c) Second to right (d) Fourth to left

17. How many persons are seated between A and E?

- (a) One (b) Two (c) Three (d) Four

Directions (Q. No. 18-22) (MAT 2012)

Study the following information carefully to answer the given questions.

Ten students are A to J are sitting in a row facing west.

I. B and F are not sitting on either of the edges.

II. G is sitting left of D and H is sitting to the right of J.

III. There are four persons between E and A.

IV. I is the north of B and F is the south of D.

V. J is between A and D and G is in E and F.

VI. There are two persons between H and C.

18. Who is sitting at the seventh place counting from left?

- (a) H (b) C (c) J (d) Either H or C

19. Who among the following is definitely sitting at one of the ends?

- (a) C (b) H (c) E (d) Cannot be determined

20. Who are immediate neighbours of I?

- (a) BC (b) BH (c) AH (d) Cannot determined

21. Who is sitting second left of D?

- (a) G (b) F (c) E (d) J

22. If G and A interchange their positions, then who become the immediate neighbours of E?

- (a) G and F (b) Only F (c) Only A (d) J and H

Directions (Q. Nos. 23-24) Read the following information carefully and then answer the questions that follow.

A group of singers, facing the audience, are standing in line on the stage as follows.

I. D is not right to C

II. F is not standing beside G.

III. B is not left of F

IV. E is not left of A

V. C and B have one person between E and F

VI. There are two persons H and C.

23. Who is on the Second extreme right?

(a) D (b) F (c) G (d) E

24. If we start counting from the left, on which number is B ?

(a) 1st (b) 2nd (c) 3rd (d) 5th

Directions (Q. No. 25- 27): Study the following information carefully to answer the given questions.

Eight persons P to W are sitting in front of one another in two rows. Each row has four persons. P is between U and V and facing North. Q, who is to the immediate left of M is facing W. R is between T and M and W is to the immediate right of V.

(UCO Bank 2011)

25. Who is sitting in front of R?

(a) U (b) Q (c) V (d) P

26. Who is to the immediate right of R?

(a) M (b) U (c) M or (d) None of these

27. In which of the following pairs, persons are sitting in front of each other?

(a) MV (b) RV (c) TV (d) UR

28. Four girls A, B, C, D are sitting around a circle facing the centre. B and C in front of each other, which of the following is definitely true ? (MAT 2009)

(a) A and D in front of each other (b) A is not between B and C

(c) D is left of C (d) A is left of C

ANSWERS

1. (c)	2. (a)	3. (a)	4. (b)	5. (a)	6. (d)	7. (b)
8. (a)	9. (b)	10. (d)	11. (c)	12. (b)	13. (d)	14. (c)

15. (d)	16. (a)	17. (a)	18. (d)	19. (c)	20. (d)	21. (a)
22. (c)	23. (b)	24. (d)	25. (d)	26. (d)	27. (a)	28. (a)

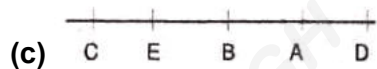
PAST YEAR QUESTIONS

2018-MAY

1. Five boys A,B,C,D and E are sitting in a row. A is to the right of B and E is to the left of B but to the right of C. A is to the left of D. Who is second from the left end?

(a) D (b) A (c) E (d) B

Answer:



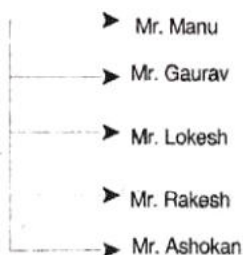
E is the second from the left end.

2. Five senior citizens are living in a multi-storeyed building. Mr. Manu lives in a flat above Mr. Ashokan, Mr. Lokesh in a flat below Mr. Gaurav, Mr. Ashokan lives in a flat below Mr. Gaurav and Mr. Rakesh lives in a flat below Mr. Lokesh. Who lives in the topmost flat?

(a) Mr. Lokesh (b) Mr. Gaurav (c) **Mr. Manu** (d) Mr. Rakesh

Answer:

(c)

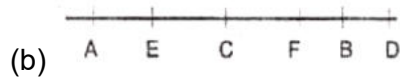


Mr. Manu lives in the top most flat.

3. Six children A, B, C, D, E and F are standing in a row. B is between F and D. E is between A and C. A does not stand next to F or D. C does not stand next to D. F is between which of the following pairs of children?

(a) B and E (b) **B and C** (c) B and D (d) B and A

Answer:



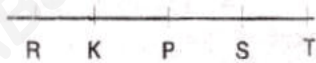
F is between B & C.

4. Five children are sitting in a row. S is sitting next to P but not T. K is sitting next to R, who is sitting on the extreme left and T is not sitting next to K. Who is/are adjacent to S.

(a) K+P (b) R+P (c) Only P **(d) P and T.**

Answer:

(d) The line "S is sitting next to P but not T" is interpreted as "S is sitting next to P, but T is not sitting next to P". By following this logic, the figure is given below:



Therefore, it is clear that P and T are sitting adjacent to S.

Therefore, the answer is option (d).

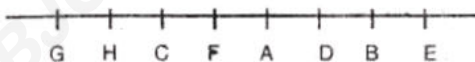
2018-NOVEMBER

5. Eight persons A, B, C, D, E, F, G and H are sitting in a line. E sits second right to D. H sits fourth left to D. C and F are immediate neighbours, but C is not immediate neighbour of A. G is not neighbour of E. Only two persons sit between A and E. The persons on left end and right end respectively are

(a) G and E (b) B and E (c) H and E (d) G and B

Answer:

(a)



The Person on the left end = G

The Person on the right end = E

6. Six children A, B, C, D, E and F are sitting in a row. B is between F and D. E is between A and C. However, A does not sit next to F or D. C does not sit next to D. Then, F is sitting between

(a) B and C (b) E and C (c) B. and D (d) None of the above

Answer:

(a)



F is sitting b/w B and C

7. Five students A, B, C, D and E are standing in a row. D is on the right of E, B is on the left of E but on the right of A. D is next to C on his left. The student in middle is

- (a) B (b) E (c) C (d) A

Answer:

(b)



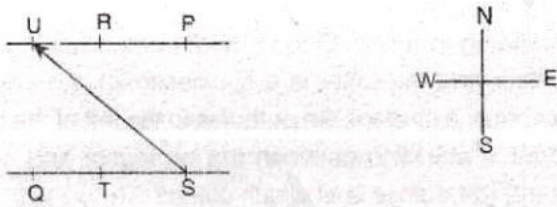
The student in middle is 'E'.

8. Six flats on a floor in two rows facing North and South are allotted to P, Q, R, S, T and U. Q gets a North facing flat and it is not next to S. S and U get diagonally opposite flat. R next to U gets a South facing flat and T gets a North facing flat. Whose flat is between Q and S?

- (a) T (b) U (c) R (d) P

Answer:

(a)



Flat 'T' is b/w Q & S

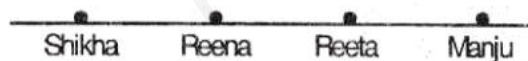
2019 - JUNE

9. Four girls are seated for a photograph. Shikha is to the left of Reena. Manju is to the right of Reena. Reeta is between Reena and Manju. Who is the second left in photograph?

- (a) Reena (b) Manju (c) Reeta (d) Shikha

Answer:

(a)

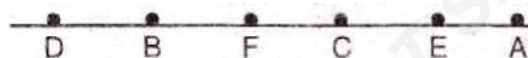


10. In a straight line, there are six persons sitting in a row. B is between F and D. E is between A and C. A does not stand next to F or D, C does not stand next to D. F is between which of the following persons?

- (a) B and E (b) B and C (c) B and D (d) B and A

Answer:

(b)



11. Five children are sitting in a row. S is sitting next to P but not T. K is sitting next to R. K is sitting on extreme end. T is not sitting next to K. Who are sitting adjacent to S?

- (a) K&P (b) R&P (c) Only P (d) P & T

Answer:

(d)

The line "S is sitting next to P but not T" is interpreted as "S is getting next to P, but T is not sitting next to P". By following this logic, the figure is given below:



Therefore, it is clear that P and T are sitting adjacent to S.

Therefore, the answer is option (d).

12. Five boys A, B, C, D and E are sitting in a row. A is to the right of B and E is to the left of B but to the right of C. A is to the left of D. Who is second from the left end?

(a) D (b) A (c) E (d) B

Answer:

(c)



2019 - NOVEMBER

13. Six person are sitting in a circle facing the center. Parikh is between Bablu and Narender; Ashok is between Bablu and Pankaj. Chitra is on the immediate left of Bablu. Who is on the immediate right of Bablu?

(a) Parikh (b) Pankaj

(c) Narender (d) Chitra (1 mark)

Answer:

(a) According to question;



So Parikh is immediate right of Bablu.

14. C is between A and B, E is at the extreme right and D is on the left of E. Who is in the middle?

(a) A (b) B

(c) D (d) E

Answer:

(b) According to question,

A C B D E

So B is in the middle.

15. 5 person are standing in a line. One of the 2 persons at the extreme ends is a professor and the other is a businessman. An advocate is standing to the right of a student. An author is to the left of the business man. The student is standing between the professor and advocate. Counting from left, the author is at which place?

- (a) 2nd (b) 3rd
(c) 4th (d) none

Answer:

(c) According to given ques;

Professor Student Advocate Author Businessman

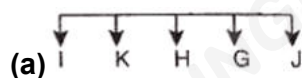
Author is 4th from the left

2020 - NOVEMBER

16. Five girls G, H, I, J, K are sitting in a row facing South not necessarily in the same order H is sitting between G and K, I is immediate right to K, J is immediate left to G. Which of the following is true?

- (a) **J is third to the left of K.**
(b) G is second to the left of I
(c) H is to the right of K
(d) H is to the left of G

Answer:



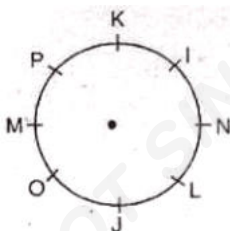
J is the third to the left of 'K'

17. Eight friends I, J, K, L, M, N, O and P are sitting in a circle facing the centre. J is sitting between O and L; P is third to the left of J and second to the right of I; K is sitting between I and O; J & M are not sitting opposite to each other which of the following statements is not correct?

- (a) K is sitting third to the right of L
(b) I is sitting between K and N
(c) **L and I are sitting opposite to each other**
(d) M is sitting between N and L.

Answer:

(c)



L and I are sitting opposite to each other is wrong.

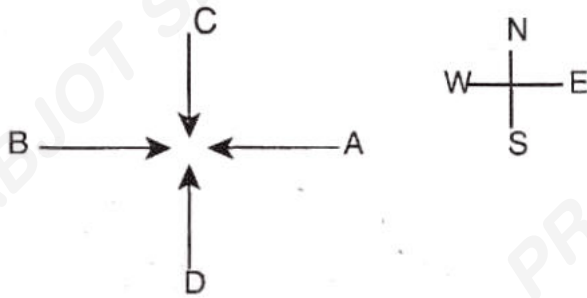
2021 - JANUARY

18. A, B, C and D are playing cards, A and B are partners. D faces towards North. If A faces West, then who faces south?

- (a) C
- (b) B
- (c) D
- (d) Data is inadequate

Answer:

- (a)



If A and B are Partner.

Here A faces towards west then B faces towards east. C and D are also partner.

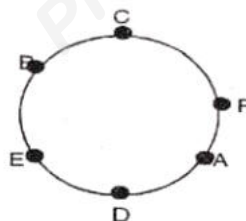
∴ 'D' faces towards North then C faces South direction.

19. A is seated between D and F at a round table. C is seated opposite to D. E is round adjust to D. Who sit opposite to B?

- (a) A
- (b) D
- (c) C
- (d) F

Answer:

- (a)



'A' sits opposite to 'B'.

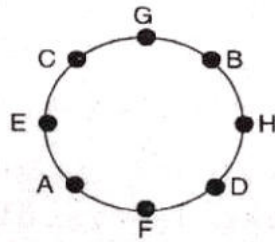
20. Four Indian, A, B, C and D and four Chinese E, F, G and H are sitting in a circle around a table facing the each other in a conference. No two Indians or Chinese are sitting side by side, C who is sitting between G and E is being D, F is between D and A and facing G, H is to the left of B. Who is sitting left of A?

- (a) E
- (b) F
- (c) G

(d) H

Answer:

(a)



'E' is sitting left of A.

21. Five friends A, B, C, D and E are sitting on a bench. A is sitting next to B; C is sitting next to D, D is not sitting with E; E is at the left end of bench. C is on second position from the right; A is on the right side of B who is the right side of E. A and C are sitting together. What is the position of B?

(a) Second from right

(b) Centre

(c) Extreme left

(d) Second from left

Answer:

(d)



B is the second from left.

2021 - JULY

22. Five girls are sitting on a bench to be photographed. Seema is to the left of Rani and to the right of Bindu. Mary is to the right of Rani. Reeta is between Rani and Mary. Who is sitting immediate right to Reeta?

(a) Seema

(b) Rani

(c) Bindu

(d) Mary

Answer:

(d)



(Mary is sitting immediate right to Reeta.)

23. A, B, C, D and E are sitting on the bench. A is sitting next to B, C is sitting to D, D is not sitting with B who is on the left end of the bench. G is on the second position from the right. A is to the right of B and E. A and C are sitting together in which position A

is sitting between?

- (a) C and D
- (b) D and E
- (c) B and C**
- (d) B and D

Answer:

(c)



So A is Sitting in b/w B and C

[24] A, B, C, D, E, F and G are sitting in a row facing north:

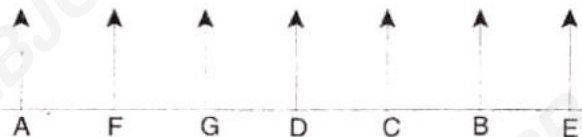
1. F is to the immediate right of E.
2. E is 4th to the right of G.
3. C is the neighbor of B and D.
4. Person who is third to the left of D is at one of ends.

Who are to the right of D?

- (a) E and F only
- (b) G, B and C
- (c) C, B and E**
- (d) G and B only (1 mark)

Answer:

(c)



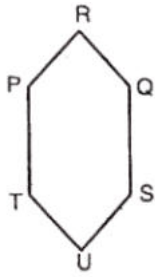
So C, B, E are to the right of 'D'

24. Six friends P,Q,R,S,T and U are sitting around the hexagonal table each at one corner and are facing the centre of the hexagonal. P is second to the left of U.Q is neighbor of R and S. T is second to the left of S. Which one is sitting opposite to S?

- (a) R
- (b) P**
- (c) Q
- (d) S

Answer:

(b)



'P' is sitting opposite to 'S'

2021 - DECEMBER

25. Six children, named as P, Q, R, S, T and U, are sitting in a row, Q is between U and S, T is between P and R, P does not sit next to either U or S. R does not sit next to S. So, U is sitting between the pairs _____ of children.

(a) Q and T

(b) Q and R

(c) Q and S

(d) Q and P

Answer:

(b) P T R U Q S

26. Five persons A, B, C, D and E are sitting in a row. A sits left to C and C sits left to B. E sits right to B, D sits in between E and B. Who is sitting in the middle?

(a) B

(b) C

(c) E

(d) D

Answer:

(a) A C B D E

27. Four ladies A, B, C and D and four Gentlemen E, F, G and H are sitting in a circle around a table facing each other.

I. No two ladies or gentleman are sitting side by side.

II. C, who is sitting between G and E, is facing D.

III. F is between D and A facing G.

IV. H is to the right of B.

Who is immediate neighbour of B?

(a) GandH

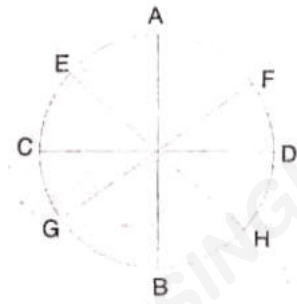
(b) E and F

(c) E and G

(d) A and B

Answer:

(a)



28. Persons M, N, O, P, Q, R, S, and T are sitting on a compound wall facing North. O sits fourth left of S; P sits second to the right of S; only two people sit between P and M; N and R are immediate neighbours of each other. N is not an immediate neighbour of M; T is not the neighbour of P. How many persons are seated between M and Q?

(a) One

(b) Two

(c) Three

(d) Four

Answer:

(a) TONRMSQP

29. In a line, P is sitting 13th from left. Q is sitting 24th from the right and 3rd left from P. How many people are sitting in the line?

(a) 34

(b) 31

(c) 32

(d) **33**

Answer:

(d) Q is sitting 3rd left of P, and Q is the 24th position from the right.

...	10 th	11 th	12 th	13 th	14 th	15 th	...
	Q			P			

Since Q is 24th and 3rd left of P, it means Q is on the 10th place from the left.

This means that counting the position of Q, there are 24 positions to the right.

Therefore, counting from 11th position, there are 23 positions to the right.

Therefore, total number of places = 10 + 23 = 33.

JUNE 2022

30. Five Boys A,B,C,D, E are sitting in a row. A is to the right of B and E is to left of B, But to the Right of C. A is to the left of D. Who is second from left end?

A. C B. E C. A D. D

31. If six persons are sitting in a hexagonal table are P, Q, R, S, T, U each facing the centre. P is seated opposite to Q who is B/w R & S. P is B/w T and U. T is the left of S. Which of them is facing R?

A. P B. Q C. U D. T

DEC2022

32. Six persons A, B, C, D, E, and F are sitting in two rows with three persons in each row. Both rows are in front of each other. E is not at the end of the any row and D is second left to the F. C is neighbour of E and diagonally opposite to D. If B is neighbour of F who is in front of C then who is sitting diagonally to F?

A. C B. E C. A D. D

33. P, Q, R, S and T are sitting in a line facing West. P and Q are sitting together. R is sitting at south end and S is sitting at North end. T is neighbour of Q and P. Who is sitting the middle?

A. P B. Q C. R D. S

JUNE 2023

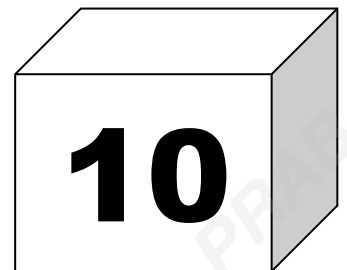
34. Seven friends A, B, C, D, E, F and G watching movie sitting in a row, E is sitting at one extreme End, C is sitting Second to E, B is sitting between A and C. G is not sitting at any Extreme End. A is not at any Extreme End. D is Sitting Immediate to F, Who is sitting in Middle.

(A.) G (B.) D (C.) C D. B

35. Pran, Qomal, Ravi, Shalu, Trilok and Uravi, Vashu and Walter are sitting in a row facing north

- (i) Pran is fourth to the right of Trilok
 - (ii) Walter is fourth to the left of Shalu
 - (iii) Ravi and Uravi which are not at the ends, are neighbors Qomal and Trilok respectively
 - (iv) Walter is immediate left of Pran and Pran is neighbour of Qomal
- Identify who are sitting at the extreme ends.

- (a) Pran and Walter
- (b) Trilok and Uravi
- (c) Trilok and Shalu
- (d) Shalu and Pran



BLOOD RELATION

CHAPTER 12

BLOOD RELATIONS

LEARNING OBJECTIVES

DEFINITION

A person who is related to another by birth rather than by marriage.

Prerequisites:

To remember easily the relations may be divided into two sides as given below:

(i) Relations of Paternal side:

Father's father → Grandfather

Father's mother → Grandmother

Father's brother → Uncle

Father's sister → Aunt

Children of uncle → Cousin

Wife of uncle → Aunt

Children of aunt → Cousin

Husband of aunt → Uncle

(ii) Relations of Maternal side:

Mother's father → Maternal grandfather

Mother's mother → Maternal grandmother

Mother's brother → Maternal uncle

Mother's sister → Aunt

Children of maternal uncle → Cousin

Wife of maternal uncle → Maternal aunty

Relations:

1. Grandfather's son	• Father or Uncle

2.	Grandmother's son	• Father or Uncle
3.	Grandfather's only son	• Father
4.	Grandmother's only son	• Father
5.	Mother's or father's mother	• Grandmother
6.	Son's wife	• Daughter-in-Law
7.	Daughter's husband	• Son-in-Law
8.	Husband's or wife's sister	• Sister-in-Law
9.	Brother's son	• Nephew
10.	Brother's daughter	• Niece
11.	Uncle or aunt's son or daughter	• Cousin
12.	Sister's husband	• Brother-in-Law
13.	Brother's wife	• Sister-in-Law
14.	Granson's or grand daughter's daughter	• Great grand Daughter

The efficiency in doing the problems of blood relations depends upon the knowledge of the blood relations. Some of the important relations are given below:

- a) My mother's or father's son is my Brother.
- b) My mother's or father's daughter is my Sister.
- c) My mother's or father's father is my Grandfather.
- d) My mother's or father's sister is my Aunt.
- e) My mother's or father's brother is my Uncle.
- f) My son's wife is my Daughter-in-law.
- g) My daughter's husband is my Son-in-law.
- h) My brother's son is my Nephew.
- i) My brother's daughter is my Neice.
- j) My sister's husband is my Brother-in-law.

- k) My brother's wife is my Sister-in-law.
- l) My husband's wife's sister is my Sister-in-law.
- m) My husband's or wife's brother is my Brother-in-law.
- n) My uncle's or aunt's son or daughter is my Cousin.
- o) My wife's father or husband's father is my Father-in-law.
- p) My wife's mother or husband's mother is my Mother-in-law. My father's wife is my Mother.
- q) My mother's husband is my Father.
- r) My son's or daughter's son is my Grandson.
- s) My son's or daughter's daughter is my Grand-daughter.

Different types of questions :

- (1) A is B's daughter, B is C's mother. D is C's brother. How is D related to A?
 (a) Father (b) Grandfather (c) Brother (d) Son
- (2) P is Q's brother. R is Q's mother. S is R's father. T is S's mother. How is P related to T?
 (a) Grand-daughter (b) Great grandson (c) Grandson (d) Grandmother
- (3) A is B's brother. C is D's father. E is B's mother. A and D are brothers. How is E related to C?
 (a) Sister (b) Sister-in-law (c) Niece (d) Wife
- (4) A is the sister of B. B is the brother of C. C is the son of D. How is D related to A?
 (a) Mother (b) Daughter (c) Son (d) Uncle
5. B is the brother of A. whose only sister is mother of C. D is maternal grandmother of C. How is A related to D?
 (a) Daughter-in-law (b) Daughter (c) Aunt (d) Nephew
6. A and B are sisters. R and S are brothers. A's daughter is R's sister. What is B's relation to S?
 (a) Mother (b) Grandmother (c) Sister (d) Aunt

7. E is the sister of B. A is the father of C. B is the son of C. How is A related to E?

- (a) Grandfather (b) Grand-daughter (c) Father (d) Great-grandfather

8. Given that:

A is the mother of B.

C is the son of A.

D is the brother of E.

E is the daughter of B.

Who is grandmother of D?

- (a) A (b) B (c) C (d) D

9. A is D's brother. D is B's father. B and C are sisters. How is A related to C?

- (a) Son (b) Grandson (c) Father (d) Uncle

10. A is B's sister. C is B's mother. D is C's father. E is D's mother, then how A is related to D?

- (a) Grandfather (b) Daughter (c) Grandmother (d) Granddaughter

11. (i) F is the brother of A.

(ii) G is the daughter of A.

(iii) K is the sister of F.

(iv) G is the brother of C.

Who is the uncle of G?

- (a) A (b) C (c) K (d) F

12. A is father of C and D is son of B. E is brother of A. If C is sister of D how is B related to E?

- (a) Sister-in-law (b) Sister (c) Brother (d) Brother-in-law

13. C is wife of B. E is the son of C. A is the brother of B and father of D. What is the relationship of E to D?

- (a) Mother (b) Sister (c) Brother (d) Cousin

14. M is the son of P. Q is the grand-daughter of O, who is the husband of P. How is M related to O?

- (a) Son (b) Daughter (c) Mother (d) Father

15. X and Y are brothers. R is the father of Y. S is the brother of T and maternal uncle of X. What is T to R?

- (a) Mother (b) Wife (c) Sister (d) Brother

EXERCISE 12 (A)

(Note: Questions are taken from previous exam questions papers of Competitive exams like SSC, RRB, MAT, UPSC etc.)

Choose the appropriate answer (a) or (b) or (c) or (d)

1. A is B's brother. C is A's mother. D is C's father, E is B's son. How is D related to A?

- (a) Son (b) Grandson (c) Grandfather (d) Great Grandfather

2. As is B's brother. C is A's father. D is C's sister and E is D's mother. How is B related to E?

- (a) Grand-daughter (b) Great grands daughter
(c) Grandaunt (d) Daughter

3. A is B's Sister. C is B's Mother. D is C's Father. E is D's Mother. Then how is A related to D?

- (a) Grandmother (b) Grandfather (c) Daughter (d) Grands-daughter

4. A is the father of B. C is the daughter of B. D is the brother of B. E is the son of A. What is the relationship between C and E?

- (a) Brother and sister (b) Cousins (c) Niece and uncle (d) Uncle and aunt

5. If P is the husband of Q and R is the mother of S and Q. What is R to P?

- (a) Mother (b) Sister (c) Aunt (d) Mother-in-law

6. P and Q are brothers. R and S are sister. P's son is S's brother. How is Q related to R?

- (a) Uncle (b) Brother (c) Father (d) Grandfather

7. X is the husband of Y. W is the daughter of X. Z is husband of W. N is the daughter of Z. What is the relationship of N to Y?

- (a) Cousin (b) Niece (c) Daughter (d) Grand-daughter
8. A reads a book and find the name of the author familiar. The author 'B' is the paternal uncle of C. C is the daughter of A. How is B related to A?
- (a) Brother (b) Sister (c) Father (d) Uncle
9. A's mother is sister of B and she has a daughter C who is 21 years old. How is B related to D?
- (a) Uncle (b) Maternal Uncle (c) Niece (d) Daughter
10. A is B's brother. C is A's mother. D is C's father. F is A's son. How is F related to D?
- (a) Son (b) Grandson (c) Grand-grandson (d) Grand-daughter
11. A is B's brother. C is A's mother. D is C's father. E is B's son. How is B related to D?
- (a) Son (b) Grand-daughter (c) Grandfather (d) Great grandfather
12. A is B's brother. C is A's mother. D is C's father. F a is A's son. How is B related to F's child?
- (a) Aunt (b) Cousin (c) Nephew (d) Grandfather
13. A is B's daughter. B is C's mother. D is C's brother. How is D related to A?
- (a) Father (b) Grandfather (c) Brother (d) Son
14. A is D's brother. D is B's father. B and C are sisters. How is C related to A?
- (a) Cousin (b) Niece (c) Aunt (d) Nephew
15. A is B's brother. C is A's mother, D is C's father. E is B's son. How is D related to E?
- (a) Grandson (b) Great Grandson (c) Great Grandfather (d) Grandfather
16. X and Y are the children of A. A is the father of X but Y is not his son. How is Y related to A?
- (a) Sister (b) Brother (c) Son (d) Daughter
17. A is B's brother. C is A's mother. D is C's father. E is B's son. How is E related to A?
- (a) Cousin (b) Nephew (c) Uncle (d) Grandson
18. Based on the statements given below, find out who is the uncle of P?
- (i) K is the bother of J
- (ii) M is the sister of K
- (iii) P is the brother of N
- (iv) N is the daughter of J

- (a) K (b) J (c) N (d) M
19. A and B are sisters. A is mother of D. D has a daughter C who is married to F. G is the husband of A. How is C related to D?
- (a) Cousin (b) Niece (c) Aunt (d) Sister-in-law
20. R and S are brothers. X is the sister of Y and X is mother of R. What is Y to S?
- (a) Uncle (b) brother (c) Father (d) Mother
21. A is B's brother. C is A's mother. D is C's father. B and D's grand-daughter. How is B related to D. Who is A's son?
- (a) Aunt (b) Cousin (c) Niece (d) Grand aunt
22. A is the son of B while B and C are sisters to one another. E is the mother of C. If D is the son of E. which of the following statements is correct?
- (a) D is the maternal uncle of A (b) E is the brother of B
- (c) D is the cousin of A (d) B and D are brothers
23. P is the father of T. T is the daughter of M. M is the daughter of K. What is P to K?
- (a) Father (b) Father-in-law (c) Brother (d) Son-in-law
24. A and B are brothers. E is the daughter of F. F is the wife of B. What is the relation of E to A?
- (a) Sister (b) Daughter (c) Niece (d) Daughter
25. M and F are a married couple. A and B are sisters. A is the sister of F. Who is B to M?
- (a) Sister (b) Sister-in-law (c) Niece (d) Daughter
26. If A is the mother of D. B is not the son of C. C is the father of D, D is the sister of B, then how is A related to B?
- (a) Mother (b) Brother (c) Step son (d) Sister
27. A and B are brother and sister respectively. C is A's father. D is C's sister and E is D's mother. How is B related to E?
- (a) Grand-daughter (b) Great grand-daughter
- (c) Aunt (d) Daughter
28. Q is the son of P. X is the daughter of Q. R is the aunty (Bua) of X and L is the son of R, then what is L to P?
- (a) Grandson (b) Grand-daughter (c) Daughter (d) Nephew
29. P and Q are brothers. R and S are sisters. P's son is S's brother. How is Q related to R?

- (a) Uncle (b) Brother (c) Father (d) Grandfather
30. A and B are the young ones of C. If C is the mother of B but A is not the daughter of C, then what is the relationship between C and A?
- (a) Nephew and Aunt (b) Brother and Sister
- (c) Mother and son (d) Niece and Aunt
31. A is the mother of D and sister of B. B has a daughter C who is married to F. G is the husband of A. How is G related to D?
- (a) Uncle (b) Husband (c) Son (d) Father
32. Pointing towards A, B said "your mother is the younger sister of my mother". How is A related to B?
- (a) Uncle (b) Cousin (c) Nephew (d) Father
33. A is B's wife's husband's brother. C and D are sisters of B. How is A related to C?
- (a) Brother (b) Sister-in-law (c) Wife (d) Sister
34. A and B are brothers. C and D are sisters. A's son is D's brother. How is B related to C?
- (a) Father (b) Brother (c) Uncle (d) Son
35. A is B's sister. C is B's mother. D is C's father. E is D's mother. Then how is A related to D?
- (a) Grandmother (b) Grandfather (c) Daughter (d) Grand-daughter
36. P, Q, R, S, T, U are 6 members of a family in which there are two married couples. T, a teacher is married to a doctor who is mother of R and U. Q the lawyer is married to P. P has one son and one grandson. Of the two married ladies one is a housewife. There is also one student and one male engineer in the family. Which of the following is true about the grand-daughter of the family?
- (a) She is a lawyer (b) She is an engineer
- (c) She is a student (d) She is a doctor
37. Six members of a family namely A, B, C, D, E and F are travelling together. 'B' is the son of C but C is not the mother of B. A and C are married couple. E is the brother of C. D is the daughter of A. F is the brother of B. How many male members are there in the family?
- (a) 3 (b) 2 (c) 4 (d) 1
38. A's mother is sister of B and has a daughter C. How can A be related to B from among the following?
- (a) Niece (b) Uncle (c) Daughter (d) Father
39. Rajiv is the brother of Atul. Sonia is the sister of Sunil. Atul is the son of Sonia. How is

Rajiv related to Sonia?

- (a) Nephew (b) Son (c) Brother (d) Father

40. Sita is the niece of Ashok. Ashok's mother is Lakshmi. Kalyani is Lakshmi's mother. Kalyani's husband is Gopal. Parvathi is the mother-in-law of Gopal. How is Sita related to Gopal?

- (a) Great grandson's daughter (b) Gopal's Sita's father
(c) Sita is Gopal's great grand-daughter (d) Grand niece

41. Seema is the daughter-in-law of Sudhir and sister-in-law of Ramesh. Mohan is the son of Sudhir and only brother of Ramesh. Find the relation between Seema and Mohan.

- (a) Sister-in-law (b) Aunt
(c) Cousin (d) Wife

42. Suresh introduces a man as "He is the son of the woman who is the mother of the husband of my mother". How is Suresh related to the man?

- (a) Uncle (b) Son (c) Cousin (d) Grandson

43. Pointing to a lady in a photograph. Meera said. "Her father's only son's wife is my mother-in-law "How is Meera's husband related to that lady in the photo?

- (a) Nephew (b) Uncle (c) Son (d) Father

44. Pointing to a photograph Vikas said "She is the daughter of my grandfather's only son". How is the related to Vikas in the photograph?

- (a) Father (b) Brother (c) Sister (d) Mother

45. Suresh's sister is the wife of Ram. Ram is Rani's brother. Ram's father is Madhur. Sheetal is Ram's grandmother. Rema is Sheetal is daughter-in-law. Rohit is Rani's brother's son. Who is Rohit to Suresh?

- (a) Brother-in-law (b) Son
(c) Brother (d) Nephew

46. Vinod introduces Vishal as the son of the only brother of his father's wife. How is Vinod related to Vishal?

- (a) Cousin (b) Brother (c) Son (d) Uncle

47. Among her children, Ganga's favourites are Ram and Rekha. Rekha is the mother of Sharat, who is loved most by his uncle Mithun. The head of the family is Ram Lal, who is succeeded by his sons Gopal and Mohan. Gopal and Ganga have been married for 35 years and have 3 children. What is the relation between Mithun and Mohan?

- (a) Uncle (b) Son (c) Brother (d) No relation

48. Rahul and Robin are brothers. Promod is Rohin's father. Sheela is Pramod's sister. Prema is Promod's niece. Shubha is Sheela's grand-daughter. How is Rahul related to

Shubha?

- (a) Brother (b) Cousin (c) Uncle (d) Nephew

49. Preeti has a son, named Arun. Ram is Preeti's brother. Neeta too has a daughter named Reema. Neeta is Ram's sister. What is Arun's relationship to Reema?

- (a) Brother (b) Nephew (c) Cousin (d) Uncle

50. There are 2 firm stars. One is the father of the other's son. What is the relationship of the two with each other?

- (a) Grandfather and Grandson (b) Grandfather and son
(c) Husband and wife (d) Father and Son

51. Ramu's mother said to Ramu, "My mother has a son whose son is Achyut". How is Achyut relation to Ramu?

- (a) Uncle (b) Cousin (c) Brother (d) Nephew

52. Ravi's father has a son Rohit who has an aunt Laxmi who has a husband Rao whose father-in-law is Mohan. What is the relation of Mohan to Ravi?

- (a) Nephew (b) Grandfather (c) Son (d) Uncle

53. Vijay says, Ananda's mother is the only daughter of my mother". How is Ananda relation to Vijay?

- (a) Brother (b) Father (c) Nephew (d) Grandfather

54. Introducing a man, a woman said, "His wife is the only daughter of my mother." How is the woman related with the man?

- (a) Sister-in-law (b) Wife (c) Aunt (d) Mother-in-law

55. A prisoner introduced a boy who came to visit him to the jailor as "Brothers and sisters I have none, he is my father's son's son". Who is the boy?

- (a) Nephew (b) Son (c) Cousin (d) Uncle

ANSWERS EXERCISE 12(A)

1. (c)	2. (a)	3. (d)	4. (c)
5. (d)	6. (a)	7. (d)	8. (a)
9. (b)	10. (c)	11. (b)	12. (d)
13. (c)	14. (b)	15. (c)	16. (d)
17. (b)	18. (a)	19. (a)	20. (a)
21. (a)	22. (a)	23. (d)	24. (c)
25. (b)	26. (a)	27. (a)	28. (a)
29. (a)	30. (c)	31. (d)	32. (b)
33. (a)	34. (c)	35. (d)	36. (c)
37. (c)	38. (a)	39. (b)	40. (c)
41. (d)	42. (b)	43. (a)	44. (c)
45. (d)	46. (a)	47. (d)	48. (c)
49. (c)	50. (d)	51. (b)	52. (b)
53. (c)	54. (b)	55. (b)	

PAST YEARS QUESTION

2018-MAY

[1] Vinod introduce Vishal as the son of the only brother of his father's wife. How is Vinod related to Vishal?

- (a) Cousin (b) Brother
(c) Son (d) Uncle (1 mark)

Answer:

(a) Vinod Introduces Vishal as the Son of the only brother of his father's wife then Vinod is cousin of Vishal.

[2] Suresh introduces a man as "he is the son of the woman who is the mother of the husband of my mother". How is Suresh is related to the man?

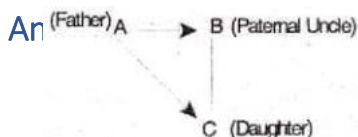
- (a) Brother-in-law (b) Son
(c) Brother (d) Nephew (1 mark)

Answer:

(b) Suresh introduces a man as "he is the son of the woman who is the mother of the husband of my mother". Then Suresh is the 'Son' of the man.

[3] A reads a book and find the name of the author familiar. The author 'B' is the paternal uncle of C. C is the daughter of A. How is B related to A?

- (a) Brother (b) Sister
(c) Father (d) Uncle (1 mark)



[4] A prisoner introduced a boy who came to visit him to the jailor as "Brothers and sisters I have none, he is my father's son's son". Who is the boy?

- (a) Nephew (b) Son
(c) Cousin (d) Uncle (1 mark)

Answer:

- (b) 'Son'

2018 - NOVEMBER

[5] Pointing to a man in a photograph, a woman said, "the father of his brother is the only son

of my grandfather", how is the woman related to the man in the photograph?

(a) Mother (b) Aunt

(c) Daughter (d) Sister (1 mark)

Answer:

(d) The father of his brother is the only son of my grandfather. So the woman is man's sister.

Explanation: Only son of woman's grandfather = woman's father Man's brother's father = man's father so. The woman is man's sister.

[6] Six persons are seen together in a group. They are A, B, C, D, E and F. B is the brother of D, but D is not brother of B. F is the brother of B, C and A are married together. F is son of C, but C is not the mother of F. E is the brother of A. The number of female members in the group is:

(a) 1 (b) 2

(c) 3 (d) 4 (1 mark)

Answer:

(b) B is the brother of D, but D is not the brother of B. This means that D is the sister of B, and hence D is female. F is brother of B, and hence F is male. F is the son of C, but C is not the mother of F, implying that C is the father of F, and hence C is male. Since C and A are married together and C is a male, therefore, A is female. E is the brother of A, therefore, E is male. Therefore, we have 2 female members - D and A.

[7] Ram and Mohan are brothers, Shankar is Mohan's father. Chhaya is Shankar's sister. Priya is Shankar's niece. Shubhra is Chhaya's grand daughter. How is Ram related to Shubhra?

(a) Brother (b) Uncle

(c) Cousine (d) Nephew (1 mark)

Answer:

(b) Let me be Ram. Mohan is my brother. Shankar is Mohan's father, i.e., my brother's father, and hence, my father, Chhaya is my father's sister, hence, my aunt. Priya is Shankar's niece, i.e., my father's niece, and hence, my cousin. Shubhra is Chhaya's grand-daughter, i.e., my aunt's grand-daughter, and hence, my niece. Therefore, I'm Shubhra's uncle.

[8] If $P + Q$ means P is the mother of Q; $P \div Q$ means P is the father of Q; $P - Q$ means P is the sister of Q; then which of the following relationship shows that M is the daughter of R?

(a) $R \div M + N$ (b) $R + N \div M$

(c) $R - M \div N$ (d) None of the above (1 mark)

Answer:

(a) M is the daughter of R implies that R is the mother/father of M. As given in the question, we can see that $P \div Q$ means that P is the father of Q. Also, when we look at option (a), it says $R \div$

M. This means that R is the father of M, and hence M is the daughter of R.

2019 - JUNE

[9] Pointing to a woman in a picture, Sumit said, she is the mother of my son's wife's daughter. How is lady related to the Sumit?

- (a) Uncle
- (b) Cousin
- (c) Daughter
- (d) None (1 mark)

Answer:

(d) Let me be Sumit. Now, there's some lady, who is the mother of my son's wife's daughter. My son's wife's daughter means, my son's daughter, and hence my grand daughter. The mother of my grand daughter (from my son) would be my daughter in law. Therefore, option (d) is the answer.

[10] Pointing to a man in a photograph, a man said "His mother's husband's sister is my aunt". Then what is relation between that man and him?

- (a) Son
- (b) Uncle
- (c) Nephew
- (d) Brother (1 mark)

Answer:

(d) Let me be the man who points to the photograph. Now, there's a man in the photo, who's mother's husband's sister is my aunt. Therefore, that "aunt" is my aunt, as she is somebody's husband's sister. (If she would have been somebody's sister's sister, she would have been my mausi). Now, clearly, the husband would be my father, and hence the mother would be my mother. Therefore, that man in the photograph is my mother's son, and hence, my brother.

[11] Pointing in a photograph, Sonia said, "His mother's only daughter is my mother. How is Sonia related to that man?"

- (a) Nephew
- (b) Sister
- (c) Wife
- (d) Niece (1 mark)

Answer:

(d) Let me be Sonia. Now, there's some man, who's mother's only daughter is my mother. My mother's mother would be my grandmother, and her son, i.e., my mother's brother, would be my uncle. Therefore, I'm that man's niece.

2019 - NOVEMBER

[For questions 14-16]

A, B, p, D, E and F are members of a family. B is the son of A but A is not the mother of B, A and C are married couple. F is the brother of A. D is the sister of B, E is the son of C.

[12] How many male members are there in the family.

- (a) 1
- (b) 2
- (c) 3
- (d) 4 (1 mark)

[13] How is F related to B?

- (a) Uncle
- (b) Daughter
- (c) Son
- (d) Niece (1mark)

[14] How many children does A have?

- (a) 3
- (b) 2
- (c) 4
- (d) 1 (1 mark)

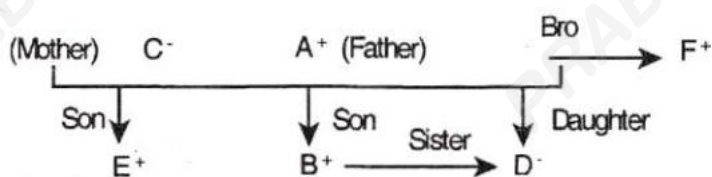
Answer:

For question

[16-18](+) →

male

(-) → female



[14] (d) B is the son of A implies that B is male. A is not the mother of B implies that A is the father of B, and hence A is also male. A and C are married couple. We know that A is male, therefore, C is female. F is the brother of A, and hence, F is also male. E is the son of C, therefore, E is also male. Therefore, there are 4 male members - B, A, F, and E.

[15] (a) Let me be F. F is the brother of A, implies that A is my brother (we already know that A is male from the above question). B is the son of A, i.e., B is the son of my brother, therefore, B is my nephew, and hence, I'm B's uncle.

[16] (a) B is the son of A.

D is the sister of B, implies that B is also a child of A.

E is the son of C, and C is the wife of A, therefore, E is the son of A.

Therefore, A has 3 children.

2020 - NOVEMBER

[17] Point out a Lady Sohil said she is the daughter of vyoman. Who is the mother of the husband of my mother. Who is the lady to Sohil?

- (a) Sister
- (b) Aunt
- (c) Daughter
- (d) Sister-in-Law (1 mark)

Answer:

(b)

I ⁺	G ⁻
↓	↓
E ⁻	C ⁺
↓	↓
K	A

∴ E is the mother of A.

[18] Pointing towards a person, A man said to woman, "His mother is the only daughter of your father". How is the woman related to that person?

- (a) Mother
- (b) Daughter
- (c) Sister
- (d) Wife (1 mark)

Answer:

(a) Daughter of your father - your sister. So person's mother is women's sister or the women is person's aunt.

So women is the mother of that person.

[19] Vicky introduces John as the son of the only brother of his father's wife. How is Vicky related to John?

- (a) Son
- (b) Cousin
- (c) Uncle
- (d) Brother (1 mark)

Answer:

(b) Only brother of his father's wife is your maternal uncle and the son of your maternal uncle is your cousin.

So, Vicky is cousin of John.

[20] Pointing to a lady, A said, "that woman is my nephew's maternal grandmother". How is that woman related to A's sister who has no sister?

- (a) Cousin
- (b) Son-in-law
- (c) Mother
- (d) Mother-in-law (1 mark)

Answer:

(c) Clearly, the lady is the grandmother of man's sister's son i.e., the mother of the mother of man's sister son i.e., the mother of man's sister. So, the lady is man's mother.

[21] Pointing out to a lady, Sahil said, "she is the daughter of the woman who is the mother of the husband of my mother". Who is the lady to Sahil?

- (a) Aunt
- (b) Sister
- (c) Daughter
- (d) Sister-in-law (1 mark)

Answer:

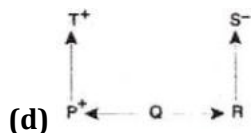
(a) The mother of the husband of my mother =*• my grandmother my grandmother's daughter -my aunt so lady is Sahil's Aunt.

2021 - JANUARY

[22] P is the brother of Q and R, S is the mother of R. T is the father of P, Which of the following statement cannot be definitely true?

- (a) S is the mother of P
- (b) P is son of S
- (c) T is husband of S
- (d) Q is son of T (1 mark)

Answer:



Here Q is the

Son/Daughter of T So (d)

option is not definite.

[23] A girl introduced a boy as the son of the daughter of father of her uncle. The boy is girl's

- (a) Son
- (b) Brother
- (c) Son-in-Law

(d) Uncle (1 mark)

Answer:

(b)

Daughter of uncle's father

→

Uncle's Sister

→

mother

mother's son

→

Brother

[24] Pointing to a lady, Sahil said, "She is the daughter of the woman who is the mother of the husband of my mother". Who is the lady to Sahil?

(a) Aunt

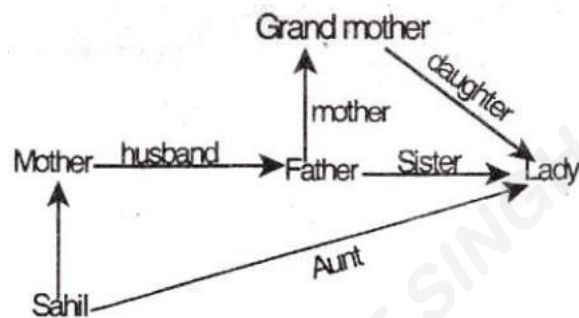
(b) Sister

(c) Daughter

(d) Sister-in-Law (1 mark)

Answer:

(a)



2021 - JULY

[25] Shyam's mother said to Shyam "My mother has a son whose son is Ram". Shyam is related to Ram as.

(a) Uncle

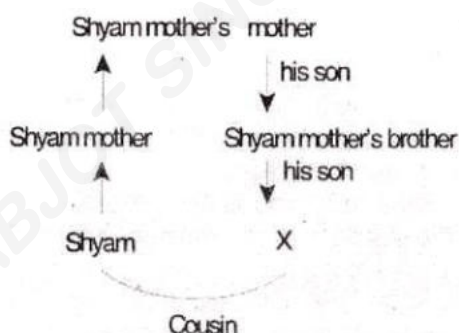
(b) Cousin

(c) Nephew

(d) Grandfather (1 mark)

Answer:

(b)



Shyam is Ram's Cousin

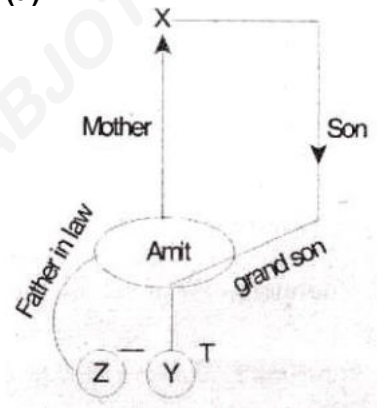
[26] Amit said "This girl is the wife of the grandson of my mother". How Amit related to the girl?

- (a) Father-in law
- (b) Grandson
- (c) Father
- (d) Son (1 mark)

Answer:

(a)

'Amit is the father in-law'



[27] A is the son C, C and Q are sister, Z is the mother of Q and P is the son of Z. Which of the following statement is true?

- (a) A and P are cousins
- (b) C and P are sisters
- (c) P is the maternal uncle of A
- (d) A is the maternal uncle of P (1 mark)

Answer:

(c)

P is the Maternal uncle of A

[28] Pointing towards "A", "B" said : your mother is the younger sister of my mother".
"A" is related to "B" as.

- (a) Uncle
- (b) Cousin
- (c) Nephew
- (d) Father (1 mark)

Answer:

(b)



A and B are cousins

∴ X and Y are sisters

2021 - DECEMBER

[29] D is daughter of E. A is son of D. C is a brother of A and B is the sister of A. F is the brother of D. How F is related to B?

- (a) Father-in-law (b) Uncle**
- (c) Brother (d) Mother-in-law (1 mark)**

Answer:

(b) Let me be B. Since I'm the sister of A, A is my brother. Since A {my brother} is the son of D, D is my mother. Since F is the brother of D (my mother), F is my maternal uncle.

[30] Introducing a boy a girl said, "He is the son of the daughter of the father of my uncle". Who is the boy to the girl?

- (a) Brother (b) Nephew**
- (c) Uncle (d) Son-in-law (1 mark)**

Answer:

(a) Let me be the girl introducing the boy. If the uncle is paternal, then the father of my uncle would be my grandfather (Dadaji), and hence his daughter would be my aunt (Bua). Son of my Bua would be my cousin. However, cousin is not in the options.

If the uncle is maternal, then the father of my uncle would be my grandfather (Nanaji), and hence his daughter could either be my Mother, or my Aunt (Mausi). Again, if the daughter is my Aunt, then her son would be my cousin, and cousin is not in the options. If the daughter is my Mother, then her son would be my brother. Therefore, option (a) is the answer.

[31] It is given that "A is the mother of B; B is the sister of C; C is the father of D". How is A related to D?

- (a) Mother (b) Grandmother**

(c) Aunt (d) Sister (1 mark)

Answer:

(b) Let me be D. C is my father. B, my father's sister, is my Aunt. A, my aunt's mother, would be my Grandmother.

Let me be R's friend. Now, my mother's brother-in-law would be either my paternal uncle, or my maternal aunt's husband. Either way, the daughter would be my cousin.

[32] P, Q, R, S, T, U are 6 members of a family in which there are two married couples. T, a teacher is married to a doctor who is mother of R and U. Q the lawyer is married to P. P has one son and one grandson. Of the two married ladies one is a housewife. There is also one student and one male engineer in the family. Which of the following is true about the granddaughter of the family?

- (a) She is a lawyer
- (b) She is an engineer
- (c) She is a student
- (d) She is a doctor (1 mark)

Answer:

(c) The family tree is as follows:

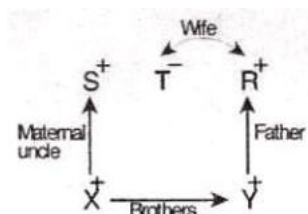
Q is the male lawyer married to P who is a housewife. They have a son, T, who is a teacher. T is married to S, who is a doctor. They have two children → R and U. Out of them, one is a male engineer, and the other is a student. Therefore, the granddaughter of the family is a student.

[33] X and Y are brothers. R is the father of Y. S is the brother of T and maternal uncle of X. What is T to R?

- (a) Mother
- (b) Wife
- (c) Sister
- (d) Brother (1 mark)

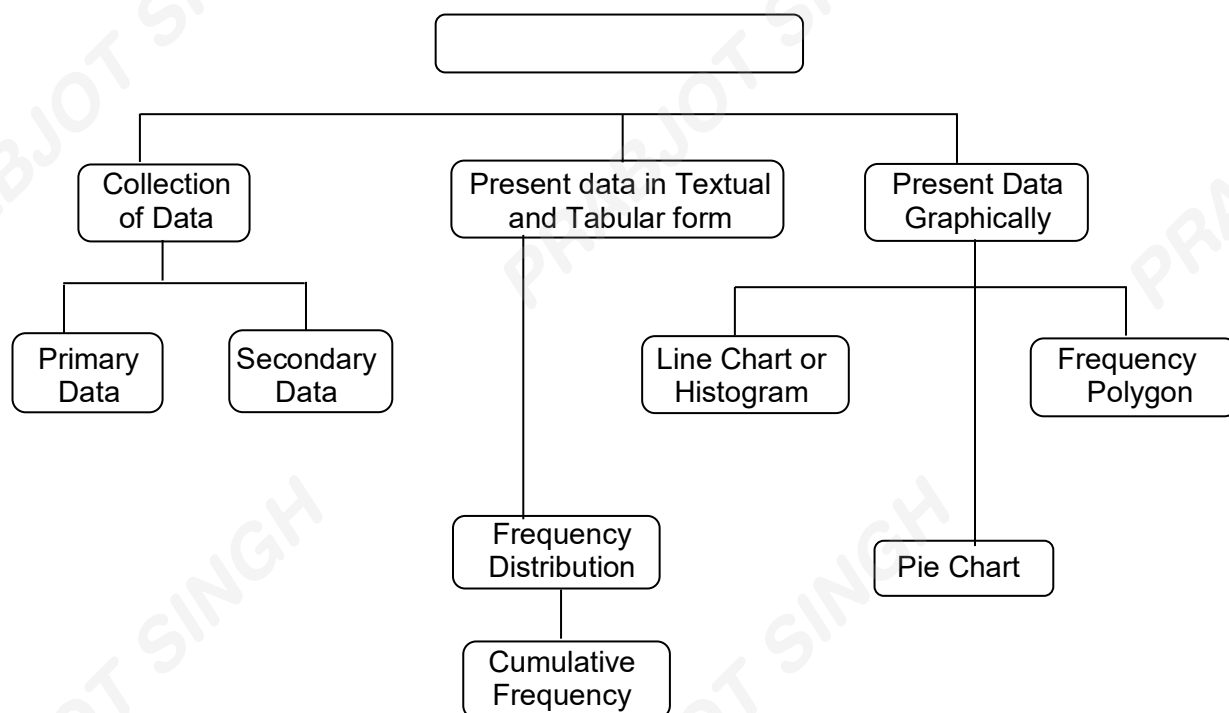
Answer:

(b)



'T' is the wife of 'R'

STATISTICAL DESCRIPTION OF DATA



14.1 INTRODUCTION OF STATISTICS

The modern development in the field of not only Management, Commerce, Economics, Social Sciences, Mathematics and so on but also in our life like public services, defence, banking, insurance sector, tourism and hospitality, police and military etc. are dependent on a particular subject known as statistics. Statistics does play a vital role in enriching a specific domain by collecting data in that field, analysing the data by applying various statistical techniques and finally making statistical inferences about the domain. In the present world, statistics has almost a universal application. Our Government applies statistics to make the economic planning in an effective and a pragmatic way. The businessman plan and expand their horizons of business on the basis of the analysis of the feedback data. The political parties try to impress the general public by presenting the statistics of their performances and accomplishments. Most of the research scholars of today also apply statistics to present their research papers in an authoritative manner. Thus the list of people using statistics goes on and on and on. Due to these factors, it is necessary to study the subject of statistics in an objective manner.

History of Statistics

Going through the history of ancient period and also that of medieval period, we do find the mention of statistics in many countries. However, there remains a question mark about the origin of the word 'statistics'. One view is that statistics is originated from the Latin word 'status'. According to another school of thought, it had its origin in the Italian word 'statista'. Some scholars believe that the German word 'statistik' was later changed to statistics and another suggestion is that the French word 'statistique' was made as statistics with the passage of time. In those days, statistics was analogous to state or, to be more precise, the data that are collected and maintained for the welfare of the people belonging to the state. We are thankful to Kautilya who had kept a record of births and deaths as well as some other precious records in his famous book 'Arthashastra' during Chandragupta's reign in the fourth century B.C. During the reign of Akbar in the sixteenth century A.D. We find statistical records on agriculture in Ain-i-Akbari written by Abu Fazl. Referring to Egypt, the first census was conducted by the Pharaoh during 300 B.C. to 2000 B.C.

Definition of Statistics

We may define statistics either in a singular sense or in a plural sense. Statistics, when used as a plural noun, may be defined as data qualitative as well as quantitative, that are collected, usually with a view of having statistical analysis.

However, statistics, when used as a singular noun, may be defined, as the scientific method that is employed for collecting, analysing and presenting data, leading finally to drawing statistical inferences about some important characteristics it means it is 'science of counting' or 'science of averages'.

Application of statistics

Among various applications of statistics, let us confine our discussions to the fields of Economics, Business Management and Commerce and Industry.

Economics

Modern developments in Economics have the roots in statistics. In fact, Economics and Statistics are closely associated. Time Series Analysis, Index Numbers, Demand Analysis etc. are some overlapping areas of Economics and Statistics. In this connection, we may also mention Econometrics - a branch of Economics that interact with statistics in a very

positive way. Conducting socio-economic surveys and analysing the data derived from it are made with the help of different statistical methods. Regression analysis, one of the numerous applications of statistics, plays a key role in Economics for making future projection of demand of goods, sales, prices, quantities etc. which are all ingredients of Economic planning.

Business Management

Gone are the days when the managers used to make decisions on the basis of hunches, intuition or trials and errors. Now a days, because of the never-ending complexity in the business and industry environment, most of the decision making processes rely upon different quantitative techniques which could be described as a combination of statistical methods and operations research techniques. So far as statistics is concerned, inferences about the universe from the knowledge of a part of it, known as sample, plays an important role in the development of certain criteria. Statistical decision theory is another component of statistics that focuses on the analysis of complicated business strategies with a list of alternatives - their merits as well as demerits.

Statistics in Commerce and Industry

In this age of cut-throat competition, like the modern managers, the industrialists and the businessmen are expanding their horizons of industries and businesses with the help of statistical procedures. Data on previous sales, raw materials, wages and salaries, products of identical nature of other factories etc are collected, analysed and experts are consulted in order to maximise profits. Measures of central tendency and dispersion, correlation and regression analysis, time series analysis, index numbers, sampling, statistical quality control are some of the statistical methods employed in commerce and industry.

Limitations of Statistics

Before applying statistical methods, we must be aware of the following limitations:

- I Statistics deals with the aggregates. An individual, to a statistician has no significance except the fact that it is a part of the aggregate.
- II Statistics is concerned with quantitative data. However, qualitative data also can be converted to quantitative data by providing a numerical description to the corresponding qualitative data.
- III Future projections of sales, production, price and quantity etc. are possible under a specific set of conditions. If any of these conditions is violated, projections are likely to be inaccurate.
- IV The theory of statistical inferences is built upon random sampling. If the rules for random sampling are not strictly adhered to, the conclusion drawn on the basis of these unrepresentative samples would be erroneous. In other words, the experts should be consulted before deciding the sampling scheme.

14.2 COLLECTION OF DATA

We may define 'data' as quantitative information about some particular characteristic(s) under consideration. Although a distinction can be made between a qualitative characteristic and a quantitative characteristic but so far as the statistical analysis of the characteristic is concerned, we need to convert qualitative information to quantitative information by providing a numeric descriptions to the given characteristic. In this connection, we may note

that a quantitative characteristic is known as a variable or in other words, a variable is a measurable quantity. Again, a variable may be either discrete or continuous. When a variable assumes a finite or a countably infinite number of isolated values, it is known as a discrete variable. Examples of discrete variables may be found in the number of petals in a flower, the number of misprints a book contains, the number of road accidents in a particular locality and so on. A variable, on the other hand, is known to be continuous if it can assume any value from a given interval. Examples of continuous variables may be provided by height, weight, sale, profit and so on. Finally, a qualitative characteristic is known as an attribute. The gender of a baby, the nationality of a person, the colour of a flower etc. are examples of attributes.

We can broadly classify data as

- (a) Primary;
- (b) Secondary.

Collection of data plays the very important role for any statistical analysis. The data which are collected for the first time by an investigator or agency are known as primary data whereas the data are known to be secondary if the data, as being already collected, are used by a different person or agency. Thus, if Prof. Das collects the data on the height of every student in his class, then these would be primary data for him. If, however, another person, say, Professor Bhargava uses the data, as collected by Prof. Das, for finding the average height of the students belonging to that class, then the data would be secondary for Prof. Bhargava.

Collection of Primary Data

The following methods are employed for the collection of primary data:

- (i) Interview method;
- (ii) Mailed questionnaire method;
- (iii) Observation method;
- (iv) Questionnaires filled and sent by enumerators.

Interview method again could be divided into (a) Personal Interview method, (b) Indirect Interview method and (c) Telephone Interview method.

In personal interview method, the investigator meets the respondents directly and collects the required information then and there from them. In case of a natural calamity like a super cyclone or an earthquake or an epidemic like plague, we may collect the necessary data much more quickly and accurately by applying this method.

If there are some practical problems in reaching the respondents directly, as in the case of a rail accident, then we may take recourse for conducting Indirect Interview where the investigator collects the necessary information from the persons associated with the problems.

Telephone interview method is a quick and rather non-expensive way to collect the primary data where the relevant information can be gathered by the researcher himself by contacting the interviewee over the phone. The first two methods, though more accurate, are inapplicable for covering a large area whereas the telephone interview, though less

consistent, has a wide coverage.

The amount of non-responses is maximum for this third method of data collection.

Mailed questionnaire method comprises of framing a well-drafted and soundly-sequenced questionnaire covering all the important aspects of the problem under consideration and sending them to the respondents with pre-paid stamp after providing all the necessary guidelines for filling up the questionnaire. Although a wide area can be covered using the mailed questionnaire method, the amount of non-responses is likely to be maximum in this method.

In observation method, data are collected, as in the case of obtaining the data on the height and weight of a group of students, by direct observation or using instrument. Although this is likely to be the best method for data collection, it is time consuming, laborious and covers only a small area. Questionnaire form of data collection is used for larger enquiries from the persons who are surveyed. Enumerators collect information directly by interviewing the persons having information : Question are explained and hence data is collected. **Sources of Secondary Data**

There are many sources of getting secondary data. Some important sources are listed below:

- (a) International sources like WHO, ILO, IMF, World Bank etc.
- (b) Government sources like Statistical Abstract by CSO, Indian Agricultural Statistics by the Ministry of Food and Agriculture and so on.
- (c) Private and quasi-government sources like ISI, ICAR, NCERT etc.
- (d) Unpublished sources of various research institutes, researchers etc.

Scrutiny of Data

Since the statistical analyses are made only on the basis of data, it is necessary to check whether the data under consideration are accurate as well as consistent. No hard and fast rules can be recommended for the scrutiny of data. One must apply his intelligence, patience and experience while scrutinising the given information.

Errors in data may creep in while writing or copying the answer on the part of the enumerator. A keen observer can easily detect that type of error. Again, there may be two or more series of figures which are in some way or other related to each other. If the data for all the series are provided, they may be checked for internal consistency. As an example, if the data for population, area and density for some places are given, then we may verify whether they are internally consistent by examining whether the relation

$$\text{Density} = \frac{\text{Area}}{\text{Population}} \text{ holds.}$$

A good statistician can also detect whether the returns submitted by some enumerators are exactly of the same type thereby implying the lack of seriousness on the part of the enumerators. The bias of the enumerator also may be reflected by the returns submitted by him. This type of error can be rectified by asking the enumerator(s) to collect the data for the disputed cases once again.

14.3 PRESENTATION OF DATA

Once the data are collected and verified for their homogeneity and consistency, we need to present them in a neat and condensed form highlighting the essential features of the data. Any statistical analysis is dependent on a proper presentation of the data under consideration.

Classification or Organisation of Data

It may be defined as the process of arranging data on the basis of the characteristic under consideration into a number of groups or classes according to the similarities of the observations. Following are the objectives of classification of data:

- (a) It puts the data in a neat, precise and condensed form so that it is easily understood and interpreted.
- (b) It makes comparison possible between various characteristics, if necessary, and thereby finding the association or the lack of it between them.
- (c) Statistical analysis is possible only for the classified data.
- (d) It eliminates unnecessary details and makes data more readily understandable.

Data may be classified as -

- (i) Chronological or Temporal or Time Series Data;
- (ii) Geographical or Spatial Series Data;
- (iii) Qualitative or Ordinal Data;
- (iv) Quantitative or Cardinal Data.

When the data are classified in respect of successive time points or intervals, they are known as time series data. The number of students appeared for CA final for the last twenty years, the production of a factory per month from 2000 to 2015 etc. are examples of time series data.

Data arranged region wise are known as geographical data. If we arrange the students appeared for CA final in the year 2015 in accordance with different states, then we come across Geographical Data.

Data classified in respect of an attribute are referred to as qualitative data. Data on nationality, gender, smoking habit of a group of individuals are examples of qualitative data. Lastly, when the data are classified in respect of a variable, say height, weight, profits, salaries etc., they are known as quantitative data.

Data may be further classified as *frequency data* and *non-frequency data*. The qualitative as well as quantitative data belong to the frequency group whereas time series data and geographical data belong to the non-frequency group.

Mode of Presentation of Data

Next, we consider the following mode of presentation of data:

- (a) Textual presentation;
- (b) Tabular presentation or Tabulation;
- (c) Diagrammatic representation.

(a) Textual presentation

This method comprises presenting data with the help of a paragraph or a number of paragraphs. The official report of an enquiry commission is usually made by textual presentation. Following is an example of textual presentation.

'In 2009, out of a total of five thousand workers of Roy Enamel Factory, four thousand and two hundred were members of a Trade Union. The number of female workers was twenty per cent of the total workers out of which thirty per cent were members of the Trade Union.

In 2010, the number of workers belonging to the trade union was increased by twenty per cent as compared to 2009 of which four thousand and two hundred were male. The number of workers not belonging to trade union was nine hundred and fifty of which four hundred and fifty were females.'

The merit of this mode of presentation lies in its simplicity and even a layman can present data by this method. The observations with exact magnitude can be presented with the help of textual presentation. Furthermore, this type of presentation can be taken as the first step towards the other methods of presentation.

Textual presentation, however, is not preferred by a statistician simply because, it is dull, monotonous and comparison between different observations is not possible in this method. For manifold classification, this method cannot be recommended.

(b) Tabular presentation or Tabulation

Tabulation may be defined as systematic presentation of data with the help of a statistical table having a number of rows and columns and complete with reference number, title, description of rows as well as columns and foot notes, if any.

We may consider the following guidelines for tabulation :

- I A statistical table should be allotted a serial number along with a self-explanatory title.
- II The table under consideration should be divided into caption, Box-head, Stub and Body. Caption is the upper part of the table, describing the columns and sub-columns, if any. The Box-head is the entire upper part of the table which includes columns and sub-column numbers, unit(s) of measurement along with caption. Stub is the left part of the table providing the description of the rows. The body is the main part of the table that contains the numerical figures.
- III The table should be well-balanced in length and breadth.
- IV The data must be arranged in a table in such a way that comparison(s) between different figures are made possible without much labour and time. Also the row totals, column totals, the units of measurement must be shown.
- V The data should be arranged intelligently in a well-balanced sequence and the presentation of data in the table should be appealing to the eyes as far as practicable.

- VI Notes describing the source of the data and bringing clarity and, if necessary, about any rows or columns known as footnotes, should be shown at the bottom part of the table.

The textual presentation of data, relating to the workers of Roy Enamel Factory is shown in the following table.

Status of the workers of Roy Enamel factory on the basis of their trade union membership for 2009 and 2010.

Table 14.1

Status	Member of TU			Non-member			Total		
	M	F	T	M	F	T	M	F	T
Year	(1)	(2)	(3) = (1) + (2)	(4)	(5)	(6) = (4) + (5)	(7)	(8)	(9) = (7) + (8)
2009	3900	300	4200	300	500	800	4200	800	5000
2010	4200	840	5040	500	450	950	4700	1290	5990

Source:

Footnote: TU, M, F and T stand for trade union, male, female and total respectively.

The tabulation method is usually preferred to textual presentation as

- (i) It facilitates comparison between rows and columns.
- (ii) Complicated data can also be represented using tabulation.
- (iii) It is a must for diagrammatic representation.
- (iv) Without tabulation, statistical analysis of data is not possible.

(c) Diagrammatic representation of data

Another alternative and attractive representation of statistical data is provided by charts, diagrams and pictures. Unlike the first two methods of representation of data, diagrammatic representation can be used for both the educated section and uneducated section of the society. Furthermore, any hidden trend present in the given data can be noticed only in this mode of representation. However, compared to tabulation, this is less accurate. So if there is a priority for accuracy, we have to recommend tabulation.

We are going to consider the following types of diagrams :

- I Line diagram or Historiagram;
- II Bar diagram;

III Pie chart.

I Line diagram or Historiagram

When the data vary over time, we take recourse to line diagram. In a simple line diagram, we plot each pair of values of (t, y_t) , y_t representing the time series at the time point t in the t - y_t plane. The plotted points are then joined successively by line segments and the resulting chart is known as line-diagram.

When the time series exhibit a wide range of fluctuations, we may think of logarithmic or ratio chart where $\log y_t$ and not y_t is plotted against t . We use Multiple line chart for representing two or more related time series data expressed in the same unit and multiple - axis chart in somewhat similar situations if the variables are expressed in different units.

II Bar diagram

There are two types of bar diagrams namely, Horizontal Bar diagram and Vertical Bar diagram. While horizontal bar diagram is used for qualitative data or data varying over space, the vertical bar diagram is associated with quantitative data or time series data. Bars i.e. rectangles of equal width and usually of varying lengths are drawn either horizontally or vertically. We consider Multiple or Grouped Bar diagrams to compare related series. Component or sub-divided Bar diagrams are applied for representing data divided into a number of components. Finally, we use Divided Bar charts or Percentage Bar diagrams for comparing different components of a variable and also the relating of the components to the whole. For this situation, we may also use Pie chart or Pie diagram or circle diagram.

ILLUSTRATIONS:

Example 14.1: The profits in lakhs of Rupees of an industrial house for 2009, 2010, 2011, 2012, 2013, 2014, and 2015 are 5, 8, 9, 6, 12, 15 and 24 respectively. Represent these data using a suitable diagram.

SOLUTION:

We can represent the profits for 7 consecutive years by drawing either a line chart or a vertical bar chart. Fig. 14.1 shows a line chart and figure 14.2 shows the corresponding vertical bar chart.

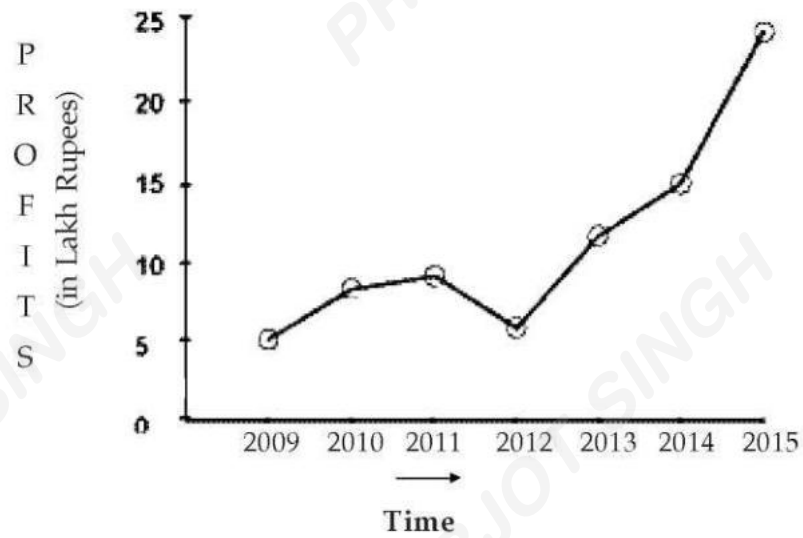


Figure 14.1

Showing line chart for the Profit of an Industrial House during 2002 to 2008.

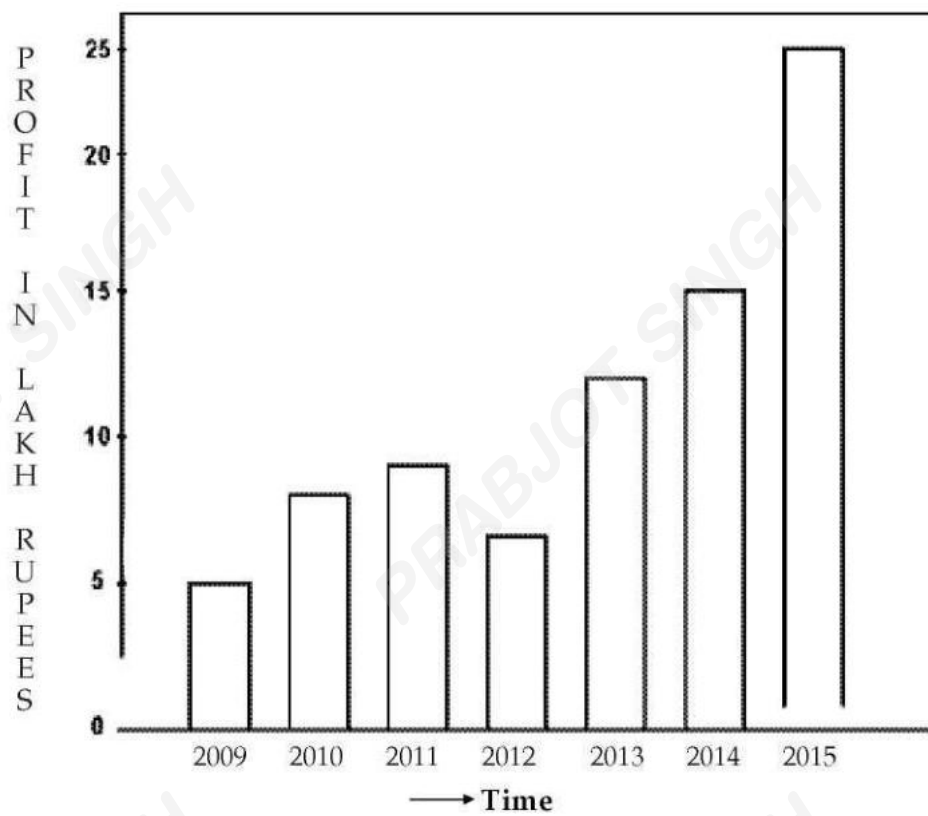


Figure 14.2

Showing vertical bar diagram for the Profit of an Industrial house from 2007 to 2015.

Example 14.2: The production of wheat and rice of a region are given below :

Year	Production in metric tones	
	Wheat	Rice
2012	12	25
2013	15	30
2014	18	32
2015	19	36

Represent this information using a suitable diagram.

Solution:

We can represent this information by drawing a multiple line chart. Alternately, a multiple bar diagram may be considered. These are depicted in figure 14.3 and 14.4 respectively.

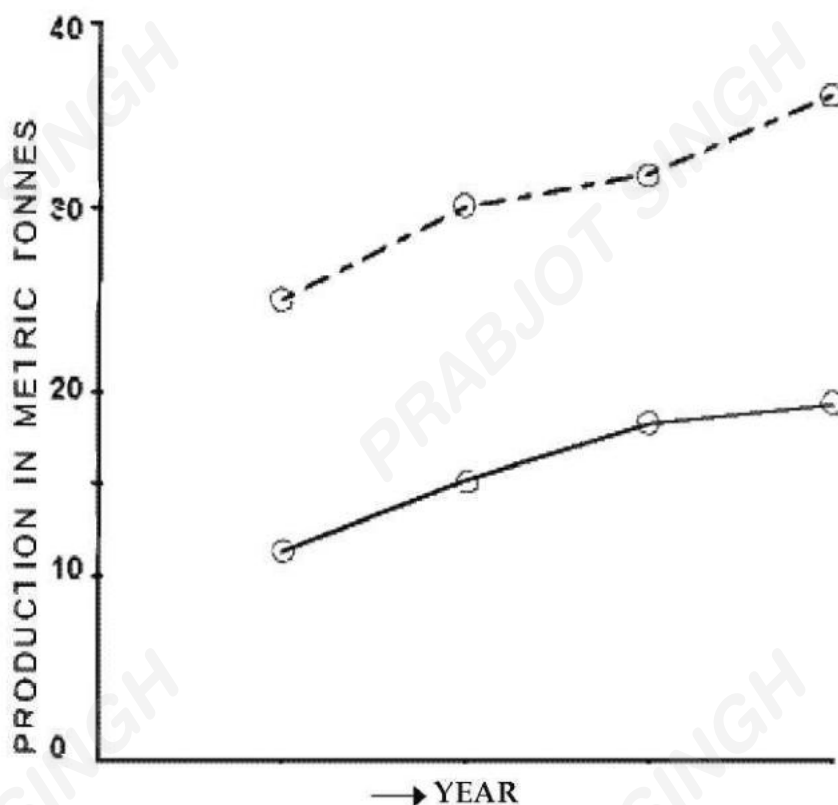


Figure 14.3

Multiple line chart showing production of wheat and rice of a region during 2012-2015.

(Dotted line represent production of rice and continuous line that of wheat).

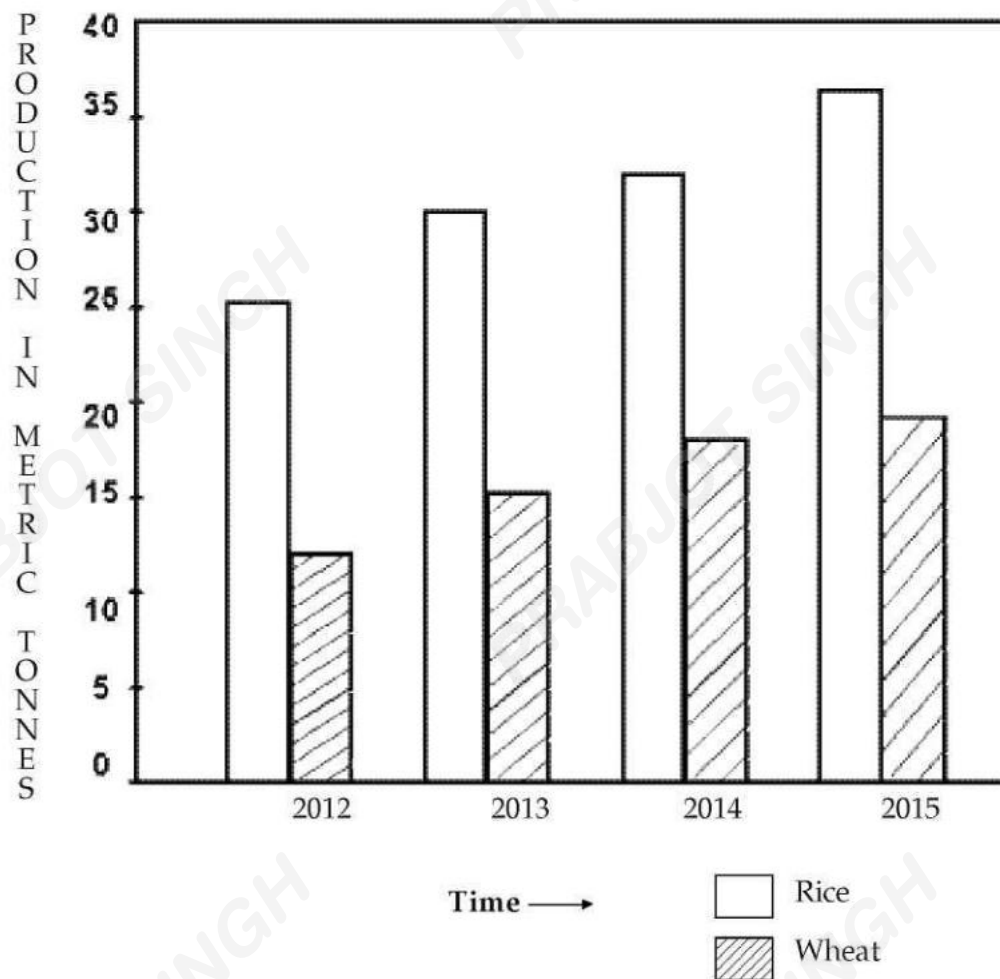


Figure 14.4

Multiple bar chart representing production of rice and wheat from 2012 to 2015.

Example 14.3: Draw an appropriate diagram with a view to represent the following data :

Source	Revenue in millions of (₹)
Customs	80
Excise	190
Income Tax	160
Corporate Tax	75
Miscellaneous	35

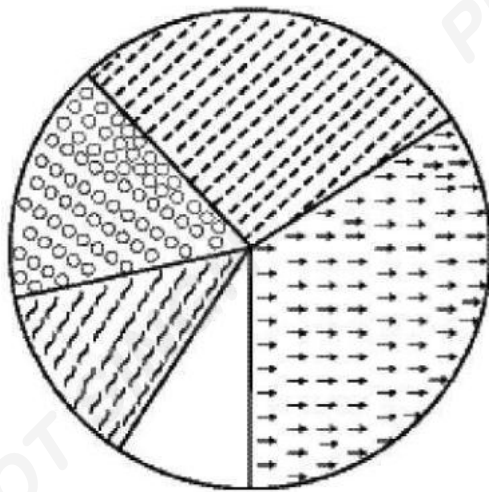
Solution:

Pie chart or divided bar chart would be the ideal diagram to represent this data. We consider Pie chart.

Table 14.2

Computation for drawing Pie chart

Source (1)	Revenue in Million rupees (2)	Central angle $= \frac{(2)}{\text{Total of (2)}} \times 360^\circ$
Customs	80	$\frac{80}{540} \times 36^\circ = 53^\circ$ (approx.)
Excise	190	$\frac{190}{540} \times 360^\circ = 127^\circ$
Income Tax	160	$\frac{160}{540} \times 360^\circ = 107^\circ$
Corporate Tax	75	$\frac{75}{540} \times 360^\circ = 50^\circ$
Miscellaneous	35	$\frac{35}{540} \times 360^\circ = 23^\circ$
Total	540	360°



Excise	→→→→→
IT	— — — —
Custom	o o o o
CT	~ ~ ~ ~
Misc.	

Figure 14.5

Pie chart showing the distribution of Revenue

14.4 FREQUENCY DISTRIBUTION

As discussed in the previous section, frequency data occur when we classify statistical data in respect of either a variable or an attribute. A frequency distribution may be defined as a tabular representation of statistical data, usually in an ascending order, relating to a measurable characteristic according to individual value or a group of values of the characteristic under study.

In case, the characteristic under consideration is an attribute, say nationality, then the tabulation is made by allotting numerical figures to the different classes the attribute may belong like, in this illustration, counting the number of Indian, British, French, German and so on. The qualitative characteristic is divided into a number of categories or classes which are mutually exclusive and exhaustive and the figures against all these classes are recorded. The figure corresponding to a particular class, signifying the number of times or how frequently a particular class occurs is known as the frequency of that class. Thus, the number of Indians, as found from the given data, signifies the frequency of the Indians. So frequency distribution is a statistical table that distributes the total frequency to a number of classes.

When tabulation is done in respect of a discrete random variable, it is known as Discrete or Ungrouped or simple Frequency Distribution and in case the characteristic under consideration is a continuous variable, such a classification is termed as Grouped Frequency Distribution. In case of a grouped frequency distribution, tabulation is done not against a single value as in the case of an attribute or a discrete random variable but against a group of values. The distribution of the number of car accidents in Delhi during 12 months of the year 2005 is an example of a ungrouped frequency distribution and the distribution of heights of the students of St. Xavier's College for the year 2004 is an example of a grouped frequency distribution.

Example 14.4: Following are the records of babies born in a nursing home in Bangalore during a week (B denoting Boy and G for Girl) :

B G G B G G B B G G
 G G B B B G B B G B
 B B G B B B G G B G

Construct a frequency distribution according to gender.

Solution:

In order to construct a frequency distribution of babies in accordance with their gender, we count the number of male births and that of female births and present this information in the following table.

Table 14.3

Frequency distribution of babies according to Gender

Category	Number of births
Boy (B)	16
Girl (G)	14
Total	30

Frequency Distribution of a Variable

For the construction of a frequency distribution of a variable, we need to go through the following steps :

- I Find the largest and smallest observations and obtain the difference between them, known as Range, in case of a continuous variable.
- II Form a number of classes depending on the number of isolated values assumed by a discrete variable. In case of a continuous variable, find the number of class intervals using the relation, No. of class Interval $\times$ class length $\cong$ Range.
- III Present the class or class interval in a table known as frequency distribution table.
- IV Apply 'tally mark' i.e. a stroke against the occurrence of a particulars value in a class or class interval.
- V Count the tally marks and present these numbers in the next column, known as frequency column, and finally check whether the total of all these class frequencies tally with the total number of observations.

Example 14.5: A review of the first 30 pages of a statistics book reveals the following printing mistakes:

0 1 3 3 2 5 6 0 1 0
 4 1 1 0 2 3 2 5 0 4
 2 3 2 2 3 3 4 6 1 4

Make a frequency distribution of printing mistakes.

Solution:

Since x , the printing mistakes, is a discrete variable, x can assume seven values 0, 1, 2, 3, 4, 5 and 6. Thus we have 7 classes, each class comprising a single value.

Table 14.4

Frequency Distribution of the number of printing mistakes of the first 30 pages of a book

Printing Mistake	Tally marks	Frequency (No. of Pages)
0	IIII	5
1	IIII	5
2	I	6
3	IIII I	6
4	IIII	4
5	II	2
6	II	2
Total	—	30

Example 14.6: Following are the weights in kgs. of 36 BBA students of St. Xavier's College.

70 73 49 61 61 47 57 50 59

59 68 45 55 65 68 56 68 55

70 70 57 44 69 73 64 49 63

65 70 65 62 64 73 67 60 50

Construct a frequency distribution of weights, taking class length as 5.

Solution:

We have, Range = Maximum weight – Minimum weight

= 73 kgs. – 44 kgs.

= 29 kgs.

No. of class interval $\times$ class lengths $\cong$ Range

$\Rightarrow$ No. of class interval $\times 5 \cong 29$

$\Rightarrow$ No. of class interval = $\frac{29}{5} \cong 6$

(We always take the next integer as the number of class intervals so as to include both the minimum and maximum values).

Table 14.5

Frequency Distribution of weights of 36 BBA Students

Weight in kg (Class Interval)	Tally marks	No. of Students (Frequency)
44-48	III	3
49-53	IIII	4
54-58	~~IIII~~	5
59-63	~~IIII~~ II	7
64-68	~~IIII~~ IIII	9
69-73	~~IIII~~ IIII	8

Total	–	36

Some important terms associated with a frequency distribution Class Limit (CL)

Corresponding to a class interval, the class limits may be defined as the minimum value and the maximum value the class interval may contain. The minimum value is known as the lower class limit (LCL) and the maximum value is known as the upper class limit (UCL). For the frequency distribution of weights of BBA Students, the LCL and UCL of the first class interval are 44 kgs. and 48 kgs. respectively.

Class Boundary (CB)

Class boundaries may be defined as the actual class limit of a class interval. For overlapping classification or mutually exclusive classification that excludes the upper class limits like 10-20, 20-30, 30-40, ... etc. the class boundaries coincide with the class limits. This is usually done for a continuous variable. However, for non-overlapping or mutually inclusive classification that includes both the class limits like 0-9, 10-19, 20-29, which is usually applicable for a discrete variable, we have

$$LCB = LCL - \frac{D}{2}$$

$$\text{and } UCB = UCL + \frac{D}{2}$$

where D is the difference between the LCL of the next class interval and the UCL of the given class interval. For the data presented in table 10.5, LCB of the first class interval

$$= 44 \text{ kgs.} - \frac{(49 - 48)}{2} \text{ kgs.}$$

$$= 43.50 \text{ kgs.}$$

and the corresponding UCB

$$= 48 \text{ kgs.} + \frac{49 - 48}{2} \text{ kgs.}$$

$$= 48.50 \text{ kgs.}$$

Mid-point or Mid-value or class mark

Corresponding to a class interval, this may be defined as the total of the two class limits or class boundaries to be divided by 2. Thus, we have

$$\text{mid-point} = \frac{LCL + UCL}{2}$$

$$= \frac{LCB + UCB}{2}$$

Referring to the distribution of weight of BBA students, the mid-points for the first two class intervals are

$$\frac{44\text{kgs.} + 48\text{kgs.}}{2} \text{ and } \frac{49\text{kgs.} + 53\text{kgs.}}{2}$$

i.e. 46 kgs. and 51 kgs. respectively.

Width or size of a class interval

The width of a class interval may be defined as the difference between the UCB and the LCB of that class interval. For the distribution of weights of BBA students, C, the class length or width is $48.50 \text{ kgs.} - 43.50 \text{ kgs.} = 5 \text{ kgs.}$ for the first class interval. For the other class intervals also, C remains same.

Cumulative Frequency

The cumulative frequency corresponding to a value for a discrete variable and corresponding to a class boundary for a continuous variable may be defined as the number of observations less than the value or less than or equal to the class boundary. This definition refers to the less than cumulative frequency. We can define more than cumulative frequency in a similar manner. Both types of cumulative frequencies are shown in the following table.

Table 14.6

Cumulative Frequency Distribution of weights of 36 BBA students

Weight in kg (CB)	Cumulative Frequency	
	Less than	More than
43.50	0	33 + 3 or 36
48.50	0 + 3 or 3	29 + 4 or 33
53.50	3 + 4 or 7	24 + 5 or 29
58.50	7 + 5 or 12	17 + 7 or 24
63.50	12 + 7 or 19	8 + 9 or 17
68.50	19 + 9 or 28	0 + 8 or 8

73.50	28 + 8 or 36	.0

Frequency density of a class interval

It may be defined as the ratio of the frequency of that class interval to the corresponding class length. The frequency densities for the first two class intervals of the frequency distribution of weights of BBA students are $\frac{3}{5}$ and $\frac{4}{5}$ i.e. 0.60 and 0.80 respectively.

Relative frequency and percentage frequency of a class interval

Relative frequency of a class interval may be defined as the ratio of the class frequency to the total frequency. Percentage frequency of a class interval may be defined as the ratio of class frequency to the total frequency, expressed as a percentage. For the last example, the relative frequencies for the first two class intervals are $\frac{3}{36}$ and $\frac{4}{36}$ respectively and the percentage frequencies are $\frac{300}{36}$ and $\frac{400}{36}$ respectively. It is quite obvious that whereas the relative frequencies add up to unity, the percentage frequencies add up to one hundred.

14.5 GRAPHICAL REPRESENTATION OF A FREQUENCY DISTRIBUTION

We consider the following types of graphical representation of frequency distribution :

- (i) Histogram or Area diagram;
 - (ii) Frequency Polygon;
 - (iii) Ogives or cumulative Frequency graphs.
- (i) Histogram or Area diagram**

This is a very convenient way to represent a frequency distribution. Histogram helps us to get an idea of the frequency curve of the variable under study. Some statistical measure can be obtained using a histogram. A comparison among the frequencies for different class intervals is possible in this mode of diagrammatic representation.

In order to draw a histogram, the class limits are first converted to the corresponding class boundaries and a series of adjacent rectangles, one against each class interval, with the class interval as base or breadth and the frequency or frequency density usually when the class intervals are not uniform as length or altitude, is erected. The histogram for the distribution of weight of 36 BBA students is shown below. The mode of the weights has also been determined using the histogram.

i.e. Mode = 66.50 kgs.

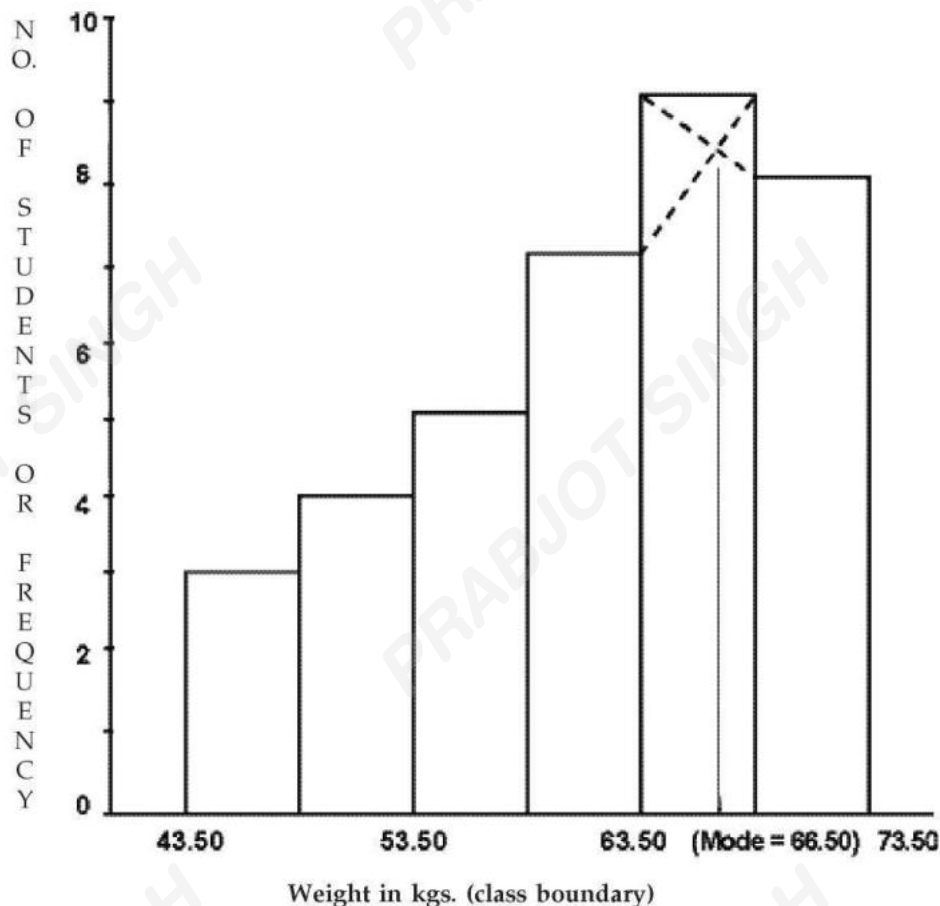


Figure 14.6

Showing histogram for the distribution of weight of 36 BBA students

(ii) Frequency Polygon

Usually frequency polygon is meant for single frequency distribution. However, we also apply it for grouped frequency distribution provided the width of the class intervals remains the same. A frequency curve can be regarded as a limiting form of frequency polygon. In order to draw a frequency polygon, we plot (x_i, f_i) for $i = 1, 2, 3, \dots, n$ with x_i denoting the mid-point of its class interval and f_i , the corresponding frequency, n being the number of class intervals. The plotted points are joined successively by line segments and the figure, so drawn, is given the shape of a polygon, a closed figure, by joining the two extreme ends of the drawn figure to two additional points $(x_0, 0)$ and $(x_{n+1}, 0)$.

The frequency polygon for the distribution of weights of BBA students is shown in Figure 14.7. We can also obtain a frequency polygon starting with a histogram by adding the mid-points of the upper sides of the rectangles successively and then completing the figure by joining the two ends as before.

Mid-points	No. of Students (Frequency)
46	3
51	4

56	5
61	7
66	9
71	8

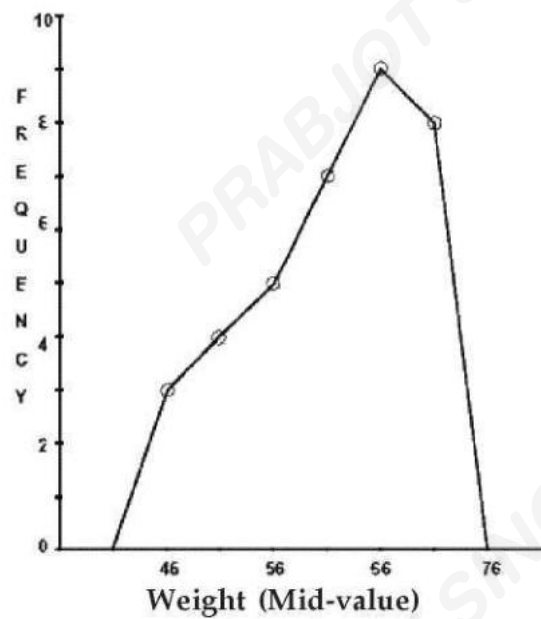


Figure 14.7

Showing frequency polygon for the distribution of height of 36 BBA students

(iii) Ogives or Cumulative Frequency Graph

By plotting cumulative frequency against the respective class boundary, we get ogives. As such there are two ogives – less than type ogives, obtained by taking less than cumulative frequency on the vertical axis and more than type ogives by plotting more than type cumulative frequency on the vertical axis and thereafter joining the plotted points successively by line segments. Ogives may be considered for obtaining quartiles graphically. If a perpendicular is drawn from the point of intersection of the two ogives on the horizontal axis, then the x-value of this point gives us the value of median, the second or middle quartile. Ogives further can be put into use for making short term projections.

Figure 14.8 depicts the ogives and the determination of the quartiles. This figure give us the following information.

1st quartile or lower quartile (Q_1) = 55 kgs.

2nd quartile or median (Q_2 or Me) = 62.50 kgs.

3rd quartile or upper quartile (Q_3) = 68 kgs.

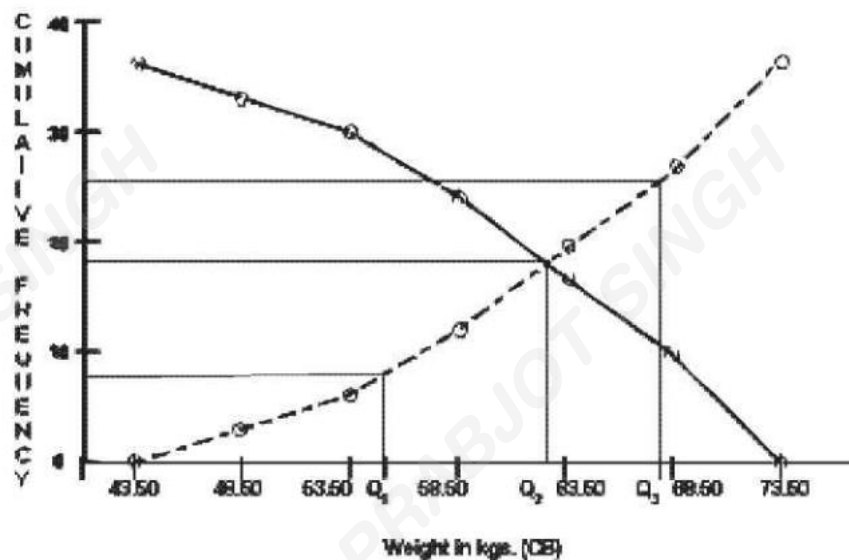


Figure 14.8

Showing the ogives for the distribution of weights of 36 BBA students

We find $Q_1 = 55$ kgs.

$Q_2 = \text{Me} = 62.50$ kgs.

$Q_3 = 68$ kgs.

Frequency Curve

A frequency curve is a smooth curve for which the total area is taken to be unity. It is a limiting form of a histogram or frequency polygon. The frequency curve for a distribution can be obtained by drawing a smooth and free hand curve through the mid-points of the upper sides of the rectangles forming the histogram.

There exist four types of frequency curves namely

- (a) Bell-shaped curve;
- (b) U-shaped curve;
- (c) J-shaped curve;
- (d) Mixed curve.

Most of the commonly used distributions provide bell-shaped curve, which, as suggested by the name, looks almost like a bell. The distribution of height, weight, mark, profit etc. usually belong to this category. On a bell-shaped curve, the frequency, starting from a rather low value, gradually reaches the maximum value, somewhere near the central part and then gradually decreases to reach its lowest value at the other extremity.

For a U-shaped curve, the frequency is minimum near the central part and the frequency slowly but steadily reaches its maximum at the two extremities. The distribution of Kolkata bound commuters belongs to this type of curve as there are maximum number of commuters during the peak hours in the morning and in the evening.

The J-shaped curve starts with a minimum frequency and then gradually reaches its maximum frequency at the other extremity. The distribution of commuters coming to Kolkata from the early morning hour to peak morning hour follows such a distribution. Sometimes, we may also come across an inverted J-shaped frequency curve.

Lastly, we may have a combination of these frequency curves, known as mixed curve. These are exhibited in the following figures.

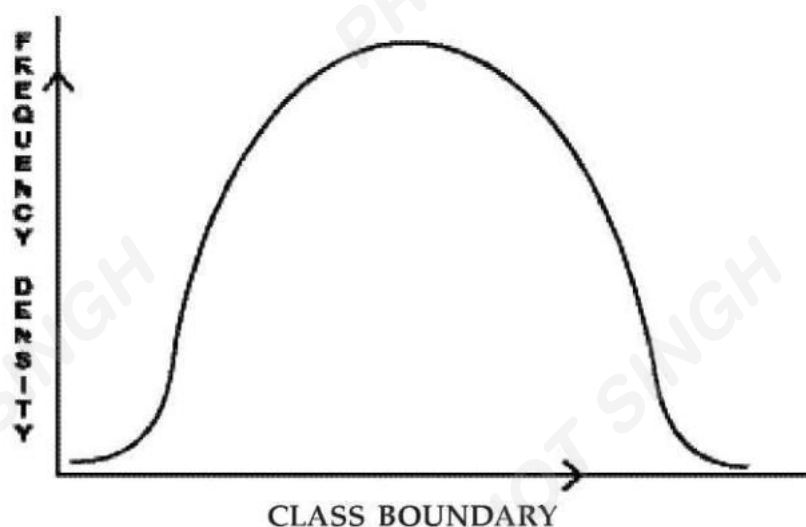
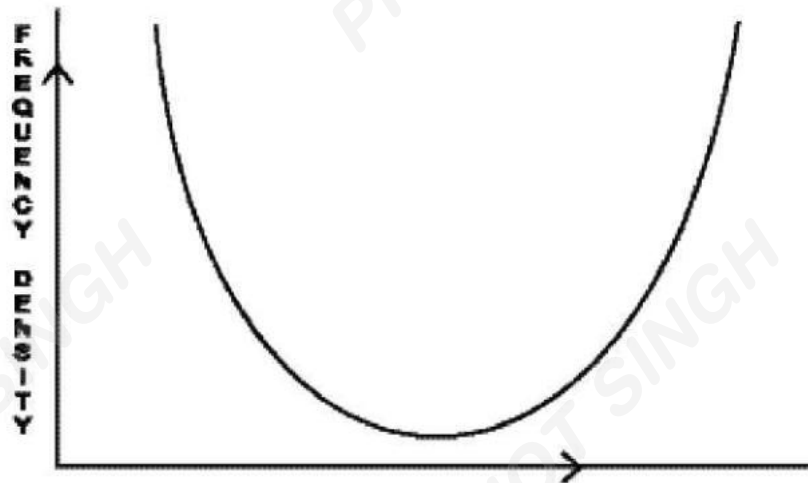
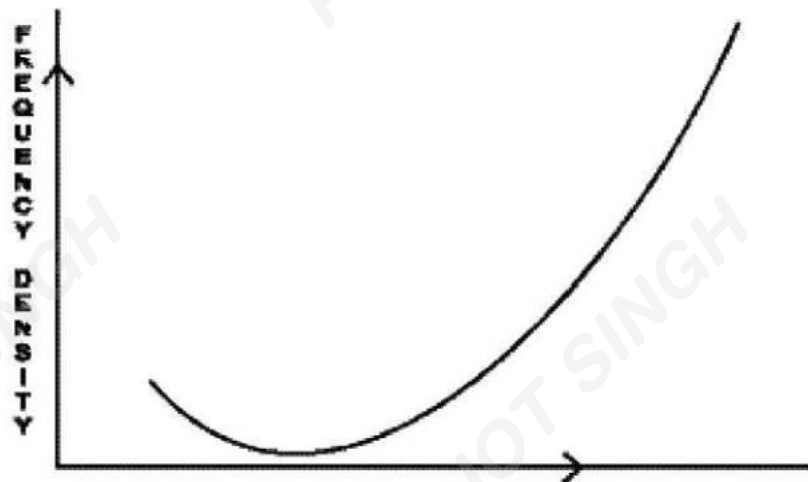


Figure 14.9 Bell-shaped curve



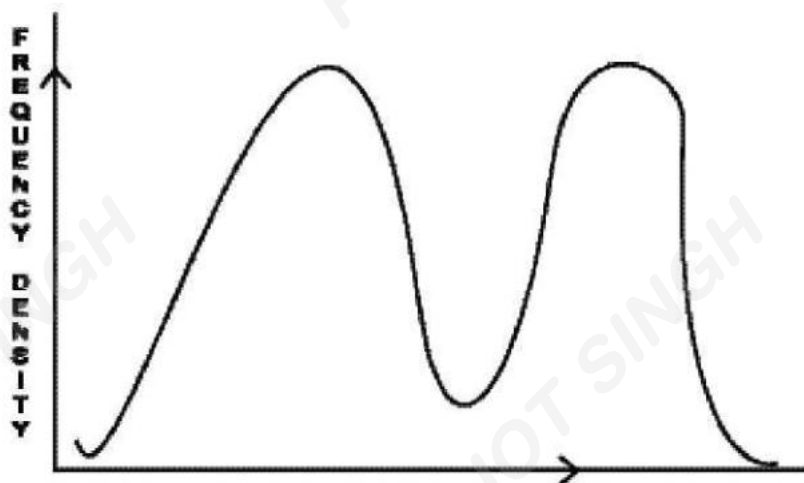
CLASS BOUNDARY

Figure 14.10 U-shaped curve



CLASS BOUNDARY

Figure 14.11 J-shaped curve



CLASS BOUNDARY

Figure 14.12 Mixed curve

SUMMARY

- ◆ Statistics deals with the aggregates. An individual, to a statistician has no significance except the fact that it is a part of the aggregate.
- ◆ Statistics is concerned with quantitative data. However, qualitative data also can be converted to quantitative data by providing a numerical description to the corresponding qualitative data.
- ◆ The theory of statistical inferences is built upon random sampling. If the rules for random sampling are not strictly adhered to, the conclusion drawn on the basis of these unrepresentative samples would be erroneous.
- ◆ We can broadly classify data as
 - (a) Primary;
 - (b) Secondary.
- ◆ Mode of Presentation of Data
 - (a) Textual presentation;
 - (b) Tabular presentation or Tabulation;
 - (c) Diagrammatic representation.
- ◆ The types of diagrams:
 - (a) Line diagram or Historiogram;
 - (b) Bar diagram;
 - (c) Pie chart.
- ◆ Frequency Distribution of a Variable
 - (a) Find the largest and smallest observations and obtain the difference between them, known as Range, in case of a continuous variable.
 - (b) Form a number of classes depending on the number of isolated values assumed by a discrete variable. In case of a continuous variable, find the number of class intervals using the relation, No. of class Interval $\times$ class length = Range.
 - (c) Present the class or class interval in a table known as frequency distribution table.
 - (d) Apply 'tally mark' i.e. a stroke against the occurrence of a particular value in a class or class interval.
 - (e) Count the tally marks and present these numbers in the next column, known as frequency column, and finally check whether the total of all these class frequencies tally with the total number of observations.

EXERCISE

Set A

Answer the following questions. Each question carries 1 mark.

1. Which of the following statements is false?
 - (a) Statistics is derived from the Latin word 'Status'
 - (b) Statistics is derived from the Italian word 'Statista'
 - (c) Statistics is derived from the French word 'Statistik'
 - (d) None of these.
2. Statistics is defined in terms of numerical data in the
 - (a) Singular sense
 - (b) Plural sense
 - (c) Either (a) or (b)
 - (d) Both (a) and (b).
3. Statistics is applied in
 - (a) Economics
 - (b) Business management
 - (c) Commerce and industry
 - (d) All these.
4. Statistics is concerned with
 - (a) Qualitative information
 - (b) Quantitative information
 - (c) (a) or (b)
 - (d) Both (a) and (b).
5. An attribute is
 - (a) A qualitative characteristic
 - (b) A quantitative characteristic
 - (c) A measurable characteristic
 - (d) All these.
6. Annual income of a person is
 - (a) An attribute
 - (b) A discrete variable
 - (c) A continuous variable
 - (d) (b) or (c).
7. Marks of a student is an example of
 - (a) An attribute
 - (b) A discrete variable

- (c) A continuous variable (d) None of these.
8. Nationality of a student is
(a) An attribute (b) A continuous variable
(c) A discrete variable (d) (a) or (c).
9. Drinking habit of a person is
(a) An attribute (b) A variable
(c) A discrete variable (d) A continuous variable.
10. Age of a person is
(a) An attribute (b) A discrete variable
(c) A continuous variable (d) A variable.
11. Data collected on religion from the census reports are
(a) Primary data (b) Secondary data
(c) Sample data (d) (a) or (b).
12. The data collected on the height of a group of students after recording their heights with a measuring tape are
(a) Primary data (b) Secondary data
(c) Discrete data (d) Continuous data.
13. The primary data are collected by
(a) Interview method (b) Observation method
(c) Questionnaire method (d) All these.
14. The quickest method to collect primary data is
(a) Personal interview (b) Indirect interview
(c) Telephone interview (d) By observation.
15. The best method to collect data, in case of a natural calamity, is
(a) Personal interview (b) Indirect interview
(c) Questionnaire method (d) Direct observation method.
16. In case of a rail accident, the appropriate method of data collection is by
(a) Personal interview (b) Direct interview
(c) Indirect interview (d) All these.

17. Which method of data collection covers the widest area?
- (a) Telephone interview method (b) Mailed questionnaire method
- (c) Direct interview method (d) All these.
18. The amount of non-responses is maximum in
- (a) Mailed questionnaire method (b) Interview method
- (c) Observation method (d) All these.
19. Some important sources of secondary data are
- (a) International and Government sources
- (b) International and primary sources
- (c) Private and primary sources
- (d) Government sources.
20. Internal consistency of the collected data can be checked when
- (a) Internal data are given (b) External data are given
- (c) Two or more series are given (d) A number of related series are given.
21. The accuracy and consistency of data can be verified by
- (a) Internal checking (b) External checking
- (c) Scrutiny (d) Both (a) and (b).
22. The mode of presentation of data are
- (a) Textual, tabulation and diagrammatic (b) Tabular, internal and external
- (c) Textual, tabular and internal (d) Tabular, textual and external.
23. The best method of presentation of data is
- (a) Textual (b) Tabular
- (c) Diagrammatic (d) (b) and (c).
24. The most attractive method of data presentation is
- (a) Tabular (b) Textual
- (c) Diagrammatic (d) (a) or (b).
25. For tabulation, 'caption' is
- (a) The upper part of the table (b) The lower part of the table

- (c) The main part of the table the
- (d) The upper part of a table that describes column and sub-column.
26. 'Stub' of a table is the
- (a) Left part of the table describing the columns
- (b) Right part of the table describing the columns
- (c) Right part of the table describing the rows
- (d) Left part of the table describing the rows.
27. The entire upper part of a table is known as
- (a) Caption
- (b) Stub
- (c) Box head
- (d) Body.
28. The unit of measurement in tabulation is shown in
- (a) Box head
- (b) Body
- (c) Caption
- (d) Stub.
29. In tabulation source of the data, if any, is shown in the
- (a) Footnote
- (b) Body
- (c) Stub
- (d) Caption.
30. Which of the following statements is untrue for tabulation?
- (a) Statistical analysis of data requires tabulation
- (b) It facilitates comparison between rows and not columns
- (c) Complicated data can be presented
- (d) Diagrammatic representation of data requires tabulation.
31. Hidden trend, if any, in the data can be noticed in
- (a) Textual presentation
- (b) Tabulation
- (c) Diagrammatic representation
- (d) All these.
32. Diagrammatic representation of data is done by
- (a) Diagrams
- (b) Charts
- (c) Pictures
- (d) All these.
33. The most accurate mode of data presentation is

- (a) Diagrammatic method (b) Tabulation
(c) Textual presentation (d) None of these.
34. The chart that uses logarithm of the variable is known as
(a) Line chart (b) Ratio chart
(c) Multiple line chart (d) Component line chart.
35. Multiple line chart is applied for
(a) Showing multiple charts
(b) Two or more related time series when the variables are expressed in the same unit
(c) Two or more related time series when the variables are expressed in different unit
(d) Multiple variations in the time series.
36. Multiple axis line chart is considered when
(a) There is more than one time series (b) The units of the variables are different
(c) (a) or (b) (d) (a) and (b).
37. Horizontal bar diagram is used for
(a) Qualitative data (b) Data varying over time
(c) Data varying over space (d) (a) or (c).
38. Vertical bar diagram is applicable when
(a) The data are qualitative
(b) The data are quantitative
(c) When the data vary over time
(d) (a) or (c).
39. Divided bar chart is considered for
(a) Comparing different components of a variable
(b) The relation of different components to the table
(c) (a) or (b)
(d) (a) and (b).
40. In order to compare two or more related series, we consider

- (a) Multiple bar chart
 - (b) Grouped bar chart
 - (c) (a) or (b)
 - (d) (a) and (b).
41. Pie-diagram is used for
- (a) Comparing different components and their relation to the total
 - (b) Representing qualitative data in a circle
 - (c) Representing quantitative data in circle
 - (d) (b) or (c).
42. A frequency distribution
- (a) Arranges observations in an increasing order
 - (b) Arranges observation in terms of a number of groups
 - (c) Relates to a measurable characteristic
 - (d) All these.
43. The frequency distribution of a continuous variable is known as
- (a) Grouped frequency distribution
 - (b) Simple frequency distribution
 - (c) (a) or (b)
 - (d) (a) and (b).
44. The distribution of shares is an example of the frequency distribution of
- (a) A discrete variable
 - (b) A continuous variable
 - (c) An attribute
 - (d) (a) or (c).
45. The distribution of profits of a blue-chip company relates to
- (a) Discrete variable
 - (b) Continuous variable
 - (c) Attributes

- (d) (a) or (b).
46. Mutually exclusive classification
- (a) Excludes both the class limits
 - (b) Excludes the upper class limit but includes the lower class limit
 - (c) Includes the upper class limit but excludes the upper class limit
 - (d) Either (b) or (c).
47. Mutually inclusive classification is usually meant for
- (a) A discrete variable
 - (b) A continuous variable
 - (c) An attribute
 - (d) All these.
48. Mutually exclusive classification is usually meant for
- (a) A discrete variable
 - (b) A continuous variable
 - (c) An attribute
 - (d) Any of these.
49. The LCB is
- (a) An upper limit to LCL
 - (b) A lower limit to LCL
 - (c) (a) and (b)
 - (d) (a) or (b).
50. The UCB is
- (a) An upper limit to UCL (b) A lower limit to LCL
 - (c) Both (a) and (b) (d) (a) or (b).
51. length of a class is
- (a) The difference between the UCB and LCB of that class
 - (b) The difference between the UCL and LCL of that class
 - (c) (a) or (b)
 - (d) Both (a) and (b).

52. For a particular class boundary, the less than cumulative frequency and more than cumulative frequency add up to
- (a) Total frequency (b) Fifty per cent of the total frequency
- (c) (a) or (b) (d) None of these.
53. Frequency density corresponding to a class interval is the ratio of
- (a) Class frequency to the total frequency (b) Class frequency to the class length
- (c) Class length to the class frequency (d) Class frequency to the cumulative frequency.
54. Relative frequency for a particular class
- (a) Lies between 0 and 1 (b) Lies between 0 and 1, both inclusive
- (c) Lies between -1 and 0 (d) Lies between -1 to 1.
55. Mode of a distribution can be obtained from
- (a) Histogram (b) Less than type ogives
- (c) More than type ogives (d) Frequency polygon.
56. Median of a distribution can be obtained from
- (a) Frequency polygon (b) Histogram
- (c) Less than type ogives (d) None of these.
57. A comparison among the class frequencies is possible only in
- (a) Frequency polygon (b) Histogram
- (c) Ogives (d) (a) or (b).
58. Frequency curve is a limiting form of
- (a) Frequency polygon (b) Histogram
- (c) (a) or (b) (d) (a) and (b).
59. Most of the commonly used frequency curves are
- (a) Mixed (b) Inverted J-shaped
- (c) U-shaped (d) Bell-shaped.
60. The distribution of profits of a company follows
- (a) J-shaped frequency curve (b) U-shaped frequency curve

(c) Bell-shaped frequency curve

(d) Any of these.

Set B

Answer the following questions. Each question carries 2 marks.

1. Out of 1000 persons, 25 per cent were industrial workers and the rest were agricultural workers. 300 persons enjoyed world cup matches on TV. 30 per cent of the people who had not watched world cup matches were industrial workers. What is the number of agricultural workers who had enjoyed world cup matches on TV?

(a) 260 (b) 240 (c) 230 (d) 250

2. A sample study of the people of an area revealed that total number of women were 40% and the percentage of coffee drinkers were 45 as a whole and the percentage of male coffee drinkers was 20. What was the percentage of female non-coffee drinkers?

(a) 10 (b) 15 (c) 18 (d) 20

3. Cost of sugar in a month under the heads raw materials, labour, direct production and others were 12, 20, 35 and 23 units respectively. What is the difference between the central angles for the largest and smallest components of the cost of sugar?

(a) 72° (b) 48° (c) 56° (d) 92°

4. The number of accidents for seven days in a locality are given below :

No. of accidents:	0	1	2	3	4	5	6
Frequency :	15	19	22	31	9	3	2

What is the number of cases when 3 or less accidents occurred?

(a) 56 (b) 6 (c) 68 (d) 87

5. The following data relate to the incomes of 86 persons :

Income in Rs. : 500-999 1000-1499 1500-1999 2000-2499

No. of persons : 15 28 367

What is the percentage of persons earning more than Rs. 1500?

(a) 50 (b) 45 (c) 40 (d) 60

6. The following data relate to the marks of a group of students:

Marks :	Below 10	Below 20	Below 30	Below 40	Below 50

No. of students : 15 38 65 84 100

How many students got marks more than 30?

- (a) 65 (b) 50 (c) 35 (d) 43

7. Find the number of observations between 250 and 300 from the following data :

Value : More than 200 More than 250 More than 300 More than 350

No. of observations: 56 38 15 0

- (a) 56 (b) 23 (c) 15 (d) 8

Set C

Answer the following questions. Each question carries 5 marks.

1. In a study about the male and female students of commerce and science departments of a college in 5 years, the following datas were obtained :

1995	2000
70% male students	75% male students
65% read Commerce	40% read Science
20% of female students read Science	50% of male students read Commerce
3000 total No. of students	3600 total No. of students.

After combining 1995 and 2000 if x denotes the ratio of female commerce student to female Science student and y denotes the ratio of male commerce student to male Science student, then

- (a) $x = y$ (b) $x > y$ (c) $x < y$ (d) $x > y$

2. In a study relating to the labourers of a jute mill in West Bengal, the following information was collected.

'Twenty per cent of the total employees were females and forty per cent of them were married. Thirty female workers were not members of Trade Union. Compared to this, out of 600 male workers 500 were members of Trade Union and fifty per cent of the male workers were married. The unmarried non-member male employees were 60 which formed ten per cent of the total male employees. The unmarried non-members of the employees were 80'. On the basis of this information, the ratio of married male non-members to the married female non-members is

- (a) 1 : 3 (b) 3 : 1 (c) 4 : 1 (d) 5 : 1

3. The weight of 50 students in pounds are given below :

82, 95, 120, 174, 179, 176, 159, 91, 85, 175
88, 160, 97, 133, 159, 176, 151, 115, 105, 172

170, 128, 112, 101, 123, 117, 93, 117, 99, 90

113, 119, 129, 134, 178, 105, 147, 107, 155, 157

98, 117, 95, 135, 175, 97, 160, 168, 144, 175

If the data are arranged in the form of a frequency distribution with class intervals as 81-100, 101-120, 121-140, 141-160 and 161-180, then the frequencies for these 5 class intervals are

- (a) 6, 9, 10, 11, 14 (b) 12, 8, 7, 11, 12 (c) 10, 12, 8, 11, 9 (d) 12, 11, 6, 9, 12

4. The following data relate to the marks of 48 students in statistics :

56,	10,	54,	38,	21,	43,	12,	22
48,	51,	39,	26,	12,	17,	36,	19
48,	36,	15,	33,	30,	62,	57,	17
5,	17,	45,	46,	43,	55,	57,	38
43,	28,	32,	35,	54,	27,	17,	16
11,	43,	45,	2,	16,	46,	28,	45

What are the frequency densities for the class intervals 30-39, 40-49 and 50-59

- (a) 0.20, 0.50, 0.90
(b) 0.70, 0.90, 1.10
(c) 0.1875, 0.1667, 0.2083
(d) 0.90, 1.00, 0.80

5. The following information relates to the age of death of 50 persons in an area :

36,	48, 50,	45,	49,	31,	50,	48,	42,	57
43,	40, 32,	41,	39,	39,	43,	47,	45,	52
47,	48, 53,	37,	48,	50,	41,	49,	50,	53
38,	41, 49,	45,	36,	39,	31,	48,	59,	48
37,	49, 53,	51,	54,	59,	48,	38,	39,	45

If the class intervals are 31-33, 34-36, 37-39, ... Then the percentage frequencies for the last five class intervals are

- (a) 18, 18, 10, 2 and 4.
- (b) 10, 15, 18, 4 and 2.
- (c) 14, 18, 20, 10 and 2.
- (d) 10, 12, 16, 4 and 6.

ANSWERS

Set A

1.	(c)	2.	(b)	3.	(d)	4.	(d)	5.	(a)	6.	(b)
7.	(b)	8.	(a)	9.	(a)	10.	(c)	11.	(b)	12.	(a)
13.	(d)	14.	(c)	15.	(a)	16.	(c)	17.	(b)	18.	(a)
19.	(a)	20.	(d)	21.	(c)	22.	(a)	23.	(b)	24.	(c)
25.	(d)	26.	(d)	27.	(c)	28.	(a)	29.	(a)	30.	(b)
31.	(c)	32.	(d)	33.	(b)	34.	(b)	35.	(b)	36.	(d)
37.	(d)	38.	(b)	39.	(d)	40.	(c)	41.	(a)	42.	(d)
43.	(a)	44.	(a)	45.	(b)	46.	(b)	47.	(a)	48.	(b)
49.	(b)	50.	(a)	51.	(a)	52.	(a)	53.	(b)	54.	(a)
55.	(a)	56.	(c)	57.	(b)	58.	(d)	59.	(d)	60.	(c)

Set B

1.	(a)	2.	(b)	3.	(d)	4.	(d)	5.	(a)	6.	(c)
7.	(b)										

Set C

1.	(b)	2.	(c)	3.	(d)	4.	(d)	5.	(a)
-

ADDITIONAL QUESTION BANK

1. Graph is a
(a) Line diagram (b) Bar diagram (c) Pie diagram (d) Pictogram
2. Details are shown by
(a) Charts (b) Tabular presentation
(c) both (d) none
3. The relationship between two variables are shown in
(a) Pictogram (b) Histogram (c) Bar diagram (d) Line diagram
4. In general the number of types of tabulation are
(a) two (b) three (c) one (d) four
5. A table has
(a) four (b) two (c) five (d) none parts.
6. The number of errors in Statistics are
(a) one (b) two (c) three (d) four
7. The number of "Frequency distribution" is
(a) two (b) one (c) five (d) four
8. $(\text{Class frequency})/(\text{Width of the class})$ is defined as
(a) Frequency density (b) Frequency distribution
(c) both (d) none
9. Tally marks determines
(a) class width (b) class boundary (c) class limit (d) class frequency
10. Cumulative Frequency Distribution is a
(a) graph (b) frequency (c) Statistical Table (d) distribution
11. To find the number of observations less than any given value
(a) Single frequency distribution (b) Grouped frequency distribution
(c) Cumulative frequency distribution (d) None is used.
12. An area diagram is
(a) Histogram (b) Frequency Polygon

- (c) Ogive (d) none
13. When all classes have a common width
(a) Pie Chart (b) Frequency Polygon
(c) both (d) none is used.
14. An approximate idea of the shape of frequency curve is given by
(a) Ogive (b) Frequency Polygon
(c) both (d) none
15. Ogive is a
(a) Line diagram (b) Bar diagram (c) both (d) none
16. Unequal widths of classes in the frequency distribution do not cause any difficulty in the construction of
(a) Ogive (b) Frequency Polygon
(c) Histogram (d) none
17. The graphical representation of a cumulative frequency distribution is called
(a) Histogram (b) Ogive (c) both (d) none.
18. The most common form of diagrammatic representation of a grouped frequency distribution is
(a) Ogive (b) Histogram (c) Frequency Polygon (d) none
19. Vertical bar chart may appear somewhat alike
(a) Histogram (b) Frequency Polygon
(c) both (d) none
20. The number of types of cumulative frequency is
(a) one (b) two (c) three (d) four
21. A representative value of the class interval for the calculation of mean, standard deviation, mean deviation etc. is
(a) class interval (b) class limit (c) class mark (d) none
22. The number of observations falling within a class is called
(a) density (b) frequency (c) both (d) none
23. Classes with zero frequencies are called
(a) nil class (b) empty class (c) class (d) none

24. For determining the class frequencies it is necessary that these classes are
(a) mutually exclusive (b) not mutually exclusive
(c) independent (d) none
25. Most extreme values which would ever be included in a class interval are called
(a) class limits (b) class interval (c) class boundaries (d) none
26. The value exactly at the middle of a class interval is called
(a) class mark (b) mid value (c) both (d) none
27. Difference between the lower and the upper class boundaries is
(a) width (b) size (c) both (d) none
28. In the construction of a frequency distribution, it is generally preferable to have classes of
(a) equal width (b) unequal width (c) maximum (d) none
29. Frequency density is used in the construction of
(a) Histogram (b) Ogive
(c) Frequency Polygon (d) none when the classes are of unequal width.
30. "Cumulative Frequency" only refers to the
(a) less-than type (b) more-than type (c) both (d) none
31. For the construction of a grouped frequency distribution
(a) class boundaries (b) class limits (c) both
(d) none are used.
32. In all Statistical calculations and diagrams involving end points of classes
(a) class boundaries (b) class value (c) both (d) none are used.
33. Upper limit of any class is _____ from the lower limit of the next class
(a) same (b) different
(c) both (d) none
34. Upper boundary of any class coincides with the Lower boundary of the next class.
(a) true (b) false (c) both (d) none.
35. Excepting the first and the last, all other class boundaries lie midway between the upper limit of a class and the lower limit of the next higher class.

- (a) true (b) false (c) both (d) none
36. The lower extreme point of a class is called
 (a) lower class limit (b) lower class boundary
 (c) both (d) none
37. For the construction of grouped frequency distribution from ungrouped data we use
 (a) class limits (b) class boundaries (c) class width (d) none
38. When one end of a class is not specified, the class is called
 (a) closed-end class (b) open- end class (c) both (d) none
39. Class boundaries should be considered to be the real limits for the class interval.
 (a) true (b) false (c) both (d) none
40. Difference between the maximum & minimum value of a given data is called
 (a) width (b) size (c) range (d) none
41. In Histogram if the classes are of unequal width then the heights of the rectangles must be proportional to the frequency densities.
 (a) true (b) false (c) both (d) none
42. When all classes have equal width, the heights of the rectangles in Histogram will be numerically equal to the
 (a) class frequencies (b) class boundaries (c) both (d) none
43. Consecutive rectangles in a Histogram have no space in between
 (a) true (b) false (c) both (d) none
44. Histogram emphasizes the widths of rectangles between the class boundaries.
 (a) false (b) true (c) both (d) none
45. To find the mode graphically
 (a) Ogive (b) Frequency Polygon
 (c) Histogram (d) none may be used.
46. When the width of all classes is same, frequency polygon has not the same area as the Histogram.
 (a) True (b) false (c) both (d) none
47. For obtaining frequency polygon we join the successive points whose abscissa represent the corresponding class frequency.....

- (a) true (b) false (c) both (d) none
48. In representing simple frequency distributions of a discrete variable
(a) Ogive (b) Histogram (c) Frequency Polygon (d) both is useful.
49. Diagrammatic representation of the cumulative frequency distribution is
(a) Frequency Polygon (b) Ogive (c) Histogram (d) none
50. For the overlapping classes 0-10 , 10-20,20-30 etc. the class mark of the class 0-10 is
(a) 5 (b) 0 (c) 10 (d) none
51. For the non-overlapping classes 0-19,20-39,40-59 the class mark of the class 0-19 is
(a) 0 (b) 19 (c) 9.5 (d) none
52. Class : 0-10 10-20 20-30 30-40 40-50
Frequency : 5 8 15 6 4
- For the class 20-30 , cumulative frequency is
(a) 20 (b) 13 (c) 15 (d) 28
53. An Ogive can be prepared in different ways.
(a) 2 (b) 3 (c) 4 (d) none
54. The curve obtained by joining the points, whose x- coordinates are the upper limits of the class-intervals and y coordinates are corresponding cumulative frequencies is called
(a) Ogive Curve (b) Histogram (c) Frequency Polygon (d) Frequency
55. The breadth of the rectangle is equal to the length of the class-interval in
(a) Ogive (b) Histogram (c) both (d) none
56. In Histogram, the classes are taken
(a) overlapping (b) non-overlapping (c) both (d) none
57. For overlapping class-intervals the class limit & class boundary are
(a) same (b) not same (c) zero (d) none
58. Classification is of
(a) four (b) Three (c) two (d) five kinds.

ANSWERS

1.	(a)	2.	(b)	3.	(d)	4.	(a)	5.	(c)
6.	(b)	7.	(a)	8.	(a)	9.	(d)	10.	(c)
11.	(c)	12.	(a)	13.	(b)	14.	(b)	15.	(a)
16.	(c)	17.	(b)	18.	(b)	19.	(a)	20.	(b)
21.	(c)	22.	(b)	23.	(b)	24.	(a)	25.	(c)
26.	(c)	27.	(c)	28.	(a)	29.	(a)	30.	(a)
31.	(b)	32.	(a)	33.	(b)	34.	(a)	35.	(a)
36.	(b)	37.	(a)	38.	(b)	39.	(a)	40.	(c)
41.	(a)	42.	(a)	43.	(a)	44.	(b)	45.	(c)
46.	(b)	47.	(b)	48.	(c)	49.	(b)	50.	(a)
51.	(c)	52.	(d)	53.	(a)	54.	(a)	55.	(b)
56.	(a)	57.	(a)	58.	(a)				

PAST YEARS QUESTION

2006 - NOVEMBER

- The quickest method to collect primary data is :
(a) Personal Interview
(b) Indirect Interview
(c) Mailed Questionnaire Method
(d) **Telephonic Interview**
- Which of the following statement is true?
(a) Statistics is derived from the French word 'Statistic'
(b) **Statistics is derived from the Italian word 'Statista'.**
(c) Statistics is derived from the Latin word 'Statistique'.
(d) None of these
- The following data relates to the incomes of 90 persons :

Income in Rs.:	1500-1999	2000-2499	2500-2999	3000-3499
No. of Persons :	13	32	20	25

What is the percentage of persons earning more than Rs. 2,500 ?

- (a) 45 **(b) 50** (c) 52 (d) 55

2007 - FEBRUARY

4. In tabulation, source of data, if any, is shown in the :

- (a) Stub (b) Body (c) Caption **(d) Footnote**

5. Divided bar chart is good for:

- (a) Comparing various components of a variable
(b) Relating the different components to the whole.

(c) (a) and (b)

(d) (a) or (b) (1 mark)

Answer:

(c) Divided Bar Chart, also known as percentage Bar Diagrams, is good for both the things i.e. for comparing different components of a variable as well as the relating of the different components to the whole.

2007 - MAY

6. Relative frequency for a particular class lies between :

- (a) 0 and 1** (b) 0 and 1, both inclusive (c) - 1 and 0 (d) - 1 and 1

Answer:

(a) Relative frequency of a class interval is defined as the ratio of the class frequency to the total frequency. Therefore, Relative frequency for a particular class lies between 0 and 1.

7. Find the number of observations between 350 and 400 from the following data:

Value :	More than 200	More than 350	More than 400	More than 450
No. of observations :	48	25	12	0

(a) 13

(b) 15

(c) 17

(d) 19

8. When the width of all classes is same, frequency polygon has not the same area as the Histogram :

- (a) False (b) True (c) Both (d) None

9. The graphical representation of a cumulative frequency distribution is called:
- (a) Histogram **(b) Ogive** (c) Both (d) None

2007 - AUGUST

10. A table has _____ parts.
- (a) Four (b) Two (c) Five (d) None

Answer:

(c) A table has five parts namely.

- (i) Stub
- (ii) Caption
- (iii) Body
- (iv) Box head
- (v) Footnote.

11. Cost of sugar in a month under the heads raw materials, labour, direct production and others were 12, 20, 35 and 23 units respectively. What is the difference between the central angles for the largest and smallest components of the cost of sugar ?
- (a) 72° (b) 48° (c) 56° **(d) 92°**

Answer:

(d) Total components of the cost of sugar

$$= (12 + 20 + 35 + 23) \text{ units} = 90 \text{ units}$$

Largest component of cost of sugar = 35 units

$$\text{i.e. } \frac{35}{90} \times 360^\circ = 140$$

Smallest component of cost of sugar

$$= 12 \text{ units}$$

$$\text{i.e. } \frac{12}{90} \times 360^\circ = 48^\circ$$

$\therefore$ Difference between the central angles for the largest and smallest components of the cost of sugar

$$= 140^\circ - 48^\circ = 92^\circ$$

12. [Frequency density corresponding to a class interval is the ratio of:
- (a) Class Frequency to the Total Frequency
- (b) Class Frequency to the Class Length**
- (c) Class Length to the Class Frequency

(d) Class Frequency to the Cumulative Frequency (1 mark)

2007 - NOVEMBER

13. In order to compare two or more related series, we consider:

- (a) Multiple Bar Chart (b) Grouped Bar Chart
(c) (a) or (b) (d) (a) and (b) (1 mark)

14. An area diagram is :

- (a) Histogram (b) Ogive (c) Frequency Polygon (d) None of these

15. Most extreme values which would ever be included in a class interval are called:

- (a) Class Interval (b) Class Limits
(c) **Class Boundaries** (d) None of these (

Answer:

(c) Most extreme values which would be ever included in a class- interval are called as class boundaries, also referred to as actual class limit, are defined as the limits up to which the two limits, (actual) of each class may be extended to fill up the gap that exist between the classes.

16. In 2000, out of total of 1,750 workers of a factory, 1,200 were members of a trade union. The number of women employed was 200 of which 175 did not belong to a trade union. In 2004, there were 1,800 employees who belong to a trade union and 50 who did not belong to trade union. Of all the employees in 2004, 300 were women of whom only 8 did not belong to the trade union. On the basis of this information, the ratio of female members of the trade union in 2000 and 2004 is :

- (a) 292: 25 (b) 8:175 (c) 175:8 (d) **25 : 292**

Answer:

(d) Year 2000

No. of female members = 200.

No. of female members who did not belong to the Trade Union = 175.

Therefore, no. of female members who belonged to the Trade Union = $200 - 175 = 25$.

Year 2004

No. of female members = 300

No. of female members who did not belong to the Trade Union = 8. Therefore, no. of female members who belonged to the Trade Union = $300 - 8 = 292$

Therefore, the ratio of female members of the trade union in 2000 and 2004 is 25 : 292.

2008 - FEBRUARY

17. The lower class boundary is :

(a) An upper limit to Lower Class Limit

(b) A lower limit to Lower Class Limit.

(c) Both (a) & (b)

(d) None of these (1 mark)

Answer:

(b) Lower class Boundary

Lower class limit - $\frac{1}{2}$ (upper class limit of the class - lower class limit of the succeeding class).
Therefore, lower class boundary is a lower limit to lower class limit.

18. The distribution of profits of a company follows :

(a) J - shaped frequency curve

(b) U - shaped frequency curve

(c) Bell - shaped frequency curve
(mark)

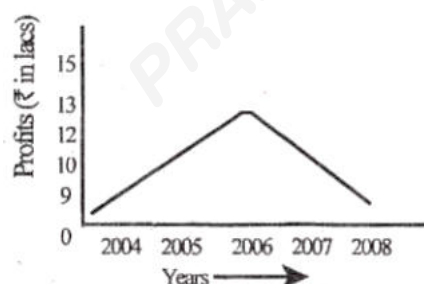
(d) Any of these

(1

Answer:

(c) The bell- shaped curve looks like a bell. On a bell- shape curve, the frequency, starting from a rather low value, gradually reaches the maximum value, somewhere near the central part and then gradually decreases to reach its lowest value at the other extremity. Similar is the case of profits of a company. It rises till the resources are fully utilized and if the resources are still utilized then due to over-utilization of resources, the profits start declining. This can be clearly depicted through the data given below:

Year	Profits (Rs. in lacs)
2004	10
2005	12
2006	15
2007	13
2008	9



19. Out of 1000 persons, 25 per cent were industrial workers and the rest were agricultural workers. 300 persons enjoyed world cup matches on T.V. 30 per cent of the people who had not watched world cup matches were industrial workers. What is the number of agricultural workers who had enjoyed world cup matches on TV?

(a) 230

(b) 250

(c) 240

(d) 260

Answer:

(d) No. of Industrial Workers = 25% of 1,000 = 250 No. of Agricultural Workers = 75% of 1,000 = 750

No. of persons who enjoyed world cup matches on TV = 300

No. of persons who had not watched world cup matches on TV = 1,000 - 300 = 700

Percentage of Industrial Workers who had not watched world cup matches on TV = 30%

$\therefore$ Percentage of Agricultural Workers who had not watched world cup matches on TV = 70%

$\therefore$ No. of Agricultural Workers who had not watched world cup matches on TV = 70% of 700 = 490

$\therefore$ No. of Agricultural Workers who enjoy world cup matches on TV = Total No. of Agricultural Workers - No. of Agricultural

Workers who had not watched world cup matches on TV = 750 - 490 = 260

20. Median of a distribution can be obtained from ;

(a) Histogram (b) Frequency Polygon (c) **Less than type Ogives** (d) None of these

Answer:

(c) Ogives are considered for obtaining quartiles graphically. If a perpendicular is drawn from the point of intersection of the two o- gives, i.e. less than type ogive and more than type give, on the horizontal axis, then x- value of this point gives us the value of median, the second or middle quartile.

2008 - JUNE

21. In indirect oral investigation :

(a) Data is not capable of numerical expression

(b) **Not possible or desirable to approach informant directly.**

(c) Data is collected from the books.

(d) None of these

Answer:

(b) Indirect oral investigation is a method in which a third person is contacted who is expected to know the necessary details about the persons for whom the enquiry is meant. This method is suitable when it is not possible or deliverable to approach informant directly.

22. Circular diagrams are always :

(a) One - dimensional

(b) **Two-dimensional**

(c) Three - dimensional

(d) Cartograms (1 mark)

Answer:

(b) Circular diagram is a Two- dimension diagram in which a circle is prepared and the radius of circle is determined on the basis of minimum square root value of the variable. Two- dimensional diagram is a diagram which is prepared on the basis of two dimension i.e. length and width.

[23] The column headings of a table are known as :

- (a) Body (b) Stub (c) Box - head (d) **Caption**

Answer:

(d) Each column is given a heading to explain what the figures in the columns represent. These column headings of a table are known as caption.

23. Some important sources of secondary data are _____ :

(a) International and Government sources

- (b) International and primary sources
(c) Private and primary sources
(d) Government sources

Answer:

(a) The Government source like Indian trade journal - weekly, reserve Bank of India Bulletin - monthly, etc and International sources like WHO, World Bank, IMF, etc are some of the important sources of secondary data.

2008 - DECEMBER

[25] From the following data find the number class intervals if class length is given as 5.

73, 72, 65, 41, 54, 80, 50, 46, 49, 53.

- (a) 6 (b) 5 (c) 7 (d) 8

Answer:

(d) We have, Range = Maximum value - Minimum value = $80 - 41 = 39$

Class length = 5

No. of class Intervals $\times$ class lengths Range

$\Rightarrow$ No. of class Intervals $\times 5 \cong 39$

$\Rightarrow$ No. of class Intervals $\cong \frac{39}{5} \cong 8$

(We always take the next integer as the no. of class intervals so as to include both the minimum and maximum values).

24. The most appropriate diagram to represent the data relating to the monthly expenditure on different items by a family is

- (a) Histogram **(b) Pie-diagram.**
(c) Frequency polygon (d) Line graph. (1 mark)

[27] Which of the following is a statistical data ?

- (a) Ram is 50 years old.
(b) Height of Ram is 5'6" and of Shyam and Hari is 5'3" and 5'4" respectively.

(c) Height of Ram is 5'6" and weight is 90kg

(d) Sale of A was more than B and C.

(1 mark)

Answer:

(b) Option (b) represents statistical data which can be understood by referring the definition of statistics keeping note of the following points.

(1) Statistics are aggregate of facts. A single figure cannot be called as statistics because it cannot be compared to draw any conclusion out of it.

(2) All statistical facts are expressed in numbers. Qualitative expressions like young, old, etc do not constitute statistics.

(3) Statistics should be placed in relation to each other so as to facilitate comparison. For this purpose, the data must be homogenous and not heterogenous, e.g. height and weight are heterogenous in character.

25. Sales of XYZ Ltd. for 4 months is :

Months	Sales
Jan.	10,000
Feb.	15,000
May	18,000
Apr.	9,000

The above data represents :

(a) Discrete (b) Continuous **(c) individual** (d) None of these

Answer:

(c) Given data represents unclassified and ungrouped data. Therefore, the given series is an individual series.

2009 - JUNE

26. Mid values are also called _____

(a) Lower limit (b) Upper limit (c) Class mark (d) None

Answer:

(c) Mid-values are also called class mark.

Class Mark = $\frac{\text{Lower class limit} + \text{Upper class limit}}{2}$

27. Which of the following is not a two-dimensional figure ?

(a) Line Diagram (b) Pie Diagram
(c) Square Diagram (d) Rectangle Diagram (1 mark)

Answer:

(a) Line Diagram.

28. Less than type and more than type Ogives meet at a point known as:

- (a) Mean (b) **Median** (c) Mode (d) None

2009 - DECEMBER

29. Arrange the dimensions of Bar diagram, Cube diagram, Pie diagram in sequence.

- (a) 1,3,2 (b) 2,1,3 (c) 2, 3, 1 (d) 3, 2, 1
(

Answer:

(a) Bar diagram is one dimensional.

Cube diagram has 3 dimensions viz. length breadth and height and hence is three-dimensional.

Pie-diagram is two-dimensional.

Therefore, if we arrange it in sequence, we get:

Bar diagram, cube-diagram and Pie diagram i.e. 1,3, 2.

30. With the help of histogram one can find.

- (a) Mean (b) Median (c) **Mode** (d) First Quartile (1 mark)

31. [Nationality of a person is :

- (a) Discrete variable (b) **An attribute**
(c) Continuous variable (d) None (1 mark)

32. If we plot less than and more than type frequency distribution, then the graph plotted is _____.

- (a) Histogram (b) Frequency Curve (c) **Ogive** (d) None of these

2010 - JUNE

33. The primary rules that should be observed in classification

- (i) As far as possible, the class should be of equal width
(ii) The classes should be exhaustive
(iii) The classes should be unambiguously defined.

Then which of the following is correct

- (a) only (i) and (ii) (b) **only (ii) and (iii)**
(c) only (i) and (iii) (d) all (i), (ii) and (iii) (1 mark)

Answer:

(b) Requisites of a good classification are:

- (1) It should be exhaustive
- (2) It should be mutually exclusive
- (3) It should be unambiguous
- (4) It should be stable and flexible
- (5) It should be homogeneous
- (6) It should be a revealing classification

34. Using Ogive Curve, we can determine

- (a) Median (b) Quartile **(c) Both (a) and (b)** (d) None.

2010 - DECEMBER

35. Mode can be obtained from

- (a) Frequency polygon. **(b) Histogram.**
(c) Ogive (d) All of the above

36. The data obtained by the internet are

- (a) Primary data **(b) Secondary data**
(c) Both (a) and (b) (d) None of these. (1 mark)

37. The statistical measure computed from the sample observations alone have been termed as

- (a) estimate (b) parameter. (c) statistic (d) attribute.

2011 - JUNE

38. When the two curves of ogive intersect, the point of intersection provides :

- (a) First Quartile **(b) Second Quartile**
(c) Third Quartile (d) Mode.

39. Frequency Density can be termed as:

- (a) Class frequency to the cumulative frequency (b) Class frequency to the total frequency
(c) Class frequency to the class length (d) Class length to the class frequency.

40. The Chronological classification of data are classified on the basis of:

- (a) Attributes (b) Area (c) Time (d) Class Interval

41. Arrange the following dimension wise : pie-diagram, bar-diagram and cubic diagram.

- (a) 1,2,3 (b) 3,1,2 (c) 3,2,1 (d) 2,1,3

Answer:

(d) Pie-Diagram : Two Dimensional Diagram (2)

These Diagrams are also called as "Area-Diagrams"¹.

Used when different segments or components of values are also to be presented.

Bar-Diagram : One Dimensional Diagram (1) means such diagrams where only one dimensional measurement i.e. height is used. There is no importance of width or thickness in these diagrams. The heights of bars are taken on the basis of values. **Cubic-Diagram :** Three Dimensional Diagram (3) are those in which three dimensions viz length, breadth & height are taken into account, used when there is wide range of data and three different but inter-related features of data are to be represented simultaneously.

2011 - DECEMBER

[45] The frequency of class 20-30 in the following data is

Class	0-10	10-20	20-30	30-40	40-50
Cumulative Frequency	5	13	28	34	38

- (a) 5 (b) 28 (c) 15 (d) 13

[46] The Graphical representation by which median is calculated is called

- (a) Ogive Curve (b) Frequency Curve (c) Line diagram (d) Histogram

42. Which of the following is not a two dimensional diagram?

- (a) Square diagram (b) Line diagram
(c) Rectangular diagram (d) Pie-chart

2012 - JUNE

43. From which graphical representation, we can calculate partition values ?

- (a) Lorenz curve (b) Ogive curve
(c) Histogram (d) None of the above.

44. The data given below refers to the marks gained by a group of students:

Marks	Below 10	Below 20	Below 30	Below 40	Below 50

No. of Students	15	38	65	84	100

The no. of students getting marks more than 30 would be?

- (a) 50 (b) 53 **(c) 35** (d) 62

45. Cost of Sugar in a month under the heads raw materials, labour, direct production and others were 12,20,35 & 23 units respectively. The difference between their central angles for the largest & smallest components of the cost of Sugar is

- (a) 92 (b) 72 (c) 48 (d) 56

2012 - DECEMBER

46. What is a exclusive series?

- (a) In which both upper and lower limit are not included in class frequency.
 (b) In which lower limit is not included in class frequency.
(c) In which upper limit is not included in class frequency.
 (d) None of the above.

47. For data on frequency distribution of weights:

70, 73, 49, 57, 56, 44, 56, 71, 65, 62, 60, 50, 55, 49, 63 and 45

If we assume class length as 5, the number of class intervals would be

- (a) 5 (b) 6 (c) 7 (d) 8

Answer:

(c)

C.I.	40-45	45-50	50-55	55-60	60-65	65-70	70-75
No. of class intervals = 7							

2013-JUNE

[53] A pie diagram is used to represent the following data:

Source:	Customs	Excise	Incometax	Wealthtax
Revenue in million rupees:	120	180	240	180

(a) (120 , 90) (b) (90 , 120)
(c) (60 , 120) (d) (90 ,60)

$$\begin{aligned}\text{Central Angle of wealth tax} &= \frac{\text{Revenue of wealth tax}}{\text{Total Revenue}} \times 360 \\ &= \frac{180}{720} \times 360 \\ &= 90\end{aligned}$$

2013- DECEMBER

48. Difference between the maximum and minimum value of a given data is called

- (a) Width (b) Size (c) **Range** (d) Class

[55] If class interval is 10 - 14, 15 -19, 20 - 24, then the first class is

- (a) 10-15 (b) **9.5-14.5** (c) 10.5-15.5 (d) 9-15

49. The difference between the upper and lower limit of a class is called _____.

- (a) Class Interval (b) Mid Value
(c) Class boundary (d) Frequency

2014 - JUNE

50. There were 200 employees in an office in which 150 were married. Total male employees were 160 out of which 120 were married. What was the number of female unmarried employees?

- (a) 30 (b) **10** (c) 40 (d) 50

Answer:

- (b) Total Employees in the office = 200
 No. of Employees who are married = 150
 No. of Employees who are unmarried = $200 - 150 = 50$
 No. of Total male Employees = 160
 No. of Married male Employees = 120
 No. of unmarried male Employees = $160 - 120 = 40$

No. of females who are unmarried = $50 - 40 = 10$

51. "The less than Ogive" is a:

- (a) U-Shaped Curve **(b) J-Shaped Curve**
(c) S-Shaped (d) Bell Shaped Curve (1)

52. The following data relates to the marks of a group of students.

Marks	No. of Students
More than 70%	07
More than 60%	18
More than 50%	40
More than 40%	60
More than 30%	75
More than 20%	100

How many students have got marks less than 50%?

- (a) **60** (b) 82 (c) 40 (d) 53

53. To draw Histogram, the frequency distribution should be:

- (a) Inclusive type **(b) Exclusive type**
(c) Inclusive and Exclusive type (d) None of these. (1 mark)

2014 - DECEMBER

54. The most appropriate diagram to represent the five - year plan outlay of India in different economic sectors is:

- (a) **Pie diagram** (b) Histogram
(c) Line-Graph (d) Frequency Polygon

55. If the fluctuations in the observed value are very small as compared to the size of the item, it is presented by:

- (a) Z chart (b) Ogive curve
(c) **False base line** (d) Control chart

Answer:

(c) If the fluctuations in the observed value are very small as compared to the size of the item, it is present by **false base line**.

56. For constructing a histogram, the class-intervals of a frequency distribution must be
(a) **equal** (b) unequal (c) equal or unequal (d) none of these

ANSWER: (a) For constructing a histogram, the class-intervals of a frequency distribution must be **equal**.

57. 100 persons are classified into male/female and graduate/non-graduate classes. This data classification is:

- (a) Cardinal data (b) **Ordinal data**
(c) Spatial Series data (d) Temporal data

2015 - JUNE

58. If we draw a perpendicular on x-axis from the point of inter-section of both 'less than' and 'more than' frequency curves we will get the value of _____

- (a) mode (b) **median** (c) arithmetic mean (d) third quartile

59. Histogram is used for the presentation of the following type of series

- (a) Time series (b) **Continuous frequency distribution**
(c) Discrete frequency distribution (d) Individual observation

60. Curve obtained by joining the points whose x coordinates are the upper limits of the class intervals and y coordinates are the corresponding cumulative frequencies is called.

- (a) Frequency Polygon (b) Frequency curve (c) Histogram (d) **Ogive.**

61. The number of observations between 150 and 200 based on the following data is

Value:	More than 100	More than 150	More than 200	More than 250

No. of observations:	76	63	28	05

- (a) 46 (b) **35** (c) 28 (d) 23 (1 mark)

62. The number of car accidents in seven days in a locality are given below:

No. of accidents:	0	1	2	3	4	5	6	7
Frequency:	12	9	11	13	8	9	6	3

What will be the number of cases when 4 or more accidents occurred?

- (a) 32 (b) 41 **(c) 26** (d) 18

2015 - DECEMBER

[70] The most common form of diagrammatic representation of a grouped frequency distribution is:

- (a) **Histogram** (b) Ogive (c) Both (d) None

63. Classification is of _____ kinds.

- (a) Two (b) Three (c) One **(d) Four** (1 mark)

64. The chart that uses logarithm of variable is known as:

- (a) **Ratio chart** (b) Line chart (c) Multiple line chart (d) Component line chart

65. Find the number of observation between 250 and 300 from the following data:

Value more than:	200	250	300	500
No. of observation:	56	38	15	0

- (a) 38 **(b) 23** (c) 15 (d) None of the above

2016 - JUNE

66. Data collected on religion from the census reports are:

- (a) Primary data **(b) Secondary data** (c) Sample data (d) (a) or (b)

2016 - DECEMBER

67. In collection of data which of the following interview methods:

- (a) Personal interview method (b) Telephone interview method (c)
Published data **(d) (a) and (b)**

68. For constructing a histogram the class intervals of a frequency distribution must be of the following type:

- (a) Equal (b) Unequal (c) Equal or Unequal (d) None of these

69. Profits made by XYZ Bank which is a blue chip company in different years refer to:

- (a) An attribute (b) A discrete variable
(c) **A continuous variable** (d) None of these.

70. Mode of presentation data

- (a) Textual presentation (b) Tabulation
(c) Oral presentation **(d) (a) and (b)**

2017 - JUNE

71. If the data represent costs spent on conducting an examination under various needs, then the most suitable diagram will be:

- (a) **Pie diagram** (b) Frequency diagram (c) Bar diagram (d) Multiple bar diagram

72. Frequency density corresponding to class interval is the ratio of:

- (a) Class frequency to the total frequency
(b) Class frequency to the class length
(c) Class length to the class frequency
(d) Class frequency to the cumulative frequency

Answer:

(b) Frequency density corresponding to a class Interval is the Ratio of class Frequency to the class Length.

$$\text{Frequency density} = \frac{\text{Frequency of the class}}{\text{Class width}}$$

73. The point of intersection of less than ogive and greater than ogive curve gives us:

- (a) Mean (b) Mode (c) Median (d) None of the above. (1 mark)

2017 - DECEMBER

74. 'Stub' of a table is the

- (a) Left part of the table describing the columns
(b) Right part of the table describing the columns

- (c) Right part of the table describing the rows
(d) **Left part of the table describing the rows.**

75. Frequency density corresponding to a class interval is the ratio of

- (a) Class frequency to total frequency
(b) Class frequency to the class length
(c) Class length to class frequency
(d) Class frequency to the cumulative frequency.

2018-MAY

76. Frequency density is used in the construction of

- (a) **Histogram** (b) Ogive
(c) Frequency polygon (d) None when the classes are of unequal width

77. Divided bar chart is considered for

- (a) Comparing different components of a variable
(b) The relation of different components to the table
(c) (a) or (b)
(d) **(a) and (b)**

2018- NOVEMBER

78. The following frequency distribution

X:	12	17	24	36	45
F:	2	5	3	8	9

is classified as

- (a) Continuous distribution (b) **Discrete distribution**
(c) Cumulative frequency distribution (d) None of the above

79. Histogram is useful to determine graphically the value of

- (a) Arithmetic mean (b) Median
(c) **Mode** (d) None of the above

80. Data are said to be _____ if the investigator himself is responsible for the collection of the data.

- (a) **Primary data** (b) Secondary data

- (c) Mixed of primary and secondary data (d) None of the above

81. A suitable graph for representing the portioning of total into sub parts in statistics is:

- (a) **A Pie chart** (b) A pictograph (c) An ogive (d) Histogram

82. The number of times a particular items occurs in a class interval is called its:

- (a) Mean (b) **Frequency** (c) Cumulative frequency (d) None of the above

83. An ogive is a graphical representation of

- (a) **Cumulative frequency distribution** (b) A frequency distribution
(c) Ungrouped data (d) None of the above

84.

Class	0-10	10-20	20-30	30-40	40-50
Frequency	4	6	20	8	3

For the class 20-30. Cumulative frequency is:

- (a) 10 (b) 26 (c) **30** (d) 41

2019-JUNE

[93] Which of the following graph is suitable for cumulative frequency distribution?

- (a) **'O'give** (b) Histogram (c) G.M (d) A.M

85. Histogram can be shown as

- (a) Ellipse (b) **Rectangle** (c) Hyperbola (d) Circle

86. _____ Series is continuous.

- (a) Open ended (b) **Exclusive** (c) Close ended (d) Unequal call intervals

87. Ogive graph is used for finding

- (a) Mean (b) Mode (c) **Median** (d) None

88. Histogram is used for finding

- (a) **Mode** (b) Mean (c) First quartile (d) None

2019 - NOVEMBER

89. The graphical representation of cumulative frequency distribution is called.

- (a) Histogram (b) Historiogram **(c) Ogive** (d) None

2020 - NOVEMBER

90. The average of salaries in a factory is Rs. 47,000. The Statement that the average salary Rs. 47,000 is _____.

- (a) Descriptive statics (b) Inferential (c) Detailed (d) Undetailed

91. Statistics cannot deal with _____ data.

- (a) quantitative **(b) qualitative** (c) textual (d) undetailed

92. Sweetness of a sweet dish is:

- (a) Attribute** (b) Discrete variable (c) Continuous variable (d) Variable

93. Census reports are used as a source of _____ data.

- (a) Secondary** (b) Primary (c) Organize (d) Confidential

94. Types of cumulative frequencies are:

- (a) 1 (b) 2 (c) 3 **(d) 4**

Answer:

(b) Cumulative frequencies are two types.

(1) Less than C.F. (2) more than C. F.

95. You are an auditor of a firm and the firm earns a profit of Rs. 67,000 you stated to them that the annual profit is Rs. 67,000. This is _____ type of statistics.

- (a) Descriptive (b) Detailed (c) Non detailed **(d) Inferential**

96. The _____ are used usually when we want to examine the relationship between two variables.

- (a) Bar Graph (b) Pie Chart **(c) Line Chart** (d) Scatter Plot

97. When data are classified according to one criterion, then it is called _____ classification.

- (a) quantitative (b) qualitative **(c) simple** (d) factored

2021 - JANUARY

98. A bar chart is drawn for

- (a) Continuous data (b) Nominal data (c) Time series data (d) **Comparing different components**

99. A tabular presentation can be used for

- (a) Continuous series data (b) Nominal data (c) Time series data for longer period (d) **Primary data**

100. A variable with qualitative characteristic is known as

- (a) Quality Variable (b) **An attribute**
(c) A discrete variable (d) A continuous variable (1 mark)

101. The accuracy and consistency of data can be verified by

- (a) **Scrutiny** (b) Internal Checking
(c) External Checking (d) Double Checking

102. From a histogram one cannot compute the approximate value of

- (a) Mode (b) **Standard deviation** (c) Median (d) Mean

103. The left part of a table providing the description of rows is called.

- (a) Caption (b) Box – head (c) **Stub** (d) Body

104. Mode can be obtained from _____.

- (a) Frequency polygon (b) **Histogram** (c) Ogive (d) All of the above

105. Most of the Commonly used distributions provide a.

- (a) **Bell – Shaped** (b) U Shaped (c) J - Shaped Curve (d) Mixed Curve

106. Which of the following is suitable for the graphical representation of a Cumulative frequency distribution ?

- (a) Frequency polygon (b) Histogram (c) **O give** (d) Pie chart

107. Sweetness of sweet dish is.

- (a) **An Attribute** (b) A discrete variable (c) A continuous variable (d) A variable

2021 - JULY

108. _____ Means separating items according to similar characteristics grouping them into various classes:

- (a) **Classification** (b) Editing (c) Separation (d) Tabulation

109. In graphical representation of data, ideographs are also called as:

- (a) Picto-graphs (b) Asymmetry graphs
(c) Symmetry graphs (d) **Pictograms**

110. A graph that uses vertical bars to represent data is called a:

- (a) Line graph (b) Scatter plot (c) Vertical graphs (d) **Bar graph**

111. In a graphical representation of data, the largest numerical value is 45 the smallest numerical value is 25. If classes desired are 4 then which class interval is:-

- (a) 45 (b) **5** (c) 20 (d) 7.5

Answer:

$$\begin{aligned} \text{(b) No. of class Interval} &= \frac{\text{Largest value} - \text{Smallest value}}{\text{Class width}} \\ &= \frac{45-25}{4} = \frac{20}{4} = 5 \end{aligned}$$

112. Frequency density of a class interval is the ratio of _____.

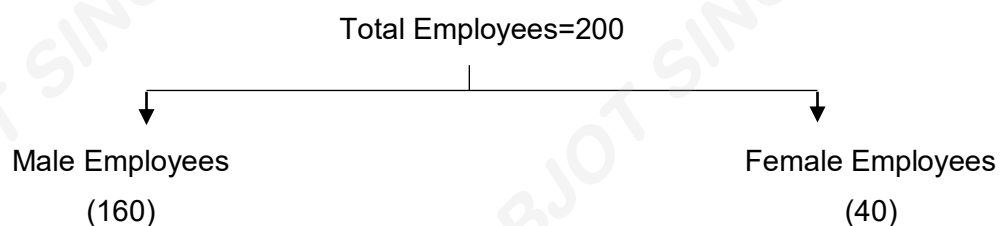
- (a) Class frequency to the total frequency
(b) Class length to class frequency.
(c) Class frequency to the cumulative frequency.
(d) **Frequency of that class interval to the corresponding class length.**

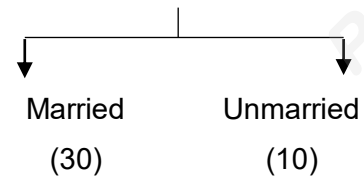
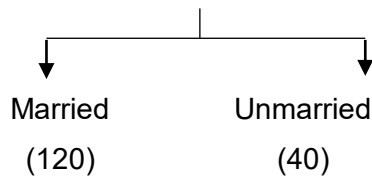
113. There were 200 employees in an office in which 150 were married. Total male employees were 160 out of which 120 were married. What was the number of female unmarried employees?

- (a) 30 (b) 40 (c) 50 (d) 10 (1 mark)

Answer:

(d)





So, No of female unmarried employees = 10

114. Data collected on religion from the census reports are:

- (a) Primary data (b) Unclassified data
(c) Sample data (d) **Secondary data**

2021 - DECEMBER

115. In a study about the male and female students of Commerce and Science departments of a college in 5 years, the following data's were obtained:

1995	2000
70% female students	75% female students
65% read Commerce	40% read Science
20% of male students read Science	50% of female students read Commerce
3000 total No. of students	3600 total No. of students

After combining 1995 and 2000 if x denotes the ratio of female commerce students to female Science student and y denotes the ratio of male commerce student to male Science student, then

- (a) $x = y$ (b) $x > y$ (c) $x < y$ (d) $x \geq y$

Answer:

c) The entire data can be summarized as follows:

Particulars	1995		2000	
No. of Students		3,000		3,600
No. of Female Students	$(70\% \times 3,000)$	2,100	$(75\% \times 3,600)$	2,700
No. of Male Students	$(30\% \times 3,000)$	900	$(25\% \times 3,600)$	900
No. of Commerce Students	$(65\% \times 3,000)$	1,950	$(60\% \times 3,600)$	2,160
No. of Science Students	$(35\% \times 3,000)$	1,050	$(40\% \times 3,600)$	1,440
No. of Male Science Students	$(20\% \times 900)$	180	$(900-810)$	90
No. of Male Commerce Students	$(80\% \times 900)$	720	$(2,160-1,350)$	810

No. of Female Science Students	(1,050-180)	870	(50% × 2,700)	1,350
No. of Female Commerce Students	(1,950-720)	1,230	(50% × 2,700)	1,350

Total female commerce students = 1,230 + 1,350 = 2,580

Total female science students = 870 + 1,350 = 2,220

Therefore, $x = \frac{2,580}{2,220} = 1.1622$

Total male commerce students = 720 + 810 = 1,530

Total male science students = 180 + 90 = 270

Therefore, $y = \frac{1,530}{270} = 5.6667$

Clearly, $x < y$.

116. A National Institute arranged its students data in accordance with different states. This arrangement of data is known as

- (a) Temporal Data **(b) Geographical Data**
 (c) Ordinal Data (d) Cardinal Data.

117. A student marks in five subject S1, S2, S3, S4 and S5 are 86, 79, 90, 88 and 89. If we need to draw a Pie chart to represent these marks, then what will be the Central angle for S3?

- (a) 103.2° **(b) 75°** (c) 105.6° (d) 94.8°

Answer:

(b) Total Marks = 86 + 79 + 90 + 88 + 89 = 432

Marks in S3 = 90

Central Angle = $\frac{90}{432} \times 360 = 75^\circ$

118. Ogive curves can be used to determine

- (a) Mean **(b) Median** (c) Mode (d) Range (

119. The following data relate to the marks of a group of students:

Marks	Below 10	Below 20	Below 30	Below 40	Below 50
No. of students	15	38	65	84	100

How many students got marks more than 30?

- (a) 65 (b) 50 **(c) 35** (d) 43

120. The following data relate to the marks of 48 students in Statistics:

56	10	54	38	21	43	12	22
48	51	39	26	12	17	36	19
48	36	15	33	30	62	57	17
5	17	45	46	43	55	57	38
43	28	32	35	54	27	17	16
11	43	45	2	16	46	28	45

What are the frequency densities for the class intervals 30-39, 40- 49, 50-59?

- (a) 0.20,0.50,0.90 (b) 0.70, 0.90, 1.10
(c) 0.1875, 0.1667, 0.2083 (d) **0.90, 1.00, 0.80**

Answer:

(d) Frequency Density = $\frac{\text{Class Frequency}}{\text{Class Length}}$

Class Interval	Observations	Frequency
30-39	38, 39, 36, 36, 33, 30, 38, 32, 35	9
40-49	43, 48, 48, 45, 46, 43, 43, 43, 45, 46, 45	11
50-59	56, 54, 51, 57, 55, 57, 54	7

Therefore, Frequency Density for the Class Interval 30 - 39 = $9 \div 10 = 0.90$

Frequency Density for the Class Interval 40 - 49 = $11 \div 10 = 1.10$

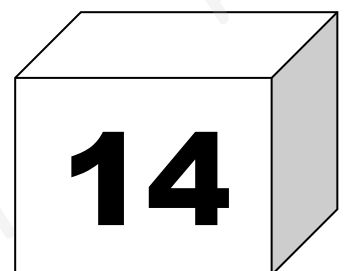
Frequency Density for the Class Interval 50 - 59 = $7 \div 10 = 0.70$

Note, in the ICAI Study Material, option (d) is given as 0.90, 1.10, 0.70, and thus that is the correct answer. However, in the exam, option (d) came as 0.90,1.00, 0.80, which is not the right answer. As a student, a conservative approach would be to leave this question unmarked to avoid the risk of negative marking.

Note: You cannot mark option (b) because it is not in the proper sequence.

121. multiple axis line chart is considered when

- (a) There is more than one time series
(b) The units of the variables are different.
(c) In any case.
(d) **If there are more than one time series and unit of variables are different.**



CENTRAL TENDENCY AND DISPERSION

DEFINITION OF CENTRAL TENDENCY

In many a case, like the distributions of height, weight, marks, profit, wage and so on, it has been noted that starting with rather low frequency, the class frequency gradually increases till it reaches its maximum somewhere near the central part of the distribution and after which the class frequency steadily falls to its minimum value towards the end. Thus, central tendency may be defined as the tendency of a given set of observations to cluster around a single central or middle value and the single value that represents the given set of observations is described as a measure of central tendency or, location, or average. Hence, it is possible to condense a vast mass of data by a single representative value. The computation of a measure of central tendency plays a very important part in many a sphere. A company is recognized by its high average profit, an educational institution is judged on the basis of average marks obtained by its students and so on. Furthermore, the central tendency also facilitates us in providing a basis for comparison between different distribution. Following are the different measures of central tendency:

- (i) Arithmetic Mean (AM)
- (ii) Median (Me)
- (iii) Mode (Mo)
- (iv) Geometric Mean (GM)
- (v) Harmonic Mean (HM)

CRITERIA FOR AN IDEAL MEASURE OF CENTRAL TENDENCY

Following are the criteria for an ideal measure of central tendency:

- (i) It should be properly and unambiguously defined.
- (ii) It should be easy to comprehend.
- (iii) It should be simple to compute.
- (iv) It should be based on all the observations.
- (v) It should have certain desirable mathematical properties.
- (vi) It should be least affected by the presence of extreme observations.

ARITHMETIC MEAN

For a given set of observations, the AM may be defined as the sum of all the observations divided by the number of observations. Thus, if a variable x assumes n values $x_1, x_2, x_3, \dots, x_n$, then the AM of x , to be denoted by $\bar{X}$, is given by,

$$\begin{aligned}\bar{X} &= \frac{x_1 + x_2 + x_3 + \dots + x_n}{n} \\ &= \frac{\sum_{i=1}^n x_i}{n} \\ \bar{X} &= \frac{\sum x_i}{n} \quad \dots \dots \dots (15.1.1)\end{aligned}$$

In case of a simple frequency distribution relating to an attribute, we have

$$\bar{X} = \frac{f_1x_1 + f_2x_2 + f_3x_3 + \dots + f_nx_n}{f_1 + f_2 + f_3 + \dots + f_n}$$

$$= \frac{\sum f_i x_i}{\sum f_i}$$

In case of grouped frequency distribution also we may use formula (15.1.2) with x_i as the mid value of the i -th class interval, on the assumption that all the values belonging to the i -th class interval are equal to x_i .

However, in most cases, if the classification is uniform, we consider the following formula for the computation of AM from grouped frequency distribution:

$$\bar{x} = A + \frac{\sum f_i d_i}{N} \times C \quad \dots\dots\dots$$

Where, $d_i = \frac{x_i - A}{C}$

A = Assumed Mean

C = Class Length

Q. ILLUSTRATIONS:

Example 15.1.1: Following are the daily wages in Rupees of a sample of 9 workers: 58, 62, 48, 53, 70, 52, 60, 84, 75. Compute the mean wage.

= Rs. 62.44.

Example 15.1.2: Compute the mean weight of a group of BBA students of St. Xavier's College from the following data:

Weight in kgs.	44 – 48	49 – 53	54 – 58	59 – 63	64 – 68	69 – 73
No. of Students	3	4	5	7	9	8

Properties of AM

(i) If all the observations assumed by a variable are constants, say k , then the AM is also k . For example, if the height of every student in a group of 10 students is 170 cm, then the mean height is, of course, 170 cm.

(ii) the algebraic sum of deviations of a set of observations from their AM is zero

$$\left. \begin{array}{l} \text{i.e. for unclassified data, } \sum (x_i - \bar{x}) = 0 \\ \text{and for grouped frequency distribution, } \sum f_i (x_i - \bar{x}) = 0 \end{array} \right\} \dots\dots\dots (15.1.4)$$

For example, if a variable x assumes five observations, say 58, 63, 37, 45, 29, then x

= 46.4. Hence, the deviations of the observations from the AM i.e. $(x_i - \bar{x})$ are 11.60, 16.60, -9.40, -1.40 and -17.40, then $\Sigma(x_i - \bar{x}) = 11.60 + 16.60 + (-9.40) + (-1.40) + (-17.40) = 0$.

- (iii) AM is affected due to a change of origin and/or scale which implies that if the original variable x is changed to another variable y by effecting a change of origin, say a , and scale say b , of x i.e. $y = a + bx$, then the AM of y is given by $\bar{y} = a + b\bar{x}$.

For example, if it is known that two variables x and y are related by $2x + 3y + 7 = 0$ and

$$\bar{x} = 15, \text{ then the AM of } y \text{ is given by } \bar{y} = \frac{-7 - 2\bar{x}}{3}$$

$$= \frac{-7 - 2 \times 15}{3} = \frac{-37}{3} = -12.33$$

- (iv) If there are two groups containing n_1 and n_2 observations and $\bar{x}_1$ and $\bar{x}_2$ as the respective arithmetic means, then the combined AM is given by

$$\bar{x} = \frac{n_1\bar{x}_1 + n_2\bar{x}_2}{n_1 + n_2}$$

This property could be extended to $k > 2$ groups and we may write

$$\bar{x} = \frac{\sum n_i \bar{x}_i}{\sum n_i}$$

Example 15.1.5: The mean salary for a group of 40 female workers is Rs. 5,200 per month and that for a group of 60 male workers is Rs. 6800 per month. What is the combined mean salary?

MEDIAN – PARTITION VALUES

As compared to AM, median is a positional average which means that the value of the median is dependent upon the position of the given set of observations for which the median is wanted. Median, for a given set of observations, may be defined as the middle-most value when the observations are arranged either in an ascending order or a descending order of magnitude.

As for example, if the marks of the 7 students are 72, 85, 56, 80, 65, 52 and 68, then in order to find the median mark, we arrange these observations in the following ascending order of magnitude: 52, 56, 65, 68, 72, 80, 85.

Since the 4th term i.e. 68 in this new arrangement is the middle most value, the median mark is 68 i.e. Median (Me) = 68.

As a second example, if the wages of 8 workers, expressed in rupees are

56, 82, 96, 120, 110, 82, 106, 100 then arranging the wages as before, in an ascending order of magnitude, we get Rs. 56, Rs. 82, Rs. 82, Rs. 96, Rs. 100, Rs. 106, Rs. 110, Rs. 120. Since there are two middlemost values, namely, Rs. 96, and Rs. 100 any value between Rs. 96 and Rs. 100 may be, theoretically, regarded as median wage. However, to bring uniqueness, we take the arithmetic mean of the two middle-most values, whenever the number of the observations is an even number. Thus, the median wage in this example, would be

$$M = \frac{96 + 100}{2} = \text{Rs. } 98$$

In case of a grouped frequency distribution, we find median from the cumulative frequency distribution of the variable under consideration. We may consider the following formula, which can be derived from the basic definition of median.

$$M = l_1 + \left(\frac{\frac{N}{2} - N_i}{N_u - N_i} \right) \times C$$

Where,

l_1 = lower class boundary of the median class i.e. the class containing median.

N = total frequency.

N_i = less than cumulative frequency corresponding to l_1 . (Pre median class)

N_u = less than cumulative frequency corresponding to l_2 . (Post median class)

l_2 being the upper class boundary of the median class.

$C = l_2 - l_1$ = length of the median class.

Properties of median

We cannot treat median mathematically, the way we can do with arithmetic mean. We consider below two important features of median.

- (i) *If x and y are two variables, to be related by $y = a + bx$ for any two constants a and b , then the median of y is given by*

$$y_{me} = a + bx_{me}$$

For example, if the relationship between x and y is given by $2x - 5y = 10$ and if x_{me} i.e. the median of x is known to be 16.

$$\text{Then } 2x - 5y = 10$$

$$\Rightarrow y = -2 + 0.40x$$

$$\Rightarrow y_{me} = -2 + 0.40x_{me}$$

$$\Rightarrow y_{me} = -2 + 0.40 \times 16$$

$$\Rightarrow y_{me} = 4.40.$$

- (i) *For a set of observations, the sum of absolute deviations is minimum when the deviations are taken from the median. This property states that $\sum |x_i - A|$ is minimum if we choose A as the median.*

PARTITION VALUES OR QUANTILES OR FRACTILES

These may be defined as values dividing a given set of observations into a number of equal parts. When we want to divide the given set of observations into two equal parts, we consider median. Similarly, quartiles are values dividing a given set of observations into four equal parts. So there are three quartiles – first quartile or lower quartile denoted by Q_1 , second quartile or median to be denoted by Q_2 or Me and third quartile or upper quartile denoted by Q_3 . First quartile is the value for which one fourth of the observations are less than or equal to Q_1 and the remaining three – fourths observations are more than or equal to Q_1 . In a similar manner, we may define Q_2 and Q_3 .

Deciles are the values dividing a given set of observation into ten equal parts. Thus, there

are nine deciles to be denoted by $D_1, D_2, D_3, \dots, D_9$. D_1 is the value for which one-tenth of the given observations are less than or equal to D_1 and the remaining nine-tenth observations are greater than or equal to D_1 when the observations are arranged in an ascending order of magnitude.

Lastly, we talk about the percentiles or centiles that divide a given set of observations into 100 equal parts. The points of sub-divisions being $P_1, P_2, \dots, P_{99}$. P_1 is the value for which one hundredth of the observations are less than or equal to P_1 and the remaining ninety-nine hundredths observations are greater than or equal to P_1 once the observations are arranged in an ascending order of magnitude.

For unclassified data, the p^{th} quartile is given by the $(n + 1)p^{\text{th}}$ value, where n denotes the total number of observations. $p = 1/4, 2/4, 3/4$ for Q_1, Q_2 and Q_3 respectively. $p = 1/10, 2/10, \dots, 9/10$. For $D_1, D_2, \dots, D_9$ respectively and lastly $p = 1/100, 2/100, \dots, 99/100$ for $P_1, P_2, P_3, \dots, P_{99}$ respectively.

In case of a grouped frequency distribution, we consider the following formula for the computation of quartiles.

$$Q = l_1 + \left(\frac{Np - N}{N_u - N} \right) \times C$$

The symbols, except p , have their usual interpretation which we have already discussed while computing median and just like the unclassified data, we assign different values to p depending on the quartile.

Another way to find quartiles for a grouped frequency distribution is to draw the ogive (less than type) for the given distribution. In order to find a particular quartile, we draw a line parallel to the horizontal axis through the point Np . We draw perpendicular from the point of intersection of this parallel line and the ogive. The x -value of this perpendicular line gives us the value of the quartile under discussion.

Example 15.1.8: Following are the wages of the labourers: Rs. 82, Rs. 56, Rs. 90, Rs. 50, Rs. 120, Rs. 75, Rs. 75, Rs. 80, Rs. 130, Rs. 65. Find Q_x, D_6 and P_{82} .

MODE

Thus, if the observations are 5, 3, 8, 9, 5 and 6, then Mode (Mo) = 5 as it occurs twice and all the other observations occur just once. The definition for mode also leaves scope for more than one mode. Thus sometimes we may come across a distribution having more than one mode. Such a distribution is known as a multi-modal distribution. Bi-modal distribution is one having two modes.

Furthermore, it also appears from the definition that mode is not always defined. As an example, if the marks of 5 students are 50, 60, 35, 40, 56, there is no modal mark as all the observations occur once i.e. the same number of times.

We may consider the following formula for computing mode from a grouped frequency distribution:

$$\text{Mode} = l_1 + \left(\frac{f_0 - f_{-1}}{2f_0 - f_{-1} - f_1} \right) \times C \quad \dots\dots\dots (15.1.9)$$

where,

l_1 = LCB of the modal class.

i.e. the class containing mode.

f_0 = frequency of the modal class

f_{-1} = frequency of the pre-modal class

f_1 = frequency of the post modal class

C = class length of the modal class

When it is difficult to compute mode from a grouped frequency distribution, we may consider the following empirical relationship between mean, median and mode:

$$\text{Mean} - \text{Mode} = 3(\text{Mean} - \text{Median}) \quad \text{..... (15.1.9A)}$$

or $\text{Mode} = 3 \text{ Median} - 2 \text{ Mean}$

holds for a moderately skewed distribution. We also note that if $y = a + bx$, then

$$y_{mo} = a + bx_{mo} \quad (15.1.10)$$

Example 15.11: For a moderately skewed distribution of marks in statistics for a group of 200 students, the mean mark and median mark were found to be 55.60 and 52.40. What is the modal

Example 15.1.12: If $y = 2 + 1.50x$ and mode of x is 15, what is the mode of y ?

GEOMETRIC MEAN AND HARMONIC MEAN

For a given set of n positive observations, the geometric mean is defined as the n -th root of the product of the observations. Thus if a variable x assumes n values $x_1, x_2, x_3, \dots, x_n$, all the values being positive, then the GM of x is given by

$$G = (x_1 \times x_2 \times x_3 \dots \times x_n)^{1/n} \quad \text{..... (15.1.11)}$$

For a grouped frequency distribution, the GM is given by

$$G = (x_1^{f_1} \times x_2^{f_2} \times x_3^{f_3} \dots \times x_n^{f_n})^{1/N} \quad \text{..... (15.1.12)}$$

$$\text{Where } N = \sum f_i$$

In connection with GM, we may note the following properties :

- (i) *Logarithm of G for a set of observations is the AM of the logarithm of the observations; i.e.*

$$\log G = \frac{1}{r} \sum \log x \quad \text{..... (15.1.13)}$$

- (ii) *if all the observations assumed by a variable are constants, say $K > 0$, then the GM of the observations is also K .*

- (iii) *GM of the product of two variables is the product of their GM's i.e. if $z = xy$, then*
 $\text{GM of } z = (\text{GM of } x) \times (\text{GM of } y) \quad \text{..... (15.1.14)}$

- (iv) *GM of the ratio of two variables is the ratio of the GM's of the two variables i.e. if $z = x/y$ then*

$$\text{GM of } z = \frac{\text{GM of } x}{\text{GM of } y} \quad \text{..... (15.1.15)}$$

Example 15.1.13: Find the GM of 3, 6 and 12.

Example 15.1.14: Find the GM for the following distribution:

$x :$	2	4	8	16

f: 2 3 3 2

Harmonic Mean

For a given set of non-zero observations, harmonic mean is defined as the reciprocal of the AM of the reciprocals of the observation. So, if a variable x assumes n non-zero values $x_1, x_2, x_3, \dots, x_n$ then the HM of x is given by

$$H = \frac{n}{\sum (1/x_i)} \quad \dots\dots\dots (15.1.16)$$

For a grouped frequency distribution, we have H – "

$$H = \frac{N}{\sum \left[\frac{f_i}{x_i} \right]} \quad \dots\dots\dots (15.1.17)$$

Properties of HM

- (i) ***If all the observations taken by a variable are constants, say k, then the HM of the observations is also k.***
- (ii) ***If there are two groups with n_1 and n_2 observations and H_1 and H_2 as respective HM's than the combined HM is given by***

$$\frac{n_1 + n_2}{\frac{n_1}{H_1} + \frac{n_2}{H_2}}$$

Example 15.15: Find the HM for 4, 6 and 10.

Example 15.1.16: Find the HM for the following data:

x:	2	4	8	16
f:	2	3	3	2

Relation between AM, GM, and HM

For any set of positive observations, we have the following inequality:

$$AM > GM > HM \quad \dots\dots\dots$$

The equality sign occurs, as we have already seen, when all the observations are equal.

Example 15.1.17: compute AM, GM, and HM for the numbers 6, 8, 12, 36.

$$\text{Weighted AM} = \frac{\sum w_i x_i}{\sum w_i} \quad \dots\dots\dots (15.1.20)$$

$$\text{Weighted GM} = \text{Ante log} \left(\frac{\sum w_i \log x_i}{\sum w_i} \right) \quad \dots\dots\dots (15.1.21)$$

$$\text{Weighted HM} = \frac{\sum w_i}{\sum \left(\frac{w_i}{x_i} \right)} \quad \dots\dots\dots (15.1.22)$$

Example 15.1.18: Find the weighted AM and weighted HM of first n natural numbers, the weights being equal to the squares of the corresponding numbers.

Example 15.1.19: Given two positive numbers a and b , prove that $AH = G^2$. Does the result hold for any set of observations?

Example 15.1.20: The AM and GM for two observations are 5 and 4 respectively. Find the two observations.

EXERCISE — UNIT-I

Set A

Write down the correct answers. Each question carries 1 mark.

1. Measures of central tendency for a given set of observations measures
 - (a) The scatterness of the observations
 - (b) The central location of the observations
 - (c) Both (a) and (b)
 - (d) None of these.
2. While computing the AM from a grouped frequency distribution, we assume that
 - (a) The classes are of equal length
 - (b) The classes have equal frequency
 - (c) All the values of a class are equal to the mid-value of that class
 - (d) None of these.
3. Which of the following statements is wrong?
 - (a) Mean is rigidly defined
 - (b) Mean is not affected due to sampling fluctuations
 - (c) Mean has some mathematical properties
 - (d) All these
4. Which of the following statements is true?
 - (a) Usually mean is the best measure of central tendency
 - (b) Usually median is the best measure of central tendency
 - (c) Usually mode is the best measure of central tendency
 - (d) Normally, GM is the best measure of central tendency
5. For open-end classification, which of the following is the best measure of central tendency?
 - (a) AM
 - (b) GM
 - (c) Median
 - (d) Mode
6. The presence of extreme observations does not affect
 - (a) AM
 - (b) Median
 - (c) Mode
 - (d) Any of these.
7. In case of an even number of observations which of the following is median?
 - (a) Any of the two middle-most value
 - (b) The simple average of these two middle values
 - (c) The weighted average of these two middle values

- (d) Any of these
8. The most commonly used measure of central tendency is
 (a) AM (b) Median (c) Mode (d) Both GM and HM.
 9. Which one of the following is not uniquely defined?
 (a) Mean (b) Median (c) Mode (d) All of these measures
 10. Which of the following measure of the central tendency is difficult to compute?
 (a) Mean (b) Median (c) Mode (d) GM
 11. Which measure(s) of central tendency is(are) considered for finding the average rates?
 (a) AM (b) GM (c) HM (d) Both (b) and (c)
 12. For a moderately skewed distribution, which of the following relationship holds?
 (a) Mean – Mode = 3 (Mean – Median) (b) Median – Mode = 3 (Mean – Median)
 (c) Mean – Median = 3 (Mean – Mode) (d) Mean – Median = 3 (Median – Mode)
 13. Weighted averages are considered when
 (a) The data are not classified
 (b) The data are put in the form of grouped frequency distribution
 (c) All the observations are not of equal importance
 (d) Both (a) and (c).
 14. Which of the following results hold for a set of distinct positive observations?
 (a) $AM > GM > HM$ (b) $HM > GM > AM$
 (c) $AM > GM > HM$ (d) $GM > AM > HM$
 15. When a firm registers both profits and losses, which of the following measure of central tendency cannot be considered?
 (a) AM (b) GM (c) Median (d) Mode
 16. Quartiles are the values dividing a given set of observations into
 (a) Two equal parts (b) Four equal parts (c) Five equal parts (d) None of these
 17. Quartiles can be determined graphically using
 (a) Histogram (b) Frequency Polygon (c) Ogive (d) Pie chart.
 18. Which of the following measure(s) possesses (possess) mathematical properties?
 (a) AM (b) GM (c) HM (d) All of these
 19. Which of the following measure(s) satisfies (satisfy) a linear relationship between two variables?
 (a) Mean (b) Median (c) Mode (d) All of these
 20. Which of the following measures of central tendency is based on only fifty percent of the central values?
 (a) Mean (b) Median (c) Mode (d) Both (a) and (b)

Set B

Write down the correct answers. Each question carries 2 marks.

1. If there are 3 observations 15, 20, 25 then the sum of deviation of the observations from their AM is
(a) 0 (b) 5 (c) - 5 (d) None of these.
2. What is the median for the following observations?
5, 8, 6, 9, 11, 4.
(a) 6 (b) 7 (c) 8 (d) None of these
3. What is the modal value for the numbers 5, 8, 6, 4, 10, 15, 18, 10?
(a) 18 (b) 10 (c) 14 (d) None of these
4. What is the GM for the numbers 8, 24 and 40?
(a) 24 (b) 12 (c) $8 \cdot \sqrt[3]{15}$ (d) 10
5. The harmonic mean for the numbers 2, 3, 5 is
(a) 2.00 (b) 3.33 (c) 2.90 (d) $-\sqrt[3]{30}$.
6. If the AM and GM for two numbers are 6.50 and 6 respectively then the two numbers are
(a) 6 and 7 (b) 9 and 4 (c) 10 and 3 (d) 8 and 5.
7. If the AM and HM for two numbers are 5 and 3.2 respectively then the GM will be
(a) 16.00 (b) 4.10 (c) 4.05 (d) 4.00.
8. What is the value of the first quartile for observations 15, 18, 10, 20, 23, 28, 12, 16?
(a) 17 (b) 16 (c) 12.75 (d) 12
9. The third decile for the numbers 15, 10, 20, 25, 18, 11, 9, 12 is
(a) 13 (b) 10.70 (c) 11 (d) 11.50
10. If there are two groups containing 30 and 20 observations and having 50 and 60 as arithmetic means, then the combined arithmetic mean is
(a) 55 (b) 56 (c) 54 (d) 52.
11. The average salary of a group of unskilled workers is Rs. 10,000 and that of a group of skilled workers is Rs. 15,000. If the combined salary is Rs. 12,000, then what is the percentage of skilled workers?
(a) 40% (b) 50% (c) 60% (d) none of these
12. If there are two groups with 75 and 65 as harmonic means and containing 15 and 13 observation then the combined HM is given by
(a) 65 (b) 70.36 (c) 70 (d) 71.
13. What is the HM of $1, 1/2, 1/3, \dots, 1/n$?
(a) n (b) 2n (c) $\frac{2}{(n+1)}$ (d) $\frac{n(n+1)}{2}$
14. An aeroplane flies from A to B at the rate of 500 km/hour and comes back from B to A at the rate of 700 km/hour. The average speed of the aeroplane is

- (a) 600 km. per hour (b) 583.33 km. per hour
 (c) $100\sqrt{35}$ km. per hour (d) 620 km. per hour.
15. If a variable assumes the values 1, 2, 3...5 with frequencies as 1, 2, 3...5, then what is the AM?
 (a) $\frac{11}{3}$ (b) 5 (c) 4 (d) 4.50
16. Two variables x and y are given by $y = 2x - 3$. If the median of x is 20, what is the median of y?
 (a) 20 (b) 40 (c) 37 (d) 35
17. If the relationship between two variables u and v are given by $2u + v + 7 = 0$ and if the AM of u is 10, then the AM of v is
 (a) 17 (b) -17 (c) -27 (d) 27.
18. If x and y are related by $x - y - 10 = 0$ and mode of x is known to be 23, then the mode of y is
 (a) 20 (b) 13 (c) 3 (d) 23.
19. If GM of x is 10 and GM of y is 15, then the GM of xy is
 (a) 150 (b) $\log 10 \times \log 15$ (c) $\log 150$ (d) None of these.
20. If the AM and GM for 10 observations are both 15, then the value of HM is
 (a) Less than 15 (b) More than 15
 (c) 15 (d) Can not be determined.

ANSWERS

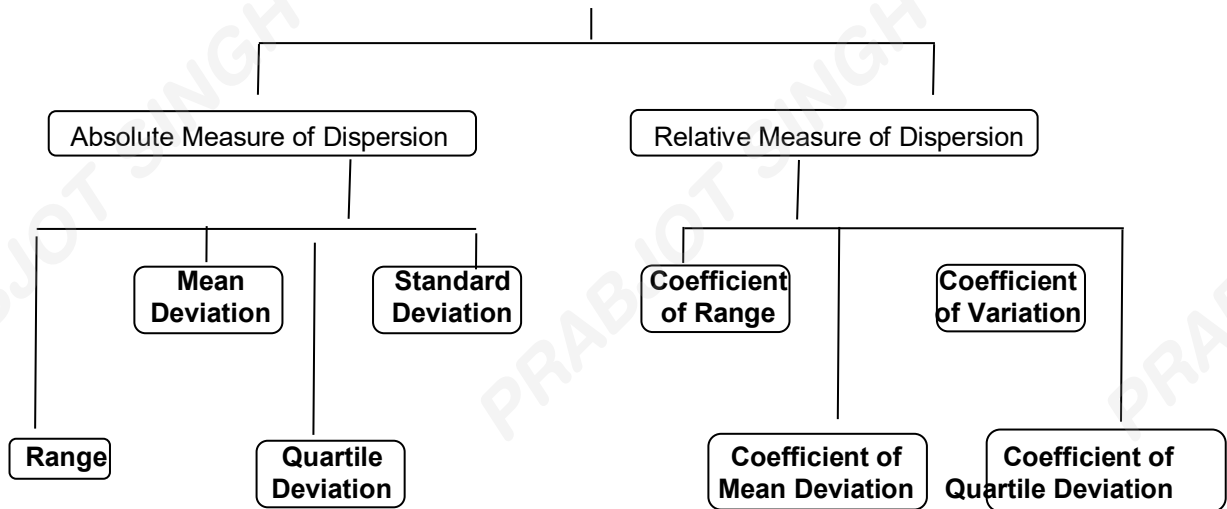
Set A

1. (b)	2. (c)	3. (b)	4. (a)	5. (c)	6. (b)
7. (b)	8. (a)	9. (c)	10. (d)	11. (d)	12. (a)
13. (c)	14. (c)	15. (b)	16. (b)	17. (c)	18. (d)
19. (d)	20. (b)				

Set B

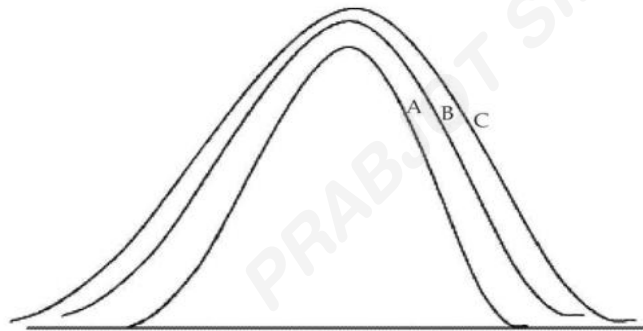
1. (a)	2. (b)	3. (b)	4. (c)	5. (c)	6. (b)
7. (d)	8. (c)	9. (b)	10. (c)	11. (a)	12. (c)
13. (c)	14. (b)	15. (a)	16. (c)	17. (c)	18. (b)
19. (a)	20. (c)				

UNIT: II DISPERSION



DEFINITION OF DISPERSION

The second important characteristic of a distribution is given by dispersion. Two distributions may be identical in respect of its first important characteristic i.e. central tendency and yet they may differ on account of scatterness. The following figure shows a number of distributions having identical measure of central tendency and yet varying measure of scatterness. Obviously, distribution is having the maximum amount of dispersion.



Showing distributions with identical measure of central tendency and varying amount of dispersion.

Dispersion for a given set of observations may be defined as the amount of deviation of the observations, usually, from an appropriate measure of central tendency. Measures of dispersion may be broadly classified into

1. Absolute measures of dispersion.

2. Relative measures of dispersion.

Absolute measures of dispersion are classified into

(i) Range	(ii) Mean Deviation
(iii) Standard Deviation	(iv) Quartile Deviation

Likewise, we have the following relative measures of dispersion :

(i) Coefficient of Range.	(ii) Coefficient of Mean Deviation
(iii) Coefficient of Variation	(iv) Coefficient of Quartile Deviation.

We may note the following points of distinction between the absolute and relative measures of dispersion :

- I absolute measures are dependent on the unit of the variable under consideration whereas the relative measures of dispersion are unit free.
- II. For comparing two or more distributions, relative measures and not absolute measures of dispersion are considered.
- III Compared to absolute measures of dispersion, relative measures of dispersion are difficult to compute and comprehend.

Characteristics for an ideal measure of dispersion

As discussed in section 15.2.1 an ideal measure of dispersion should be properly defined, easy to comprehend, simple to compute, based on all the observations, unaffected by sampling fluctuations and amenable to some desirable mathematical treatment.

RANGE

For a given set of observations, range may be defined as the difference between the largest and smallest of observations. Thus if L and S denote the largest and smallest observations respectively then we have

$$\text{Range} = L - S$$

The corresponding relative measure of dispersion, known as coefficient of range, is given by

$$\text{Coefficient of range} = \frac{L-S}{L+S} \times 100$$

$$R_y = |b| \times R_x \dots\dots\dots$$

Example 15.2.1: Following are the wages of 8 workers expressed in Rupees.

82, 96, 52, 75, 70, 65, 50, 70. Find the range and also its coefficient.

Example 15.2.2: What is the range and its coefficient for the following distribution of weights?

Weights in kgs. :	50 – 54	55 – 59	60 – 64	65 – 69	70 – 74
No. of Students :	12	18	23	10	3

Example 15.2.3 : If the relationship between x and y is given by $2x + 3y = 10$ and the range of x is Rs. 15, what would be the range of y?

MEAN DEVIATION

Since range is based on only two observations, it is not regarded as an ideal measure of dispersion. A better measure of dispersion is provided by mean deviation which, unlike range, is based on all the observations. For a given set of observation, mean deviation is defined as the arithmetic mean of the absolute deviations of the observations from an appropriate measure of central tendency. Hence if a variable x assumes n values $x_1, x_2, x_3..$

x_n , then the mean deviation of x about an average A is given by

$$MD_A = \frac{1}{n} \sum |x_i - A|$$

For a grouped frequency distribution, mean deviation about A is given by

$$MD_A = \frac{1}{n} \sum |x_i - A| f_i$$

Where x_i and f denote the mid value and frequency of the i -th class interval and

$$N = \sum f_i$$

In most cases we take A as mean or median and accordingly, we get mean deviation about mean or mean deviation about median.

A relative measure of dispersion applying mean deviation is given by

$$\text{Coefficient of mean deviation} = \frac{\text{Mean deviation about } A}{A} \times 100$$

Mean deviation takes its minimum value when the deviations are taken from the median. Also mean deviation remains unchanged due to a change of origin but changes in the same ratio due to a change in scale i.e. if $y = a + bx$, a and b being constants,

then MD of $y = |b| \times MD$ of x (15.2.4)

Example 15.2.4: What is the mean deviation about mean for the following numbers?

5, 8, 10, 10, 12, 9.

Example. 15.2.5: Find mean deviations about median and also the corresponding coefficient for the following profits ('000 ') of a firm during a week.

82, 56, 75, 70, 52, 80, 68.

Example 15.2.6 : Compute the mean deviation about the arithmetic mean for the following data:

$x :$	1	3	5	7	9
$f :$	5	8	9	2	1

Also find the coefficient of the mean deviation about the AM.

Example 15.2.7: Compute the coefficient of mean deviation about median for the following distribution:

Weight in kgs. :	40-50	50-60	60-70	70-80
No. of persons :	8	12	20	10

Example 15.2.8: If x and y are related as $4x + 3y + 11 = 0$ and mean deviation of x is 5.40, what is the mean deviation of y ?

STANDARD DEVIATION

Although mean deviation is an improvement over range so far as a measure of dispersion is concerned, mean deviation is difficult to compute and further more, it cannot be treated mathematically. The best measure of dispersion is, usually, standard deviation which does not possess the demerits of range and mean deviation.

Standard deviation for a given set of observations is defined as the root mean square deviation when the deviations are taken from the AM of the observations. If a variable x assumes n values $x_1, x_2, x_3, \dots, x_n$ then its standard deviation(s) is given by

$$s = \sqrt{\frac{\sum (x_i - \bar{x})^2}{n}}$$

For a grouped frequency distribution, the standard deviation is given by

$$s = \sqrt{\frac{\sum (x_i - \bar{x})^2}{N}}$$

(15.2.5) and (15.2.6) can be simplified to the following forms

$$s = \sqrt{\frac{\sum x_i^2}{N} - \bar{x}^2} \text{ for unclassified data}$$

$$= \sqrt{\frac{\sum f_i x_i^2}{N} - \bar{x}^2} \text{ for a grouped frequency distribution.}$$

Sometimes the square of standard deviation, known as variance, is regarded as a measure of dispersion. We have, then,

$$\text{Variance} = s^2 = \frac{\sum (x_i - \bar{x})^2}{n} \text{ for unclassified data}$$

$$= \frac{\sum f_i (x_i - \bar{x})^2}{N} \text{ for a grouped frequency distribution}$$

A relative measure of dispersion using standard deviation is given by coefficient of variation (cv) which is defined as the ratio of standard deviation to the corresponding arithmetic mean, expressed as a percentage.

$$\text{Coefficient of Variation (CV)} = \frac{SD}{AM} \times 100$$

ILLUSTRATIONS:

Example 15.2.9: Find the standard deviation and the coefficient of variation for the following numbers: 5, 8, 9, 2, 6

Example 15.2.10: Show that for any two numbers a and b , standard deviation is given

$$\text{by } \frac{|a-b|}{2}$$

Solution: For two numbers a and b , AM is given by $\bar{x} = \frac{a+b}{2}$

The variance is

$$\begin{aligned}
 s^2 &= \frac{\sum (x_i - \bar{x})^2}{2} \\
 &= \frac{\left(a - \frac{a+b}{2}\right)^2 + \left(b - \frac{a+b}{2}\right)^2}{2} \\
 &= \frac{\frac{(a-b)^2}{4} + \frac{(a-b)^2}{4}}{2} \\
 &= \frac{(a-b)^2}{4} \\
 \Rightarrow s &= \frac{|a-b|}{2}
 \end{aligned}$$

(The absolute sign is taken, as SD cannot be negative).

Example 15.2.11: Prove that for the first n natural numbers, SD is $\sqrt{\frac{n^2-1}{12}}$

Properties of standard deviation

- I. If all the observations assumed by a variable are constant i.e. equal, then the SD is zero. This means that if all the values taken by a variable x is k , say, then $s = 0$. This result applies to range as well as mean deviation.
- II. SD remains unaffected due to a change of origin but is affected in the same ratio due to a change of scale i.e., if there are two variables x and y related as $y = a + bx$ for any two constants a and b , then SD of y is given by

$$s_y = |b| s_x$$
- III. If there are two groups containing n_1 and n_2 observations, $\bar{x}_1$ and $\bar{x}_2$ as respective AM's, s_1 and s_2 as respective SD's, then the combined SD is given by

$$s = \sqrt{\frac{n_1 s_1^2 + n_2 s_2^2 + n_1 d_1^2 + n_2 d_2^2}{n_1 + n_2}}$$

where, $d_1 = \bar{x}_1 - \bar{x}$

$d_2 = \bar{x}_2 - \bar{x}$

and $\bar{x} = \frac{n_1 \bar{x}_1 + n_2 \bar{x}_2}{n_1 + n_2}$ = combined AM

This result can be extended to more than 2 groups. For $x(7^2)$ groups, we have

$$s = \sqrt{\frac{\sum n_i s_i^2 + \sum n_i d_i^2}{\sum n_i}} \dots\dots\dots$$

With $d_i = x_i - \bar{x}$

and $\bar{x} = \frac{\sum n_i \bar{x}_i}{\sum n_i}$

Where $\bar{x}_1 = \bar{x}_2$ (11.35) is reduced to

$$s = \sqrt{\frac{n_1 s_1^2 + n_2 s_2^2}{n_1 + n_2}}$$

Example 15.2.13: If AM and coefficient of variation of x are 10 and 40 respectively, what is the variance of $(15 - 2x)$?

Example 15.2.14: Compute the SD of 9, 5, 8, 6, 2.

Example 15.2.15: For a group of 60 boy students, the mean and SD of stats. marks are 45 and 2 respectively. The same figures for a group of 40 girl students are 55 and 3 respectively. What is the mean and SD of marks if the two groups are pooled together?

Example 15.2.16: The mean and standard deviation of the salaries of the two factories are provided below:

Factory	No. of Employees	Mean Salary	SD of Salary
A	30	Rs. 4800	Rs. 10
B	20	Rs. 5000	Rs. 12

- Find the combined mean salary and standard deviation of salary.
- Examine which factory has more consistent structure so far as satisfying its employees are concerned.

Example 15.2.17: A student computes the AM and SD for a set of 100 observations as 50 and 5 respectively. Later on, she discovers that she has made a mistake in taking one observation as 60 instead of 50. What would be the correct mean and SD if

- The wrong observation is left out?
- The wrong observation is replaced by the correct observation?

QUARTILE DEVIATION

Another measure of dispersion is provided by **quartile deviation** or **semi-inter-quartile range** which is given by

$$Q_d = \frac{Q_3 - Q_1}{2} \dots\dots\dots (15.2.14)$$

A relative measure of dispersion using quartiles is given by coefficient of quartile deviation which is

$$\text{Coefficient of quartile deviation} = \frac{Q_3 - Q_1}{Q_3 + Q_1} \times 100 \dots\dots\dots (15.2.15)$$

Quartile deviation provides the best measure of dispersion for open-end classification. It is also less affected due to sampling fluctuations. Like other measures of dispersion, quartile deviation remains unaffected due to a change of origin but is affected in the same ratio due to change in scale.

Example 15.2.18 : Following are the marks of the 10 students : 56, 48, 65, 35, 42, 75, 82, 60, 55, 50. Find quartile deviation and also its coefficient.

Example 15.2.19 : If the quartile deviation of x is 6 and $3x + 6y = 20$, what is the quartile deviation of y?

Example 15.2.21: The mean and variance of 5 observations are 4.80 and 6.16 respectively. If three of the observations are 2, 3 and 6, what are the remaining observations?

Example 15.2.22: After shift of origin and change of scale, a frequency distribution of a continuous variable with equal class length takes the following form of the changed variable (d):

d:	-2	-1	0	1	2
Frequency :	17	35	28	15	5

2014 - DECEMBER

1. The third decile for the numbers 15,10, 20, 25, 18, 11,9, 12, is:
(a) 13 **(b) 10.70** (c) 11 (d) 11.50
2. A random variable X has uniform distribution on the interval (-3,7). The mean of the distribution is:
(a) **2** (b) 4 (c) 5 (d) 6 (1 mark)
3. If the arithmetic mean of two numbers is 10 and the geometric mean of these numbers is 8, then the harmonic mean is:
(a) 9 (b) 8.9 **(c) 6.4** (d) None of these

2015 - JUNE

4. The harmonic mean H of two numbers is 4 and their arithmetic mean A and the geometric mean G satisfy the equation $2A + G^2 = 27$, then the numbers are
(a) (1,3) (b) (9,5) **(c) (6,3)** (d) (12,7)

2015- DECEMBER

5. Quartiles can be determined graphically using:
(a) Histogram (b) Frequency polygon **(c) Ogive curve** (d) Pie chart
6. In a class of 50 students, 10 have failed and their average marks in 2.5. The total marks secured by the entire class were 281. The average marks who have passed is:
(a) 5.32 (b) 7.25 **(c) 6.40** (d) None of the above.

2016 - JUNE

7. If the mean of two numbers is 30 and geometric mean is 24 then what will be these two numbers?
(a) 36 and 24 (b) 30 and 30 (c) 48 and 12 (d) None of these

2016 - DECEMBER

8. For moderately skewed distribution of marks in commerce for a group of 200 students the mean marks and mode marks were found to be 55.60 and 46. What is the median marks?
(a) 55.5 (b) 60.5 **(c) 52.4** (d) None of these
9. Mean for the data 6, 4, 1, 6, 5, 10, 3 is 5 when each observation added by 2, what is mean of the data
(a) 5 (b) 6 **(c) 7** (d) 10
10. The average of 10 observations is 14.4. If the average of first 4 observations is 16.5. The average of remaining 6 observations is:
(a) 13.6 (b) 13.0 (c) 13.2 (d) 12.5
11. The ordering of a particular design of a cloth show room, a _____ size be more appropriate.
(a) median (b) mean **(c) mode** (d) all of these
12. The second and third moments of a sample of seven observation (-6, -4, -2, 0, 2, 4, 6) are
(a) (12,0) (b) (0, 12) (c) (0, 16) (d) (16, 0)
13. The geometric mean of three numbers 40, 50 and x is 10, the value of x is
(a) 5 (b) 4 (c) 2 (d) $\frac{1}{2}$

2017 - JUNE

14. The rates of returns from three different shares are 100%, 200% and 400% respectively. The average rate of return will be:
(a) 350% (b) 233.33% **(c) 200%** (d) 300%
15. If geometric mean is 6 and arithmetic mean is 6.5, then harmonic mean will be:

- (a) $\frac{6^2}{6.5}$ (b) $\frac{6}{6.5^2}$ (c) $\frac{6}{6.5}$ (d) None of the above.

16. A company's past 10 years average earning is Rs. 40 crores. To have the same average earning for 11 years including these 10 years, how much earning must be made by the company in the eleventh year?

- (a) **Rs. 40 crores** (b) Rs. $\frac{40 \times 10}{11}$ crores
(c) More than Rs. 40 crores (d) None of the above. (1 mark)

17. A person purchases 5 rupees worth of eggs from 10 different markets. You are to find the average number of eggs per rupee purchased from all the markets taken together. The suitable average in this case is:

- (a) A.M. (b) G.M. (c) **H.M.** (d) None of the above.

18. For a moderately skewed distribution, the relationship between mean, median and mode is:

- (a) Mean - Mode = 2 (Mean - Median) (b) Mean - Median = 3 (Mean - Mode)
(c) Mean - Median = 2 (Mean - Mode) (d) **Mean - Mode = 3 (Mean - Median).**

2017 – DECEMBER

19. _____ is the reciprocal of the AM of the reciprocal of observations.

- (a) **HM** (b) GM (c) Both (a) and (b) (d) None of the above.

20. Mean deviation is the least when deviations are taken from

- (a) Mean (b) **Median** (c) Mode (d) Harmonic mean

21. If the mean value of seven numbers 7, 9, 12, X, 4, 11 and 5 is 9, then the missing number X will be:

- (a) 13 (b) 14 (c) **15** (d) 8

22. When all observations occur with equal _____ frequency does not exist.

- (a) Median (b) **mode** (c) Mean (d) None of the above.

2018-May

23. If the variables x and z are so related that $z = ax + b$ for each $x = x_1$, where a and b are constant, then $\bar{z} = a\bar{x} + b$

(a) True (b) false (c) both (d) none

24. Relation between mean, median and mode is

- (a) mean-mode = 2 (mean-median) (b) mean-median = 3(mean-mode)
(c) mean-median = 2 (mean-mode) **(d) mean-mode = 3(mean-median)**

25. If each item is reduced by 15 A. M is

- (a) Reduced by 15** (b) increased by 15 (c) reduced by 10 (d) none

26. For 899,999, 391,384, 390, 480,485,760,111,240 Rank of median is

- (a) 2.75 **(b) 5.5** (c) 8.25 (d) none

2018 - November

27. The median of the data 5, 6, 7, 7, 8, 9,10,11,11,12,15,18,18 and 19 is

- (a) 10.5** (b) 10 (c) 11 (d) 11.5

28. The mean of 20 items of a data is 5 and if each item is multiplied by 3, then the new mean will be

- (a) 5 (b) 10 (c) 15 (d) 20

29. The Geometric mean of 3, 6, 24 and 48 is

- (a) 8 **(b) 12** (c) 24 (d) 6

30. The Algebraic sum of the deviation of a set of values from their arithmetic mean is

- (a) >0 **(b) =0** (c) < 0 (d) None of the above

31. Which one of the following is not a central tendency?

- (a) Mean Deviation** (b) Arithmetic mean (c) Median (d) Mode

32. If total frequencies of three series are 50, 60 and 90 and their means are 12, 15 and 20 respectively, then the mean of their composite series is

- (a) 16 (b) 15.5 **(c) 16.5** (d) 14.5

33. If the variance of 5, 7, 9 and 11 is 4, then the coefficient of variation is:

- (a) 15 **(b) 25** (c) 17 (d) 19

34. Standard Deviation for the marks obtained by a student in monthly test in mathematic (out of 50) as 30, 35, 25, 20, 15 is

- (a) 25 (b) $\sqrt{50}$ (c) $\sqrt{30}$ (d) 50

35. If in a moderately skewed distribution the values of mode and mean are 32.1 and 35.4 respectively, then the value of the median is

- (a) 34.3 (b) 33.3 (c) 34 (d) 33

36. the mean of the following distribution is 6 then the value of P is

X:	2	4	6	10	P + 5
f:	3	2	3	1	2

- (a) 7 (b) 5 (c) 8 (d) 11 (1 mark)

2019 - June

37. The AM of 15 Observation is 9 and the AM of first 9 Observation is 11 and then AM of remaining Observations is

- (a) 11 (b) 6 (c) 5 (d) 9

38. In a moderately Skewed distribution the values of mean .& median are 12 & 8 respectively. The value of mode is

- (a) 0 (b) 12 (c) 15 (d) 30

39. Which of the following is positional average?

- (a) Median (b) GM (c) HM (d) AM

40. For a symmetric distribution

- (a) Mean = Median = Mode (b) Mode = 3 Median - 2 Mean
(c) Mode = $\frac{1}{3}$ Median = $\frac{1}{2}$ Mean (d) None

41. For the distribution

X	1	2	3	4	5	6
F	6	9	10	14	12	8

The value of median is

- (a) 3.5 (b) 3 **(c) 4** (d) 5

2019 - November

42. The deviations are minimum when taken from:

- (a) Mean **(b) Median** (c) Mode (d) None

43. If the AM & GM of two numbers are 30 and 24 respectively. Find the no.'s

- (a) 12 and 24 **(b) 48 and 12** (c) 30 and 30 (d) 40 and 20

44. Find the mode of the following data:

Class Interval	3-6	6-9	9- 12	12-15	15-18	18-21
Frequency	2	5	10	23	21	12

- (a) 25 (b) 4.6 **(c) 14.6** (d) 13.5

45. Histogram is used to represent

- (a) Mode** (b) Median (c) Percentile (d) Quartile

46. Find the median of the following.

CI	0-10	10-20	20-30	30-40	40-50
f	2	3	4	5	6

- (a) 35 **(b) 32** (c) 36 (d) 37.5

47. Difference between upper limit and lower limit of a class is known as.

- (a) Range (b) Class mark **(c) Class size** (d) Class boundary

48. Find the mode of the following:

0-10	10-20	20-30	30-40	40-50	50-60

- 7 14 22 34 20 19
- (a) 32 **(b) 34.61** (c) 25.42 (d) 35

49. Find the median of the following:

CI	0-10	10-20	20-30	30-40	40-50
f	5	15	28	10	2
	(a) 10.57	(b) 23.57	(c) 25	(d) None	

50. $\sum_{i=1}^n (\bar{x} - x_i)$ is equal to

- (a) $\bar{x} \sum_{i=1}^n \bar{x}$ (b) $n(\bar{x} \sum_{i=1}^n x_i)$ (c) $\bar{x} - n\bar{x}$ **(d) zero**

2020 - November

51. Given the weights for the numbers 1,2,3.....n are respectively $1^2, 2^2, 3^2, \dots, n^2$ then weighted HM is _____.

- (a) $\frac{2n+1}{4}$ (b) $\frac{2n+1}{6}$ **(c) $\frac{2n+1}{3}$** (d) $\frac{2n+1}{2}$

52. [Which measure is suitable for open-end classification?

- (a) Median** (b) Mean (c) Mode (d) GM

53. 50th Percentile is equal to

- (a) Median** (b) Mode (c) Mean (d) None

54. The harmonic mean A and B is $1/3$ and harmonic mean of C and D is $1/5$. The harmonic mean of ABCD is

- (a) 8/15** (b) $1/4$ (c) $1/15$ (d) $5/3$

55. Which one of these is least affected by extreme values?

- (a) Mean **(b) Median** (c) Mode (d) None
(1 mark)

56. A fire engine rushes to a place of fire accident with a speed of 110kmph and after the completion of operation returned to the base at a speed of 35 kmph. The average speed per hour in per-direction is obtained as _____ speeds.

- (a) Average of **(b) H M of** (c) G M of (d) Half of HM of

57. Ten matches data is given. Then which of the following cannot be found?

- (a) Least score (b) Highest score (c) Best score **(d) Median score**

58. If the AM and HM of two numbers are 6 and 9 respectively, then GM is

- (a) 7:35 (b) 8:5 (c) 6.75 (d) None

2021 - January

59. From the record on sizes of shoes sold in a shop, one can compute the following to determine the most preferred shoe size.

- (a) Mean (b) Median **(c) Mode** (d) Range

60. Which of the following measure does not possess mathematical properties?

- (a) Arithmetic mean (b) Geometric mean (c) Harmonic mean (d) Median

61. If $y = 3 + (4.5)x$ and the mode for x -value is 20, then the mode for y -value is

- (a) 3.225 (b) 12 (c) 24.5 **(d) 93**

62. If there are two groups with n_1 and n_2 observations and H_1 and H_2 are respective harmonic means, then the harmonic mean of combined observation is

- (a) $\frac{n_1 H_1 + n_2 H_2}{n_1 + n_2}$ (b) $\frac{n_1 H_1 + n_2 H_2}{H_1 + H_2}$ (c) $\frac{n_1 + n_2}{n_1 H_1 + n_2 H_2}$ **(d) $\frac{(n_1 + n_2)H_1 + H_2}{n_1 H_2 + n_2 H_1}$**

2021 - July

63. There are n numbers. When 50 is subtracted from each of these number the sum of the numbers so obtained is - 10. When 46 is subtracted from each of the original n numbers, then the sum of numbers. So obtained is 70. What is the mean of the original n numbers?

- (a) 56.8 (b) 25.7 **(c) 49.5** (d) 53.8

64. If a school has 14 teachers, their heights (in cm) are:

172, 173, 164, 178, 168, 169, 173, 172, 173, 164, 178, 168, 169, 173 then average deviation of this data is:

- (a) 2.43 approx. (b) 3.93 approx. **(c) 3.43 approx.** (d) 2.92 approx.

65. The mean of ' n ' observation is ' x '. If k is added to each observation, then the new mean is.

- (a) k (b) xk (c) $x-k$ **(d) $x+k$**

66. If $y = 3 + 1.9x$, and mode of x is 15, then the mode of y is:

- (a) 15.9 (b) 27.8 (c) 35.7 **(d) 31.5**

67. Expenditures of a company (in million rupees) per item in various years)

Year	Item of expenditures				
	Salary	Fuel and Transport	Bonus	Interest on Loans	Taxes
1998	288	98	3.00	23.4	83
1999	342	112	2.52	32.5	108
2000	324	108	3.84	41.6	74
2001	336	133	3.68	36.4	88
2002	420	142	3.96	49.4	98

What is the average amount of interest per year which the company had to pay during this period?

- (a) 33.66 **(b) 36.66** (c) 31.66 (d) 39.66

68. The mean deviation of the numbers 3, 10, 6, 11, 14, 17, 9, 8, 12 about the mean is (correct to one decimal place):

- (a) 8.7 (b) 4.2 **(c) 3.1** (d) 9.8

2021 - DECEMBER

69. If there are 3 observations 15, 20, 25 then the sum of deviation of the observations from their AM is

- (a) 0** (b) 5 (c) -5 (d) 10

70. If the AM and GM for 10 observations are both 15, then the value of HM is

- (a) less than 15 (b) more than 15 **(c) 15** (d) cannot be determined

71. If average mark for a group of 30 girls is 80, a group of boys is 70 and combined average is 76, then how many are in the boy's group?

- (a) 21 **(b) 20** (c) 22 (d) 19

72. If two variables a and b are related by $c = ab$ then G.M. of c is equal to

- (a) G.M. of a + G.M. of b **(b) G.M. of a x G.M. of b**
 (c) G.M. of a - G.M. of b (d) G.M. of a / G.M. of b

73. For a moderately skewed distribution the median is twice the mean, then the mode is _____ times the median.

(a) 3

(b) 2

(c) $\frac{2}{3}$

(d) $\frac{3}{2}$

74. The median value of the set of observations 48, 36, 72, 87, 19, 66, 56, 91 is

(a) 53

(b) 87

(c) 61

(d) 19

75. The marks secured by 5 students in a subject are 82, 73, 69, 84, 66. What is the coefficient of Range?

(a) 0.12

(b) 12

(c) 120

(d) 0.012

76. For a data having odd number of values, the difference between the first and the middle value is equal to the difference between the last and the middle value; similarly the difference between the second and middle values is equal to that of second last and middle value so on. Therefore, the middle value is equal to

(a) Half of the range

(b) Half of standard deviation

(c) Mode

(d) Mean

77. One hundred participants expressed their opinion on recommending a new product to their friends using the attributes : most unlikely, not sure, likely, most likely. The appropriate measure of central tendency that can be used here is

(a) Mean
mean

(b) Mode

(c) Geometric mean

(d) Harmonic

78. Along a road there are 5 buildings of apartments, marked as 1, 2, 3, 4, 5. Number of people residing in each building is available. A bus stop is to be setup near one of the buildings so that the total distance walked by the residents to the bus stop from their buildings must be kept minimum. One must consider involving _____ to find the position of the bus stop.

(a) Mean

(b) Median

(c) Mode

(d) Weighted mean

79. Given that Mean = 70.20 and Mode = 70.50, the Median is expected to be.

(a) 70.15

(b) 70.20

(c) 70.30

(d) 70.35

2022 DEC

80. If mean (X) is = 10 and mode(Z) is = 7, then find out the value of median(M)

A. 9

B. 17

C. 3

D. 4.33

81. If the coefficient of variation and standard deviation are 30 and 12 respectively, then the arithmetic mean of the distribution is

A. 40

B. 56

C. 25

D. 19

82. The relationship between two variable x and y is given by $4x - 10y = 20$. If the median value of the variable x is 10 then what is median value of y?

A. 1.0

B. 20

C. 30

D. 4.0

83. The median of the observations 42, 72, 35, 92, 67, 85, 72, 81, 51, 56 is

- A. 69.5 B. 72 C. 64 D. 61.5

84. The mean of 50 observations is 36. If two observations 30 and 42 are to be excluded, then the mean of the remaining observations will be:

- A. 36 B. 38 C. 48 D. 50

85. If Arithmetic Mean and Geometric Mean between two numbers are 5 and 4 respectively, then these numbers are

- A. 2 & 3 B. 2 & 8 C. 4 & 6 D. 1 & 16

86. If Arithmetic mean between two numbers is 5 and Geometric mean is 4 then what is the value of Harmonic mean?

- A. 3.2 B. 3.4 C. 3.5 D. 36

87. The average age of 15 students in a class is 9 years. Out of them, the average age of 5 student, is 13 years and that of 8 students is 5 years. What is the average of remaining 2 students?

- A. 5 years B. 9 years C. 10 years D. 15 years

2023 JUNE

88. Find the mean of the following data

Class interval	10-20	20-30	30-40	40-50	50-60	60-70	70-80
Frequency	9	13	6	4	6	2	3

- A. 23.7 B. 35.7 C. 28.5 D. 43.7

89. The median of the following set of observation 24, 18, 36, 42, 30, 28, 21, 29, 25, 33, is

- A. 26.5 B. 27.5 C. 28.5 D. 29.5

90. Find the Mode of the following data :

X	25-30	30-35	35-40	40-45	45-50	50-55
F(X)	20	53	42	42	41	43

- A. 31.75 B. 30.75 C. 33.75 D. 35.75

91. For a given data set 5, 10, 3, 6, 4, 8, 9, 3, 15, 2, 9, 4, 19, 11, 4 what is the median ?

A. 8

B. 6

C. 4

D. 9

92. If the mean of two numbers is 30 and Gm is 24, then what will be the Harmonic mean of two numbers?

A. 4.5

B. 3.5

C. 2.5

D. 1.5

93. The geometric Mean of 3, 7, 11, 15, 24, 28, 30, 0 is

A. 6

B. 0

C. 9

D. 12

EXERCISE — UNIT-II

Set A

Write down the correct answers. Each question carries one mark.

1. Which of the following statements is correct?
 - (a) Two distributions may have identical measures of central tendency and dispersion.
 - (b) Two distributions may have the identical measures of central tendency but different measures of dispersion.
 - (c) Two distributions may have the different measures of central tendency but identical measures of dispersion.
 - (d) All the statements (a), (b) and (c).
2. Dispersion measures
 - (a) The scatterness of a set of observations
 - (b) The concentration of a set of observations
 - (c) Both (a) and (b)
 - (d) Neither (a) and (b).
3. When it comes to comparing two or more distributions we consider
 - (a) Absolute measures of dispersion
 - (b) Relative measures of dispersion
 - (c) Both (a) and (b)
 - (d) Either (a) or (b).

4. Which one is easier to compute?
 - (a) Relative measures of dispersion
 - (b) Absolute measures of dispersion
 - (c) Both (a) and (b)
 - (d) Range
5. Which one is an absolute measure of dispersion?
 - (a) Range
 - (b) Mean Deviation
 - (c) Standard Deviation
 - (d) All these measures
6. Which measure of dispersion is most useful?
 - (a) Standard deviation
 - (b) Quartile deviation
 - (c) Mean deviation
 - (d) Range
7. Which measures of dispersions is not affected by the presence of extreme observations?
 - (a) Range
 - (b) Mean deviation
 - (c) Standard deviation
 - (d) Quartile deviation
8. Which measure of dispersion is based on the absolute deviations only?
 - (a) Standard deviation
 - (b) Mean deviation
 - (c) Quartile deviation
 - (d) Range
9. Which measure is based on only the central fifty percent of the observations?
 - (a) Standard deviation
 - (b) Quartile deviation
 - (c) Mean deviation
 - (d) All these measures
10. Which measure of dispersion is based on all the observations?
 - (a) Mean deviation
 - (b) Standard deviation
 - (c) Quartile deviation
 - (d) (a) and (b) but not (c)
11. The appropriate measure of dispersion for open-end classification is
 - (a) Standard deviation
 - (b) Mean deviation
 - (c) Quartile deviation
 - (d) All these measures.
12. The most commonly used measure of dispersion is
 - (a) Range
 - (b) Standard deviation
 - (c) Coefficient of variation
 - (d) Quartile deviation.
13. Which measure of dispersion has some desirable mathematical properties?
 - (a) Standard deviation
 - (b) Mean deviation
 - (c) Quartile deviation
 - (d) All these measures
14. If the profits of a company remains the same for the last ten months, then the standard deviation of profits for these ten months would be ?
 - (a) Positive
 - (b) Negative
 - (c) Zero
 - (d) (a) or (c)
15. Which measure of dispersion is considered for finding a pooled measure of dispersion after combining several groups?
 - (a) Mean deviation
 - (b) Standard deviation
 - (c) Quartile deviation
 - (d) Any of these

16. A shift of origin has no impact on
 (a) Range (b) Mean deviation
 (c) Standard deviation (d) All these and quartile deviation.
17. The range of 15, 12, 10, 9, 17, 20 is
 (a) 5 (b) 12 (c) 13 (d) 11.
18. The standard deviation of 10, 16, 10, 16, 10, 10, 16, 16 is
 (a) 4 (b) 6 (c) 3 (d) 0.
19. For any two numbers SD is always
 (a) Twice the range (b) Half of the range
 (c) Square of the range (d) None of these.
20. If all the observations are increased by 10, then
 (a) SD would be increased by 10
 (b) Mean deviation would be increased by 10
 (c) Quartile deviation would be increased by 10
 (d) All these three remain unchanged.
21. If all the observations are multiplied by 2, then
 (a) New SD would be also multiplied by 2
 (b) New SD would be half of the previous SD
 (c) New SD would be increased by 2
 (d) New SD would be decreased by 2.

Set B

Write down the correct answers. Each question carries two marks.

1. What is the coefficient of range for the following wages of 8 workers?
 Rs. 80, Rs. 65, Rs. 90, Rs. 60, Rs. 75, Rs. 70, Rs. 72, Rs. 85.
 (a) Rs. 30 (b) ' 20 (c) 30 (d) 20
2. If R_x and R_y denote ranges of x and y respectively where x and y are related by $3x + 2y + 10 = 0$, what would be the relation between x and y ?
 (a) $R_x = R_y$ (b) $2 R_x = 3 R_y$ (c) $3 R_x = 2 R_y$ (d) $R_x = 2 R_y$
3. What is the coefficient of range for the following distribution?
- | Class Interval : | 10-19 | 20-29 | 30-39 | 40-49 | 50-59 |
|------------------|-------|-------|-------|-------|-------|
| Frequency: | 11 | 25 | 16 | 7 | 3 |
- (a) 22 (b) 50 (c) 72.46 (d) 75.82
4. If the range of x is 2, what would be the range of $-3x + 50$?
 (a) 2 (b) 6 (c) -6 (d) 44
5. What is the value of mean deviation about mean for the following numbers?
 5, 8, 6, 3, 4.
 (a) 5.20 (b) 7.20 (c) 1.44 (d) 2.23
6. What is the value of mean deviation about mean for the following observations?

- 50, 60, 50, 50, 60, 60, 60, 50, 50, 50, 60, 60, 60, 50.
- (a) 5 (b) 7 (c) 35 (d) 10
7. The coefficient of mean deviation about mean for the first 9 natural numbers is
(a) 200/9 (b) 80 (c) 400/9 (d) 50.
8. If the relation between x and y is $5y - 3x = 10$ and the mean deviation about mean for x is 12, then the mean deviation of y about mean is
(a) 7.20 (b) 6.80 (c) 20 (d) 18.80.
9. If two variables x and y are related by $2x + 3y - 7 = 0$ and the mean and mean deviation about mean of x are 1 and 0.3 respectively, then the coefficient of mean deviation of y about its mean is
(a) -5 (b) 12 (c) 50 (d) 4.
10. The mean deviation about mode for the numbers 4/11, 6/11, 8/11, 9/11, 12/11, 8/11 is
(a) 1/6 (b) 1/11 (c) 6/11 (d) 5/11.
11. What is the standard deviation of 5, 5, 9, 9, 9, 10, 5, 10, 10?
(a) $\sqrt{14}$ (b) $\frac{\sqrt{42}}{3}$ (c) 4.50 (d) 8
12. If the mean and SD of x are a and b respectively, then the SD of $\frac{x-a}{b}$ is
(a) -1 (b) 1 (c) ab (d) a/b.
13. What is the coefficient of variation of the following numbers?
53, 52, 61, 60, 64.
(a) 8.09 (b) 18.08 (c) 20.23 (d) 20.45
14. If the SD of x is 3, what is the variance of $(5 - 2x)$?
(a) 36 (b) 6 (c) 1 (d) 9
15. If x and y are related by $2x + 3y + 4 = 0$ and SD of x is 6, then SD of y is
(a) 22 (b) 4 (c) $\sqrt{5}$ (d) 9.
16. The quartiles of a variable are 45, 52 and 65 respectively. Its quartile deviation is
(a) 10 (b) 20 (c) 25 (d) 8.30.
17. If x and y are related as $3x + 4y = 20$ and the quartile deviation of x is 12, then the quartile deviation of y is
(a) 16 (b) 14 (c) 10 (d) 9.
18. If the SD of the 1st n natural numbers is 2, then the value of n must be
(a) 2 (b) 7 (c) 6 (d) 5.
19. If x and y are related by $y = 2x + 5$ and the SD and AM of x are known to be 5 and 10 respectively, then the coefficient of variation is
(a) 25 (b) 30 (c) 40 (d) 20.
20. The mean and SD for a, b and 2 are 3 and $\frac{2}{\sqrt{3}}$ respectively, The value of ab would be

(a) 5

(b) 6

(c) 12

(d) 3.

UNIT-II: ANSWERS

Set A

1. (d)	2. (a)	3. (b)	4. (d)	5. (d)	6. (a)
7. (d)	8. (b)	9. (b)	10. (d)	11. (c)	12. (b)
13. (a)	14. (c)	15. (b)	16. (d)	17. (d)	18. (c)
19. (b)	20. (d)	21. (a)			

Set B

1. (d)	2. (c)	3. (c)	4. (b)	5. (c)	6. (a)
7. (c)	8. (a)	9. (b)	10. (b)	11. (b)	12. (b)
13. (a)	14. (a)	15. (b)	16. (a)	17. (d)	18. (b)
19. (c)	20. (a)				

2014 - DECEMBER

1. If the first quartile is 142 and semi-inter quartile range is 18, then the value of median is:
(a) 151 **(b) 160** (c) 178 (d) None of these (1 mark)
2. The quartile deviation is:
(a) $\frac{2}{3}$ of S.D. (b) $\frac{4}{5}$ of S.D. (c) $\frac{5}{6}$ of S.D. (d) None of these

2015 - JUNE

3. The standard deviation of a variable x is known to be 10. The standard deviation of $50 + 5x$ is
(a) 50 (b) 100

- (c) 10 (d) 500

4. Coefficient of quartile deviation is equal to

(a) Quartile deviation $\times$ 100/median

(b) Quartile deviation $\times$ 100 / mean

(c) Quartile deviation $\times$ 100 / mode

(d) None

5. If all the observations are increased by 5, then

(a) S.D. would be increased by 5

(b) Mean deviation would be increased by 5

(c) Quartile deviation would be increased by 5

(d) All the three would not be increased by 5

2015- DECEMBER

6. What is value of mean deviation about mean from the number 5, 8, 6, 3 and 4 ?

(a) 5.20

(b) 7.20

(c) 1.44

(d) 2.23

7. For the observation of 6, 4, 1, 6, 5, 10, 4, 8 the range is:

(a) 10

(b) 9

(c) 8

(d) None

8. If a variance of a random variable 'x' is 23, then what is variance of $2x + 10$?

(a) 56

(b) 33

(c) 46

(d) 92

9. If variance = 148.6 and $\bar{x} = 40$, then the coefficient of variation is:

(a) 37.15

(b) 30.48

(c) 33.75

(d) None of the above

2016 - JUNE

10. The SD of first n natural number is

(a) $\sqrt{\frac{n^2 - 1}{12}}$

(b) $\sqrt{\frac{n(n+1)}{12}}$

(c) $\sqrt{\frac{n(n-1)}{6}}$

(d) None of these.

11. If mean and coefficient of variation of the marks of 10 students is 20 and 80 respectively. What will be variance of them?

(a) 256

(b) 16

(c) 25

(d) None of these.

12. If same amount is added to or subtracted from all the values of an individual series then the

standard deviation and variance both shall be _____

- (a) changed **(b) unchanged** (c) same (d) none of these

2016 - DECEMBER

NO QUESTION ASKED

2017 - JUNE

13. If arithmetic mean and coefficient of variation of x are 10 and 40, respectively then the variance of $-15 + \frac{3x}{2}$ will be:

- (a) 64 (b) 81 (c) 49 **(d) 36**

2017 - DECEMBER

NO QUESTION ASKED

2018-May

14. If the variables x and z are so related that $z = ax + b$ for each $x = x_1$, where a and b are constant, then $\bar{z} = a\bar{x} + b$

- (a) True** (b) false (c) both (d) none

15. $\frac{(Q_3 - Q_1)}{(Q_3 + Q_1)}$ is known as

- (a) Coefficient of Range **(b) Coefficient of Q.D.**
(c) Coefficient of S.D. (d) Coefficient of M.D.

16. If the S.D. of the 1st n natural Nos. is $\sqrt{30}$, Then the value of n is

- (a) 19** (b) 20 (c) 21 (d) None

2018 - November

17. Which one of the following is not a central tendency?

- (a) Mean Deviation** (b) Arithmetic mean (c) Median (d) Mode

18. If the range of a set of values is 65 and maximum value in the set is 83, then the minimum value in the set is

- (a) 74 (b) 9 **(c) 18** (d) None of the above

19. If the variance of 5, 7, 9 and 11 is 4, then the coefficient of variation is:

- (a) 15 **(b) 25** (c) 17 (d) 19

20. Standard Deviation for the marks obtained by a student in monthly test in mathematic (out of 50) as 30, 35, 25, 20, 15 is

- (a) 25 (b) $\sqrt{50}$ (c) $\sqrt{30}$ (d) 50

21. If the standard deviation for the marks obtained by a student in monthly test is 36, then the variance is

- (a) 6 (b) 36 (c) **1296** (d) None of the above

2019 - June

22. If $\sigma^2 = 100$ and coefficient of variation = 20% then $\bar{x} =$

- (a) 60 (b) 70 (c) 80 (d) **50**

23. Standard deviation is _____ times of $\sqrt{MD \times QD}$

- (a) $2/3$ (b) $4/5$ (c) $\sqrt{\frac{15}{8}}$ (d) $\sqrt{\frac{8}{15}}$

24. The Q.D of 6 numbers 15, 8, 36, 40, 38, 41 is equal to

- (a) 12.5 (b) 25 (c) **13.5** (d) 37

25. S.D of first five consecutive natural numbers is

- (a) $\sqrt{10}$ (b) $\sqrt{8}$ (c) $\sqrt{3}$ (d) $\sqrt{2}$

26. If the profits of a company remain same for the last ten months then the S.D. of profits of the company would be:

- (a) Positive (b) Negative (c) **Zero** (d) (a) or (c)

27. Coefficient of quartile deviation is $1/4$ then Q_3/Q_1 is

- (a) **$5/3$** (b) $4/3$ (c) $3/4$ (d) $3/5$

28. The sum of mean and SD of a series is $a + b$, if we add 2 to each observation of the series then the sum of mean and SD is

- (a) **$a + b + 2$** (b) $6-a + b$ (c) $4 + a - b$ (d) $a + b + 4$

2019 – November

29. The approximate ratio of SD, MD, QD is:

- (a) 3:4:5 (b) 2:3:4 (c) **15:12:10** (d) 5 : 6 : 7

30. Origin is shifted by 5, what will happen

- (a) SD will increase by 5 (b) QD will increase by 5
(c) MD will increase by 5 (d) **There will be no change in SD**

31. Coefficient of variation is equal to:

- (a) $\frac{SD}{Mean}$ (b) $\frac{SD}{Mean} \times 100$ (c) $\frac{Mean}{SD} \times 100$ (d) $\frac{Mean}{SD}$

32. Find SD of the following

1,2,3, 4, 5,6,7, 8, 9.

- (a) **2.58** (b) 60/9 (c) 60/3 (d) 3.20

33. If mean = 200 and variance = 80. Find coefficient of variation.

- (a) 2.56 (b) **4.47** (c) 32 (d) 0.32

34. Which of the following is affected by shifting of scale.

- (a) SD (b) MD (c) QD (d) **None of these**

35. Coefficient of variation is 80. Mean is 20. Find variance:

- (a) 640 (b) **256** (c) 16 (d) 250

36. Difference between upper limit and lower limit of a class is known as.

- (a) Range (b) Class mark (c) **Class size** (d) Class boundary

37. SD from numbers 1,4, 5, 7, 8 is 2.45. If 10 is added to each then SD will be:

- (a) 12.45 (b) 24.5 (c) 12 (d) **will not change.**

38. Ten matches data is given. Then which of the following cannot be found?

- (a) Least score (b) Highest score (c) Best score (d) **Median score**

39. Which of the following measure of dispersion is based on absolute deviations?

- (a) Range (b) S. D (c) **Mean Deviation** (d) Quartile Deviation

2021 - January

40. The best statistical measure used for comparing two series is

- (a) Mean absolute deviation (b) Range
(c) **Coefficient of variation** (d) Standard deviation

41. The relationship between P-series and Q series is given by $2P - 3Q - 10$. If the range of P-Series is 18. What would be the range of Q?

- (a) 10 (b) 15 (c) 9 (d) **12**

42. It is given that the mean ($\bar{X}$) is 10 and standard deviation (s.d.) is 3.2. If the observations are increased by 4, then the new mean and standard deviations are:

- (a) $\bar{X} = 10$, s.d. = 7.2 (b) $\bar{X} = 10$, s.d. = 3.2
(c) $\bar{X} = 14$, s.d. = 3.2 (d) $\bar{X} = 14$, s.d. = 7.2

43. Which of the following is a relative measure of dispersion?

- (a) Range (b) Mean deviation
(c) Standard deviation (d) **Coefficient of quartile deviation**

44. Find the coefficient of mean deviation about mean for the data: 5, 7, 8, 10, 11, 13, 19

- (a) 17.28 (b) 28.57 (c) **32.11** (d) 18.56

45. If a school has 14 teachers, their heights (in cm) are:

172, 173, 164, 178, 168, 169, 173, 172, 173, 164, 178, 168, 169, 173 then average deviation of this data is:

- (a) 2.43 approx. (b) 3.93 approx. (c) **3.43 approx.** (d) 2.92 approx. (1 mark)

46. The standard deviation of 1 to 9 natural number is:

- (a) 6.65 (b) **2.58** (c) 6.75 (d) 5.62 (1 mark)

47. The probable value of mean deviation when $Q_3 = 40$ and $Q_1 = 15$ is:

- (a) **15** (b) 18.75 (c) 17.50 (d) 0

48. If the numbers are 5, 1, 8, 7, 2 then the coefficient of variation is:

- (a) 56.13% (b) **59.13%** (c) 48.13% (d) 44.13%

49. If every observation is increased by 7 then:

- (a) Standard deviation increased by 7 (b) Mean deviation increased by 7.
(c) **Not affected at all.** (d) Quartile deviation increased by 7.

50. If the relationship between x and y is given by $2x + 3y = 10$ and the range of y is 10, then what is the range of x?

- (a) 10 (b) 18 (c) 8 (d) **15**

51. The mean deviation of the numbers 3, 10, 6, 11, 14, 17, 9, 8, 12 about the mean is (correct to one decimal place):

- (a) 8.7 (b) 4.2 (c) **3.1** (d) 9.8

2021 - DECEMBER

52. The marks secured by 5 students in a subject are 82, 73, 69, 84, 66. What is the coefficient of Range?

- (a) 0.12 **(b) 12** (c) 120 (d) 0.012

53. For a data having odd number of values, the difference between the first and the middle value is equal to the difference between the last and the middle value; similarly the difference between the second and middle values is equal to that of second last and middle value so on. Therefore, the middle value is equal to

- (a) Half of the range (b) Half of standard deviation
(c) Mode **(d) Mean** (

54. One hundred participants expressed their opinion on recommending a new product to their friends using the attributes : most unlikely, not sure, likely, most likely. The appropriate measure of central tendency that can be used here is

- (a) Mean **(b) Mode** (c) Geometric mean (d) Harmonic mean

JUNE 2022

DEC 2022

7. If the coefficient of variation and standard deviation are 30 and 12 respectively, then the arithmetic mean of the distribution in

- A. 40 B. 56 C. 25 D. 19

8. _____ is based on all the observations and _____ is based on the central fifty percent of the observations.

- A. Mean deviation, Range B. Mean deviation, quartile deviation
C. Range, standard deviation D. Quartile deviation, standard deviation

96. If the variance of a random variable 'x' is 17, then what is variance of $y = 2x + 5$?

- A. 34 B. 39 C. 68 D. 78

97. If the variance of given data is 12, and their mean value is 40, what is coefficient of variation (CV)?

- A. 5.66% B. 6.66% C. 7.50% D. 8.65%

98. In a given set if all data are of same value then variance would be:

- A. 0 B.1 C.-1 D.0.5

87. If the sum of square of the values equals to 3390. Number of observations are 30 and Standard deviation is 7, what is the mean value or the above observations?

- A. 14 B.11 C.8 D. 5

JUNE 2023

1. If the relationship between x and y is given by $4x + 3y + 11 = 0$ and Mean Deviation of y is 7.20 what is the MD of x?

- (a) 2.70 (b)7.20 (c)4.50 (d)5.40

2. If MD the relationship between x and y is given by $4x + 3y + 11 = 0$ and Mean Deviation of y is 7.20 what is the MD of x?

- (a) 2.70 (b)7.20 (c)4.50 (d)5.40

ADDITIONAL QUESTION BANK

1. The number of measures of central tendency is
(a) two (b) three (c) four (d) five
2. The words "mean" or "average" only refer to
(a) A.M (b) G.M (c) H.M (d) none
3. is the most stable of all the measures of central tendency.
(a) G.M (b) H.M (c) A.M (d) none.
4. Mean is of types.
(a) 3 (b) 4 (c) 8 (d) 5
5. Weighted A.M is related to
(a) G.M (b) frequency (c) H.M (d) none.
6. Frequencies are also called weights.
(a) True (b) false (c) both (d) none
7. The algebraic sum of deviations of observations from their A.M is
(a) 2 (b) -1 (c) 1 (d) 0
8. G.M of a set of n observations is the root of their product.
(a) $n/2$ th (b) $(n + 1)$ th (c) nth (d) $(n - 1)$ th
9. The algebraic sum of deviations of 8, 1, 6 from the A.M viz.5 is
(a) - 1 (b) 0 (c) 1 (d) none
10. G.M of 8, 4, 2 is
(a) 4 (b) 2 (c) 8 (d) none
11. is the reciprocal of the A.M of reciprocal of observations.
(a) H.M (b) G.M (c) both (d) none
12. A.M is never less than G.M
(a) True (b) false (c) both (d) none
13. G.M is less than H.M
(a) true (b) false (c) both (d) none
14. The value of the middlemost item when they are arranged in order of magnitude is called
(a) standard deviation (b) mean (c) mode (d) median
15. Median is unaffected by extreme values.
(a) true (b) false (c) both (d) none
16. Median of 2, 5, 8, 4, 9, 6, 71 is
(a) 9 (b) 8 (c) 5 (d) 6
17. The value which occurs with the maximum frequency is called
(a) median (b) mode (c) mean (d) none
18. In the formula $\text{Mode} = L_1 + \frac{(d_1 \times c)}{(d_1 + d_2)}$ d_1 is the difference of frequencies in the modal class & the class.

(a) preceding

(b) following

(c) both

(d) none

19. In the formula $\text{Mode} = L_1 + (d_1 \times c) / (d_1 + d_2)$
 d_2 is the difference of frequencies in the modal class & the class.
 (a) preceding (b) succeeding (c) both (d) none
20. In formula of median for grouped frequency distribution N is
 (a) total frequency (b) frequency density
 (c) frequency (d) cumulative frequency
21. When all observations occur with equal frequency does not exist.
 (a) median (b) mode (c) mean (d) none
22. Mode of the observations 2, 5, 8, 4, 3, 4, 4, 5, 2, 4, 4 is
 (a) 3 (b) 2 (c) 5 (d) 4
23. For the observations 5, 3, 6, 3, 5, 10, 7, 2 there are modes.
 (a) 2 (b) 3 (c) 4 (d) 5
24. of a set of observations is defined to be their sum, divided by the no. of observations.
 (a) H.M (b) G.M (c) A.M (d) none
25. Simple average is sometimes called
 (a) weighted average (b) unweighted average
 (c) relative average (d) none
26. When a frequency distribution is given, the frequencies themselves treated as weights.
 (a) True (b) false (c) both (d) none
27. Each value is considered only once for
 (a) simple average (b) weighted average
 (c) both (d) none
28. Each value is considered as many times as it occurs for
 (a) simple average (b) weighted average
 (c) both (d) none
29. Multiplying the values of the variable by the corresponding weights and then dividing the sum of products by the sum of weights is
 (a) simple average (b) weighted average
 (c) both (d) none
30. Simple & weighted average are equal only when all the weights are equal.
 (a) True (b) false (c) both (d) none
31. The word "average" used in "simple average" and "weighted average" generally refers to
 (a) median (b) mode (c) A.M, G.M or H.M (d) none
32. average is obtained on dividing the total of a set of observations by their number
 (a) simple (b) weighted (c) both (d) none
33. Frequencies are generally used as

- (a) range (b) weights (c) mean (d) none
34. The total of a set of observations is equal to the product of their number of observations and the
(a) A.M (b) G.M (c) H.M (d) none
35. The total of the deviations of a set of observations from their A.M is always
(a) 0 (b) 1 (c) -1 (d) none
36. Deviation may be positive or negative or zero
(a) true (b) false (c) both (d) none
37. The sum of the squares of deviations of a set of observations has the smallest value, when the deviations are taken from their
(a) A.M (b) H.M (c) G.M (d) none
38. For a given set of positive observations H.M is less than G.M
(a) true (b) false (c) both (d) none
39. For a given set of positive observations A.M is greater than G.M
(a) true (b) false (c) both (d) none
40. Calculation of G.M is more difficult than
(a) A.M (b) H.M (c) median (d) none
41. has a limited use
(a) A.M (b) G.M (c) H.M (d) none
42. A.M of 8, 1, 6 is
(a) 5 (b) 6 (c) 4 (d) none
43. can be calculated from a frequency distribution with open end intervals
(a) Median (b) Mean (c) Mode (d) none
44. The values of all items are taken into consideration in the calculation of
(a) median (b) mean (c) mode (d) none
45. The values of extreme items do not influence the average in case of
(a) median (b) mean (c) mode (d) none
46. In a distribution with a single peak and moderate skewness to the right, it is closer to the concentration of the distribution in case of
(a) mean (b) median (c) both (d) none
47. If the variables x & z are so related that $z = ax + b$ for each $x = x_i$ where a & b are constants, then $\bar{z} = a\bar{x} + b$
(a) true (b) false (c) both (d) none
48. G.M is defined only when
(a) all observations have the same sign and none is zero
(b) all observations have the different sign and none is zero
(c) all observations have the same sign and one is zero
(d) all observations have the different sign and one is zero
49. is useful in averaging ratios, rates and percentages.

- (a) A.M (b) G.M (c) H.M (d) none
50. G.M is useful in construction of index number.
(a) true (b) false (c) both (d) none
51. More laborious numerical calculations involves in G.M than A.M
(a) True (b) false (c) both (d) none
52. H.M is defined when no observation is
(a) 3 (b) 2 (c) 1 (d) 0
53. When all values occur with equal frequency, there is no
(a) mode (b) mean (c) median (d) none
54. cannot be treated algebraically
(a) mode (b) mean (c) median (d) none
55. For the calculation of, the data must be arranged in the form of a frequency distribution.
(a) median (b) mode (c) mean (d) none
56. is equal to the value corresponding to cumulative frequency
(a) mode (b) mean (c) median (d) none
57. is the value of the variable corresponding to the highest frequency
(a) mode (b) mean (c) median (d) none
58. The class in which mode belongs is known as
(a) median class (b) mean class (c) modal class (d) none
59. The formula of mode is applicable if classes are of width.
(a) equal (b) unequal (c) both (d) none
60. For calculation of we have to construct cumulative frequency distribution
(a) mode (b) median (c) mean (d) none
61. For calculation of we have to construct a grouped frequency distribution
(a) median (b) mode (c) mean (d) none
62. Relation between mean, median & mode is
(a) $\text{mean} - \text{mode} = 2 (\text{mean} - \text{median})$ (b) $\text{mean} - \text{median} = 3 (\text{mean} - \text{mode})$
(c) $\text{mean} - \text{median} = 2 (\text{mean} - \text{mode})$ (d) $\text{mean} - \text{mode} = 3 (\text{mean} - \text{median})$
63. When the distribution is symmetrical, mean, median and mode
(a) coincide (b) do not coincide (c) both (d) none
64. Mean, median & mode are equal for the
(a) Binomial distribution (b) Normal distribution
(c) both (d) none
65. In most frequency distributions, it has been observed that the three measures of central tendency viz. mean, median & mode, obey the approximate relation, provided the distribution is
(a) very skew (b) not very skew (c) both (d) none

66. divides the total number of observations into two equal parts.
 (a) mode (b) mean (c) median (d) none
67. Measures which are used to divide or partition the observations into a fixed number of parts are collectively known as
 (a) partition values (b) quartiles (c) both (d) none
68. The middle most value of a set of observations is
 (a) median (b) mode (c) mean (d) none
69. The number of observations smaller than is the same as the number larger than it.
 (a) median (b) mode (c) mean (d) none
70. is the value of the variable corresponding to cumulative frequency $N/2$
 (a) mode (b) mean (c) median (d) none
71. divide the total no. observations into 4 equal parts.
 (a) median (b) deciles (c) quartiles (d) percentiles
72. quartile is known as Upper quartile
 (a) First (b) Second (c) Third (d) none
73. Lower quartile is
 (a) first quartile (b) second quartile (c) upper quartile (d) none
74. The number of observations smaller than lower quartile is the same as the no. lying between lower and middle quartile.
 (a) true (b) false (c) both (d) none
75. are used for measuring central tendency, dispersion & skewness.
 (a) Median (b) Deciles (c) Percentiles (d) Quartiles.
76. The second quartile is known as
 (a) median (b) lower quartile (c) upper quartile (d) none
77. The lower & upper quartiles are used to define
 (a) standard deviation (b) quartile deviation
 (c) both (d) none
78. Three quartiles are used in
 (a) Pearson's formula (b) Bowley's formula
 (c) both (d) none
79. Less than First quartile, the frequency is equal to
 (a) $N/4$ (b) $3N/4$ (c) $N/2$ (d) none
80. Between first & second quartile, the frequency is equal to
 (a) $3N/4$ (b) $N/2$ (c) $N/4$ (d) none
81. Between second & upper quartile, the frequency is equal to
 (a) $3N/4$ (b) $N/4$ (c) $N/2$ (d) none
82. Above upper quartile, the frequency is equal to

- (a) $N/4$ (b) $N/2$ (c) $3N/4$ (d) none
83. Corresponding to first quartile, the cumulative frequency is
(a) $N/2$ (b) $N/4$ (c) $3N/4$ (d) none
84. Corresponding to second quartile, the cumulative frequency is
(a) $N/4$ (b) $2N/4$ (c) $3N/4$ (d) none
85. Corresponding to upper quartile, the cumulative frequency is
(a) $3N/4$ (b) $N/4$ (c) $2N/4$ (d) none
86. The values which divide the total number of observations into 10 equal parts are
(a) quartiles (b) percentiles (c) deciles (d) none
87. There are deciles.
(a) 7 (b) 8 (c) 9 (d) 10
88. Corresponding to first decile, the cumulative frequency is
(a) $N/10$ (b) $2N/10$ (c) $9N/10$ (d) none
89. Fifth decile is equal to
(a) mode (b) median (c) mean (d) none
90. The values which divide the total number of observations into 100 equal parts is
(a) percentiles (b) quartiles (c) deciles (d) none
91. Corresponding to second decile, the cumulative frequency is
(a) $N/10$ (b) $2N/10$ (c) $5N/10$ (d) none
92. There are percentiles.
(a) 100 (b) 98 (c) 97 (d) 99
93. 10th percentile is equal to
(a) 1st decile (b) 10th decile (c) 9th decile (d) none
94. 50th percentile is known as
(a) 50th decile (b) 50th quartile (c) mode (d) median
95. 20th percentile is equal to
(a) 19th decile (b) 20th decile (c) 2nd decile (d) none
96. $(3\text{rd quartile} - 1\text{st quartile})/2$ is
(a) skewness (b) median (c) quartile deviation (d) none
97. 1st percentile is less than 2nd percentile.
(a) true (b) false (c) both (d) none
98. 25th percentile is equal to
(a) 1st quartile (b) 25th quartile (c) 24th quartile (d) none
99. 90th percentile is equal to
(a) 9th quartile (b) 90th decile (c) 9th decile (d) none
100. 1st decile is greater than 2nd decile

- (a) True (b) false (c) both (d) none
101. Quartile deviation is a measure of dispersion.
(a) true (b) false (c) both (d) none
102. To define quartile deviation we use
(a) lower & middle quartiles (b) lower & upper quartiles
(c) upper & middle quartiles (d) none
103. Calculation of quartiles, deciles, percentiles may be obtained graphically from
(a) Frequency Polygon (b) Histogram (c) Ogive (d) none
104. 7th decile is the abscissa of that point on the Ogive whose ordinate is
(a) $7N/10$ (b) $8N/10$ (c) $6N/10$ (d) none
105. Rank of median is
(a) $(n + 1)/2$ (b) $(n + 1)/4$ (c) $3(n + 1)/4$ (d) none
106. Rank of 1st quartile is
(a) $(n + 1)/2$ (b) $(n + 1)/4$ (c) $3(n + 1)/4$ (d) none
107. Rank of 3rd quartile is
(a) $3(n + 1)/4$ (b) $(n + 1)/4$ (c) $(n + 1)/2$ (d) none
108. Rank of k th decile is
(a) $(n + 1)/2$ (b) $(n + 1)/4$ (c) $(n + 1)/10$ (d) $k(n + 1)/10$
109. Rank of k th percentile is
(a) $(n + 1)/100$ (b) $k(n + 1)/10$ (c) $k(n + 1)/100$ (d) none
110. is equal to value corresponding to cumulative frequency $(N + 1)/2$ from simple frequency distribution
(a) Median (b) 1st quartile (c) 3rd quartile (d) 4th quartile
111. is equal to the value corresponding to cumulative frequency $(N + 1)/4$ from simple frequency distribution
(a) Median (b) 1st quartile (c) 3rd quartile (d) 1st decile
112. is equal to the value corresponding to cumulative frequency $3(N + 1)/4$ from simple frequency distribution
(a) Median (b) 1st quartile (c) 3rd quartile (d) 1st decile
113. is equal to the value corresponding to cumulative frequency $k(N + 1)/10$ from simple frequency distribution
(a) Median (b) kth decile (c) kth percentile (d) none
114. is equal to the value corresponding to cumulative frequency $k(N + 1)/100$ from simple frequency distribution
(a) kth decile (b) kth percentile (c) both (d) none
115. For grouped frequency distribution is equal to the value corresponding to cumulative frequency $N/2$
(a) median (b) 1st quartile (c) 3rd quartile (d) none
116. For grouped frequency distribution is equal to the value corresponding to cumulative frequency $N/4$

- (a) median (b) 1st quartile (c) 3rd quartile (d) none
117. For grouped frequency distribution is equal to the value corresponding to cumulative frequency $3N/4$
- (a) median (b) 1st quartile (c) 3rd quartile (d) none
118. For grouped frequency distribution is equal to the value corresponding to cumulative frequency $kN/10$
- (a) median (b) kth percentile (c) kth decile (d) none
119. For grouped frequency distribution is equal to the value corresponding to cumulative frequency $kN/100$
- (a) kth quartile (b) kth percentile (c) kth decile (d) none
120. In Ogive, abscissa corresponding to ordinate $N/2$ is
- (a) median (b) 1st quartile (c) 3rd quartile (d) none
121. In Ogive, abscissa corresponding to ordinate $N/4$ is
- (a) median (b) 1st quartile (c) 3rd quartile (d) none
122. In Ogive, abscissa corresponding to ordinate $3N/4$ is
- (a) median (b) 3rd quartile (c) 1st quartile (d) none
123. In Ogive, abscissa corresponding to ordinate is kth decile.
- (a) $kN/10$ (b) $kN/100$ (c) $kN/50$ (d) none
124. In Ogive, abscissa corresponding to ordinate is kth percentile.
- (a) $kN/10$ (b) $kN/100$ (c) $kN/50$ (d) none
125. For 899, 999, 391, 384, 590, 480, 485, 760, 111, 240 Rank of median is
- (a) 2.75 (b) 5.5 (c) 8.25 (d) none
126. For 333, 999, 888, 777, 666, 555, 444 Rank of 1st quartile is
- (a) 3 (b) 1 (c) 2 (d) 7
127. For 333, 999, 888, 777, 1000, 321, 133 Rank of 3rd quartile is
- (a) 7 (b) 4 (c) 5 (d) 6
128. Price per kg.(Rs.) : 45 50 35; Kgs.Purchased : 100 40 60 Total frequency is
- (a) 300 (b) 100 (c) 150 (d) 200
129. The length of a rod is measured by a tape 10 times. You are to estimate the length of the rod by averaging these 10 determinations.
- What is the suitable form of average in this case?
- (a) A.M (b) G.M (c) H.M (d) none
130. A person purchases 5 rupees worth of eggs from 10 different markets. You are to find the average no. of eggs per rupee for all the markets taken together. What is the suitable form of average in this case?
- (a) A.M (b) G.M (c) H.M (d) none
131. You are given the population of India for the years of 1981 & 1991. You are to find the population of India at the middle of the period by averaging these population figures, assuming a constant rate of increase of population.
- What is the suitable form of average in this case?

- (a) A.M (b) G.M (c) H.M (d) none
132. is least affected by sampling fluctuations.
(a) Standard deviation (b) Quartile deviation (c) both (d) none
133. "Root – Mean Square Deviation from Mean" is
(a) Standard deviation (b) Quartile deviation (c) both (d) none
134. Standard Deviation is
(a) absolute measure (b) relative measure (c) both (d) none
135. Coefficient of variation is
(a) absolute measure (b) relative measure (c) both (d) none
136. deviation is called semi-interquartile range.
(a) Percentile (b) Standard (c) Quartile (d) none
137. Deviation is defined as half the difference between the lower & upper quartiles.
(a) Quartile (b) Standard (c) both (d) none
138. Quartile Deviation for the data 1, 3, 4, 5, 6, 6, 10 is
(a) 3 (b) 1 (c) 6 (d) 1.5
139. Coefficient of Quartile Deviation is
(a) $(\text{Quartile Deviation} \times 100) / \text{Median}$ (b) $(\text{Quartile Deviation} \times 100) / \text{Mean}$
(c) $(\text{Quartile Deviation} \times 100) / \text{Mode}$ (d) none
140. Mean for the data 6, 4, 1, 6, 5, 10, 3 is
(a) 7 (b) 5 (c) 6 (d) none
141. Coefficient of variation = $(\text{Standard Deviation} \times 100) / \text{Mean}$
(a) true (b) false (c) both (d) none
142. If mean = 5, Standard deviation = 2.6 then the coefficient of variation is
(a) 49 (b) 51 (c) 50 (d) 52
143. If median = 5, Quartile deviation = 1.5 then the coefficient of quartile deviation is
(a) 33 (b) 35 (c) 30 (d) 20
144. A.M of 2, 6, 4, 1, 8, 5, 2 is
(a) 4 (b) 3 (c) 4 (d) none
145. Most useful among all measures of dispersion is
(a) S.D (b) Q.D (c) Mean deviation (d) none
146. For the observations 6, 4, 1, 6, 5, 10, 4, 8 Range is
(a) 10 (b) 9 (c) 8 (d) none
147. A measure of central tendency tries to estimate the
(a) central value (b) lower value (c) upper value (d) none
148. Measures of central tendency are known as
(a) differences (b) averages (c) both (d) none
149. Mean is influenced by extreme values.

- (a) true (b) false (c) both (d) none
150. Mean of 6, 7, 11, 8 is
(a) 11 (b) 6 (c) 7 (d) 8
151. The sum of differences between the actual values and the arithmetic mean is
(a) 2 (b) -1 (c) 0 (d) 1
152. When the algebraic sum of deviations from the arithmetic mean is not equal to zero, the figure of arithmetic mean correct.
(a) is (b) is not (c) both (d) none
153. In the problem
- | | | | | | |
|-----------------|-------|-------|-------|-------|-------|
| No. of shirts: | 30-32 | 33-35 | 36-38 | 39-41 | 42-44 |
| No. of persons: | 15 | 14 | 42 | 27 | 18 |
- The assumed mean is
(a) 34 (b) 37 (c) 40 (d) 43
154. In the problem
- | | | | | |
|----------------|-----|-----|------|-------|
| Size of items: | 1-3 | 3-8 | 8-15 | 15-26 |
| Frequency: | 5 | 10 | 16 | 15 |
- The assumed mean is
(a) 20.5 (b) 2 (c) 11.5 (d) 5.5
155. The average of a series of overlapping averages, each of which is based on a certain number of item within a series is known as
(a) moving average (b) weighted average
(c) simple average (d) none
156. averages is used for smoothening a time series.
(a) moving average (b) weighted average (c) simple average (d) none
157. Pooled Mean is also called
(a) Mean (b) Geometric Mean (c) Grouped Mean (d) none
158. Half of the numbers in an ordered set have values less than the and half will have values greater than the
(a) mean, median (b) median, median (c) mode, mean (d) none.
159. The median of 27, 30, 26, 44, 42, 51, 37 is
(a) 30 (b) 42 (c) 44 (d) 37
160. For an even number of values the median is the
(a) average of two middle values (b) middle value
(c) both (d) none
161. In the case of a continuous frequency distribution, the size of the item indicates class interval in which the median lies.
(a) $(n-1)/2$ th (b) $(n+1)/2$ th (c) $n/2$ th (d) none

162. The deviations from median are if negative signs are ignored as compared to other measures of central tendency.
 (a) minimum (b) maximum (c) same (d) none
163. Ninth Decile lies in the class interval of the item
 (a) $n/9$ (b) $9n/10$ (c) $9n/20$ (d) none item.
164. Ninety Ninth Percentile lies in the class interval of the item
 (a) $99n/100$ (b) $99n/10$ (c) $99n/200$ (d) none item.
165. is the value of the variable at which the concentration of observation is the densest.
 (a) mean (b) median (c) mode (d) none
166. Height in cms: 60-62 63-65 66-68 69-71 72-74
 No. of students: 15 118 142 127 18
 Modal group is
 (a) 66-68 (b) 69-71 (c) 63-65 (d) none
167. A distribution is said to be symmetrical when the frequency rises & falls from the highest value in the proportion.
 (a) unequal (b) equal (c) both (d) none
168. always lies in between the arithmetic mean & mode.
 (a) G.M (b) H.M (c) Median (d) none
169. Logarithm of G.M is the of logarithms of the different values.
 (a) weighted mean (b) simple mean (c) both (d) none
170. is not much affected by fluctuations of sampling.
 (a) A.M (b) G.M (c) H.M (d) none
171. The data 1, 2, 4, 8, 16 are in
 (a) Arithmetic progression (b) Geometric progression
 (c) Harmonic progression (d) none
172. & can not be calculated if any observation is zero.
 (a) G.M & A.M (b) H.M & A.M (c) H.M & G. M (d) None.
173. & are called ratio averages.
 (a) H.M & G.M (b) H. M & A.M (c) A.M & G.M (d) none
174. is a good substitute to a weighted average.
 (a) A.M (b) G.M (c) H.M (d) none
175. For ordering shoes of various sizes for resale, a size will be more appropriate.
 (a) median (b) modal (c) mean (d) none
176. is called a positional measure.
 (a) mean (b) mode (c) median (d) none
177. 50% of actual values will be below & 50% of will be above

- (a) mode (b) median (c) mean (d) none
178. Extreme values have effect on mode.
(a) high (b) low (c) no (d) none
179. Extreme values have effect on median.
(a) high (b) low (c) no (d) none
180. Extreme values have effect on A.M.
(a) greatest (b) least (c) some (d) none
181. Extreme values have effect on H.M.
(a) least (b) greatest (c) medium (d) none
182. is used when representation value is required & distribution is asymmetric.
(a) mode (b) mean (c) median (d) none
183. is used when most frequently occurring value is required (discrete variables).
(a) mode (b) mean (c) median (d) none
184. is used when rate of growth or decline required.
(a) mode (b) A.M (c) G.M (d) none
185. In finding , the distribution has open-end classes.
(a) median (b) mean (c) standard deviation (d) none
186. The cumulative frequency distribution is used for
(a) median (b) mode (c) mean (d) none
187. In the quantities are in ratios.
(a) A.M (b) G.M (c) H.M (d) none
188. is used when variability has also to be calculated.
(a) A.M (b) G.M (c) H.M (d) none
189. is used when the sum of absolute deviations from the average should be least.
(a) Mean (b) Mode (c) Median (d) None
190. is used when sampling variability should be least.
(a) Mode (b) Median (c) Mean (d) none
191. is used when distribution pattern has to be studied at varying levels.
(a) A.M (b) Median (c) G.M (d) none
192. The average discovers
(a) uniformity in variability (b) variability in uniformity of distribution
(c) both (d) none
193. The average has relevance for
(a) homogeneous population (b) heterogeneous population
(c) both (d) none
194. The correction factor is applied in

- (a) inclusive type of distribution (b) exclusive type of distribution
(c) both (d) none
195. "Mean has the least sampling variability" prove the mathematical property of mean
(a) True (b) false (c) both (d) none
196. "The sum of deviations from the mean is zero" is the mathematical property of mean
(a) True (b) false (c) both (d) none
197. "The mean of the two samples can be combined" is the mathematical property of mean
(a) True (b) false (c) both (d) none
198. "Choices of assumed mean does not affect the actual mean"..... prove the mathematical property of mean
(a) True (b) false (c) both (d) none
199. "In a moderately asymmetric distribution mean can be found out from the given values of median & mode"..... is the mathematical property of mean
(a) True (b) false (c) both (d) none
200. The mean wages of two companies are equal. It signifies that the workers of both the companies are equally well-off.
(a) True (b) false (c) both (d) none
201. The mean wage in factory A is Nu.6,000 whereas in factory B it is Nu.5,500. It signifies that factory A pays more to all its workers than factory B.
(a) True (b) false (c) both (d) none
202. Mean of 0, 3, 5, 6, 7, 9, 12, 0, 2 is
(a) 4.9 (b) 5.7 (c) 5.6 (d) none
203. Median of 15, 12, 6, 13, 12, 15, 8, 9 is
(a) 13 (b) 8 (c) 12 (d) 9
204. Median of 0.3, 5, 6, 7, 9, 12, 0, 2 is
(a) 7 (b) 6 (c) 3 (d) 5
192. Mode of 0, 3, 5, 6, 7, 9, 12, 0, 2 is
(a) 6 (b) 0 (c) 3 (d) 5
193. Mode Of 15, 12, 5, 13, 12, 15, 8, 8, 9, 9, 10, 15 is
(a) 15 (b) 12 (c) 8 (d) 9
194. Median of 40, 50, 30, 20, 25, 35, 30, 30, 20, 30 is
(a) 25 (b) 30 (c) 35 (d) none
195. Mode of 40, 50, 30, 20, 25, 35, 30, 30, 20, 30 is
(a) 25 (b) 30 (c) 35 (d) none
196. in particular helps in finding out the variability of the data.
(a) Dispersion (b) Median (c) Mode (d) None
197. Measures of central tendency are called averages of the order.

- (a) 1st (b) 2nd (c) 3rd (d) none
198. Measures of dispersion are called averages of the order.
- (a) 1st (b) 2nd (c) 3rd (d) none
199. In measuring dispersion, it is necessary to know the amount of & the degree of
- (a) variation, variation (b) variation, median
(c) median, variation (d) none
200. The amount of variation is designated as measure of dispersion.
- (a) relative (b) absolute (c) both (d) none
201. The degree of variation is designated as measure of dispersion.
- (a) relative (b) absolute (c) both (d) none
215. For purposes of comparison between two or more series with varying size or no. of items, varying central values or units of calculation, only measures can be used.
- (a) absolute (b) relative (c) both (d) none
216. The relation $\text{Relative range} = \text{Absolute range} / \text{Sum of the two extremes}$ is
- (a) True (b) false (c) both (d) none
217. The relation $\text{Absolute range} = \text{Relative range} / \text{Sum of the two extremes}$ is
- (a) True (b) false (c) both (d) none
218. In quality control is used as a substitute for standard deviation.
- (a) mean deviation (b) median (c) range (d) none
219. factor helps to know the value of standard deviation.
- (a) Correction (b) Range (c) both (d) none
220. is extremely sensitive to the size of the sample
- (a) Range (b) Mean (c) Median (d) Mode
221. As the sample size increases, ... also tends to increase.
- (a) Range (b) Mean (c) Median (d) Mode
222. As the sample size increases, range also tends to increase though not proportionately.
- (a) true (b) false (c) both (d) none.
223. As the sample size increases, range also tends to
- (a) decrease (b) increase (c) same (d) none
224. The dependence of range on extreme items can be avoided by adopting
- (a) standard deviation (b) mean deviation (c) quartile deviation (d) none
225. Quartile deviation is called
- (a) semi inter quartile range (b) quartile range
(c) both (d) none
226. When 1st quartile = 20, 3rd quartile = 30, the value of quartile deviation is
- (a) 7 (b) 4 (c) - 5 (d) 5

227. $(Q_3 - Q_1)/(Q_3 + Q_1)$ is
 (a) coefficient of Quartile Deviation (b) coefficient of Mean Deviation
 (c) coefficient of Standard deviation (d) none
228. Standard deviation is denoted by
 (a) σ^2 (b) σ (c) $\sqrt{\sigma}$ (d) none
229. The square of standard deviation is known as
 (a) variance (b) standard deviation (c) mean deviation (d) none
230. Mean of 25, 32, 43, 53, 62, 59, 48, 31, 24, 33 is
 (a) 44 (b) 43 (c) 42 (d) 41
231. For the following frequency distribution
- | Class interval: | 10-20 | 20-30 | 30-40 | 40-50 | 50-60 | 60-70 |
|-----------------|-------|-------|-------|-------|-------|-------|
| Frequency: | 20 | 9 | 31 | 18 | 10 | 9 |
- assumed mean can be taken as
 (a) 55 (b) 45 (c) 35 (d) none
232. The value of the standard deviation does not depend upon the choice of the origin.
 (a) True (b) false (c) both (d) none
233. Coefficient of standard deviation is
 (a) S.D/Median (b) S.D/Mean (c) S.D/Mode (d) none
234. The value of the standard deviation will change if any one of the observations is changed.
 (a). True (b) false (c) both (d) none
235. When all the values are equal then variance & standard deviation would be
 (a) 2 (b) -1 (c) 1 (d) 0
236. For values lie close to the mean, the standard deviations are
 (a) big (b) small (c) moderate (d) none
237. If the same amount is added to or subtracted from all the values, variance & standard deviation shall
 (a) changed (b) unchanged (c) both (d) none
238. If the same amount is added to or subtracted from all the values, the mean shall increase or decrease by the amount
 (a) big (b) small (c) same (d) none
239. If all the values are multiplied by the same quantity, the & also would be multiple of the same quantity.
 (a) mean, standard deviation (b) mean , median
 (c) mean, mode (d) median , deviations
240. For a moderately non-symmetrical distribution, Mean deviation = $4/5$ of standard deviation
 (a) true (b) false (c) both (d) none

241. For a moderately non-symmetrical distribution, Quartile deviation = Standard deviation/3
 (a) true (b) false (c) both (d) none
242. For a moderately non-symmetrical distribution, probable error of standard deviation = Standard deviation/3
 (a) true (b) false (c) both (d) none
243. Quartile deviation = Probable error of Standard deviation.
 (a) true (b) false (c) both (d) none
244. Coefficient of Mean Deviation is
 (a) Mean deviation $\times$ 100/Mean or mode
 (b) Standard deviation $\times$ 100/Mean or median
 (c) Mean deviation $\times$ 100/Mean or median
 (d) none
245. Coefficient of Quartile Deviation = Quartile Deviation $\times$ 100/Median
 (a) true (b) false (c) both (d) none
246. Karl Pearson's measure gives
 (a) coefficient of Mean Variation (b) coefficient of Standard deviation
 (c) coefficient of variation (d) none
247. In range has the greatest use.
 (a) Time series (b) quality control (c) both (d) none
248. Mean is an absolute measure & standard deviation is based upon it. Therefore standard deviation is a relative measure.
 (a) true (b) false (c) both (d) none
249. Semi-quartile range is one-fourth of the range in a normal symmetrical distribution.
 (a) Yes (b) No (c) both (d) none
250. Whole frequency table is needed for the calculation of
 (a) range (b) variance (c) both (d) none
251. Relative measures of dispersion make deviations in similar units comparable.
 (a) true (b) false (c) both (d) none
252. Quartile deviation is based on the
 (a) highest 50% (b) lowest 25%
 (c) highest 25% (d) middle 50% of the item.
253. S.D is less than Mean deviation
 (a) true (b) false (c) both (d) none
254. Coefficient of variation is independent of the unit of measurement.
 (a) true (b) false (c) both (d) none
255. Coefficient of variation is a relative measure of
 (a) mean (b) deviation (c) range (d) dispersion.

256. Coefficient of variation is equal to
 (a) Standard deviation $\times$ 100 / median
 (b) Standard deviation $\times$ 100 / mode
 (c) Standard deviation $\times$ 100 / mean
 (d) none
257. Coefficient of Quartile Deviation is equal to
 (a) Quartile deviation $\times$ 100 / median
 (b) Quartile deviation $\times$ 100 / mean
 (c) Quartile deviation $\times$ 100 / mode
 (d) none
258. If each item is reduced by 15 A.M is
 (a) reduced by 15 (b) increased by 15 (c) reduced by 10 (d) none
259. If each item is reduced by 10, the range is
 (a) increased by 10 (b) decreased by 10 (c) unchanged (d) none
260. If each item is reduced by 20, the standard deviation
 (a) increased (b) decreased (c) unchanged (d) none
261. If the variables are increased or decreased by the same amount the standard deviation is
 (a) decreased (b) increased (c) unchanged (d) none
262. If the variables are increased or decreased by the same proportion, the standard deviation changes by
 (a) same proportion (b) different proportion (c) both (d) none
263. The mean of the 1st n natural no. is
 (a) $n/2$ (b) $(n - 1)/2$ (c) $(n + 1)/2$ (d) none
264. If the class interval is open-end then it is difficult to find
 (a) frequency (b) A.M (c) both (d) none
265. Which one is true—
 (a) A.M = assumed mean + arithmetic mean of deviations of terms
 (b) G.M = assumed mean + arithmetic mean of deviations of terms
 (c) Both
 (d) none
266. If the A.M of any distribution be 25 & one term is 18. Then the deviation of 18 from A.M is
 (a) 7 (b) -7 (c) 43 (d) none
267. For finding A.M in Step-deviation method, the class intervals should be of
 (a) equal lengths (b) unequal lengths (c) maximum lengths (d) none
268. The sum of the squares of the deviations of the variable is when taken about A.M
 (a) maximum (b) zero (c) minimum (d) none

269. The A.M of 1, 3, 5, 6, x, 10 is 6 . The value of x is
 (a) 10 (b) 11 (c) 12 (d) none
270. The G.M of 2 & 8 is
 (a) 2 (b) 4 (c) 8 (d) none
271. $(n + 1)/2$ th term is median if n is
 (a) odd (b) even (c) both (d) none
272. For the values of a variable 5, 2, 8, 3, 7, 4, the median is
 (a) 4 (b) 4.5 (c) 5 (d) none
273. The abscissa of the maximum frequency in the frequency curve is the
 (a) mean (b) median (c) mode (d) none
274. Variable: 2 3 4 5 6 7
 No. of men: Mode is 5 6 8 13 7 4
 (a) 6 (b) 4 (c) 5 (d) none
275. The class having maximum frequency is called
 (a) modal class (b) median class (c) mean class (d) none
276. For determination of mode, the class intervals should be
 (a) overlapping (b) maximum (c) minimum (d) none
277. First Quartile lies in the class interval of the
 (a) $n/2$ th item (b) $n/4$ th item (c) $3n/4$ th item (d) $n/10$ th item
278. The value of a variate that occur most often is called
 (a) median (b) mean (c) mode (d) none
279. For the values of a variable 3, 1, 5, 2, 6, 8, 4 the median is
 (a) 3 (b) 5 (c) 4 (d) none
280. If $y = 5x - 20$ & $x = 30$ then the value of y is
 (a) 130 (b) 140 (c) 30 (d) none
281. If $y = 3x - 100$ and $x = 50$ then the value of y is
 (a) 60 (b) 30 (c) 100 (d) 50
282. The median of the numbers 11, 10, 12, 13, 9 is
 (a) 12.5 (b) 12 (c) 10.5 (d) 11
283. The mode of the numbers 7, 7, 7, 9, 10, 11, 11, 11, 12 is
 (a) 11 (b) 12 (c) 7 (d) 7 & 11
284. In a symmetrical distribution when the 3rd quartile plus 1st quartile is halved, the value would give
 (a) mean (b) mode (c) median (d) none
285. In Zoology is used.
 (a) median (b) mean (c) mode (d) none
286. For calculation of Speed & Velocity

- (a) G.M (b) A.M (c) H.M (d) none is used.
287. The S.D is always taken from
(a) median (b) mode (c) mean (d) none
288. Coefficient of Standard deviation is equal to
(a) S.D/A.M (b) A.M/S.D (c) S.D/GM (d) none
289. The distribution, for which the coefficient of variation is less, is consistent.
(a) less (b) more (c) moderate (d) none

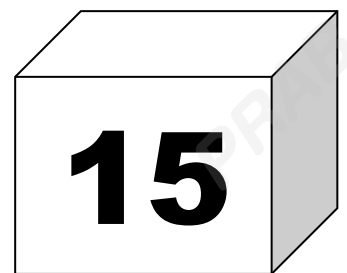
ANSWERS

1.	(b)	2.	(a)	3.	(c)	4.	(a)	5.	(b)
6.	(a)	7.	(d)	8.	(c)	9.	(b)	10.	(a)
11.	(a)	12.	(a)	13.	(b)	14.	(d)	15.	(a)
16.	(d)	17.	(b)	18.	(a)	19.	(b)	20.	(a)
21.	(b)	22.	(d)	23.	(a)	24.	(c)	25.	(b)
26.	(a)	27.	(a)	28.	(b)	29.	(b)	30.	(a)
31.	(c)	32.	(a)	33.	(b)	34.	(a)	35.	(a)
36.	(a)	37.	(a)	38.	(a)	39.	(a)	40.	(a)
41.	(c)	42.	(a)	43.	(a)	44.	(b)	45.	(a)
46.	(b)	47.	(a)	48.	(a)	49.	(b)	50.	(a)
51.	(a)	52.	(d)	53.	(a)	54.	(a)	55.	(b)
56.	(c)	57.	(a)	58.	(c)	59.	(c)	60.	(b)
61.	(b)	62.	(d)	63.	(a)	64.	(b)	65.	(b)
66.	(c)	67.	(c)	68.	(a)	69.	(a)	70.	(c)
71.	(c)	72.	(c)	73.	(a)	74.	(a)	75.	(d)
76.	(a)	77.	(b)	78.	(b)	79.	(a)	80.	(c)
81.	(b)	82.	(a)	83.	(b)	84.	(b)	85.	(a)
86.	(c)	87.	(c)	88.	(a)	89.	(b)	90.	(a)
91.	(b)	92.	(d)	93.	(a)	94.	(d)	95.	(c)

96.	(c)	97.	(a)	98.	(a)	99.	(c)	100.	(b)
101.	(a)	102.	(b)	103.	(c)	104.	(a)	105.	(a)
106.	(b)	107.	(a)	108.	(d)	109.	(c)	110.	(a)
111.	(b)	112.	(c)	113.	(b)	114.	(b)	115.	(a)
116.	(b)	117.	(c)	118.	(c)	119.	(b)	120.	(a)
121.	(b)	122.	(b)	123.	(a)	124.	(b)	125.	(b)
126.	(c)	127.	(d)	128.	(d)	129.	(a)	130.	(c)
131.	(b)	132.	(a)	133.	(a)	134.	(a)	135.	(b)
136.	(c)	137.	(a)	138.	(d)	139.	(a)	140.	(b)
141.	(a)	142.	(d)	143.	(c)	144.	(c)	145.	(a)
146.	(b)	147.	(a)	148.	(b)	149.	(a)	150.	(d)
151.	(c)	152.	(b)	153.	(b)	154.	(c)	155.	(a)

156. (a)	157. (c)	158. (b)	159. (d)	160. (a)
161. (c)	162. (a)	163. (b)	164. (a)	165. (c)
166. (a)	167. (b)	168. (c)	169. (a)	170. (b)
171. (b)	172. (c)	173. (c)	174. (c)	175. (b)
176. (c)	177. (b)	178. (d)	179. (c)	180. (c)
181. (b)	182. (b)	183. (b)	184. (c)	185. (a)
186. (a)	187. (b)	188. (a)	189. (c)	190. (c)
191. (b)	192. (a)	193. (b)	194. (b)	195. (b)
196. (a)	197. (a)	198. (a)	199. (b)	200. (b)
201. (b)	202. (a)	203. (c)	204. (d)	205. (b)
206. (a)	207. (b)	208. (b)	209. (a)	210. (a)
211. (b)	212. (a)	213. (b)	214. (a)	215. (b)
216. (a)	217. (b)	218. (c)	219. (a)	220. (a)
221. (a)	222. (a)	223. (b)	224. (c)	225. (a)

226. (d)	227. (a)	228. (b)	229. (a)	230. (d)
231. (c)	232. (a)	233. (b)	234. (a)	235. (d)
236. (b)	237. (b)	238. (c)	239. (a)	240. (b)
241. (b)	242. (b)	243. (a)	244. (c)	245. (a)
246. (c)	247. (b)	248. (b)	249. (a)	250. (c)
251. (b)	252. (d)	253. (a)	254. (a)	255. (d)
256. (c)	257. (a)	258. (a)	259. (c)	260. (c)
261. (c)	262. (a)	263. (c)	264. (a)	265. (a)
266. (b)	267. (a)	268. (c)	269. (b)	270. (b)
271. (a)	272. (b)	273. (c)	274. (c)	275. (a)
276. (a)	277. (b)	278. (c)	279. (c)	280. (a)
281. (d)	282. (d)	283. (d)	284. (c)	285. (c)
286. (c)	287. (c)	288. (a)	289. (b)	



PROBABILITY

INTRODUCTION

The terms 'Probably' 'in all likelihood', 'chance', 'odds in favour', 'odds against' are too familiar nowadays and they have their origin in a branch of Mathematics, known as Probability. In recent time, probability has developed itself into a full-fledged subject and become an integral part of statistics. The theories of Testing Hypothesis and Estimation are based on probability.

RANDOM EXPERIMENT

In order to develop a sound knowledge about probability, it is necessary to get ourselves familiar with a few terms.

Experiment: An experiment may be described as a performance that produces certain results.

Random Experiment: An experiment is defined to be random if the results of the experiment depend on chance only. For example if a coin is tossed, then we get two outcomes—Head (H) and Tail (T). It is impossible to say in advance whether a Head or a Tail would turn up when we toss the coin once. Thus, tossing a coin is an example of a random experiment. Similarly, rolling a dice (or any number of dice), drawing items from a box containing both defective and non—defective items, drawing cards from a pack of well shuffled fifty—two cards etc. are all random experiments.

Events: The results or outcomes of a random experiment are known as events. Sometimes events may be combination of outcomes. The events are of two types:

- (i) Simple or Elementary,
- (ii) Composite or Compound.

An event is known to be simple if it cannot be decomposed into further events. Tossing a coin once provides us two simple events namely Head and Tail. On the other hand, a composite event is one that can be decomposed into two or more events. Getting a head when a coin is tossed twice is an example of composite event as it can be split into the events HT and TH which are both elementary events.

Mutually Exclusive Events or Incompatible Events: A set of events $A_1, A_2, A_3, \dots$ is known to be mutually exclusive if not more than one of them can occur simultaneously. Thus occurrence of one such event implies the non-occurrence of the other events of the set. Once a coin is tossed, we get two mutually exclusive events Head and Tail.

Exhaustive Events: The events $A_1, A_2, A_3, \dots$ are known to form an exhaustive set if one of these events must necessarily occur. As an example, the two events Head and Tail, when a coin is tossed once, are exhaustive as no other event except these two can occur.

Equally Likely Events or Mutually Symmetric Events or Equi-Probable Events: The events of a random experiment are known to be equally likely when all necessary evidence are taken into account, no event is expected to occur more frequently as compared to the other events of the set of events. The two events Head and Tail when a coin is tossed is an example of a pair of equally likely events because there is no reason to assume that Head (or Tail) would occur more frequently as compared to Tail (or Head).

163 CLASSICAL DEFINITION OF PROBABILITY OR A PRIOR DEFINITION

Let us consider a random experiment that result in n finite elementary events, which are assumed to be equally likely. We next assume that out of these n events, $n_A (< n)$ events are favourable to an event A . Then the probability of occurrence of the event A is defined as the ratio of the number of events favourable to A to the total number of events. Denoting this by $P(A)$, we have

$$P(A) = \frac{n_A}{n} = \frac{\text{No. of equally likely events favourable to } A}{\text{Total no. of equally likely events}} \dots\dots\dots (16A)$$

However if instead of considering all elementary events, we focus our attention to only those composite events, which are mutually exclusive, exhaustive and equally likely and if $m (< n)$ denotes such events and is furthermore $m_A (< n_A)$ denotes the no. of mutually exclusive, exhaustive and equally likely events favourable to A , then we have

$$P(A) = \frac{m_A}{m} = \frac{\text{No. of mutually exclusive, exhaustive and equally likely events favourable to } A}{\text{Total no. of mutually exclusive, exhaustive and equally likely events}} \dots\dots\dots (16.2)$$

For this definition of probability, we are indebted to Bernoulli and Laplace. This definition is also termed as a priori definition because probability of the event A is defined on the basis of prior knowledge.

This classical definition of probability has the following demerits or limitations:

- (i) It is applicable only when the total no. of events is finite.
- (ii) It can be used only when the events are equally likely or equi-probable. This assumption is made well before the experiment is performed.
- (iii) This definition has only a limited field of application like coin tossing, dice throwing, drawing cards etc. where the possible events are known well in advance. In the field of uncertainty or where no prior knowledge is provided, this definition is inapplicable.

In connection with classical definition of probability, we may note the following points:

- (a) The probability of an event lies between 0 and 1, both inclusive.
i. e. $0 < P(A) < 1$ (16.3)

When $P(A) = 0$, A is known to be an impossible event and when $P(A) = 1$, A is

known to be a sure event.

- (b) Non-occurrence of event A is denoted by A' or A^c or $\bar{A}$ and it is known as complimentary event of A. The event A along with its complimentary A' forms a set of mutually exclusive and exhaustive events.

i. e. $P(A) + P(A') = 1$

$\Rightarrow P(A') = 1 - P(A)$

$$= \frac{m - m_A}{m}$$

- (c) The ratio of no. of favourable events to the no. of unfavourable events is known as odds in favour of the event A and its inverse ratio is known as odds against the event A.

i. e. odds in favour of A = $m_A : (m - m_A)$ (16.5)

and odds against A = $(m - m_A) : m_A$

ILLUSTRATIONS:

Example A coin is tossed three times. What is the probability of getting:

(i) 2 heads

(ii) at least 2 heads.

Example A dice is rolled twice. What is the probability of getting a difference of 2 points?

Example 16.3: Two dice are thrown simultaneously. Find the probability that the sum of points on the two dice would be 7 or more.

Example 16.4: What is the chance of picking a spade or an ace not of spade from a pack of 52 cards?

Example 16.5: Find the probability that a four digit number comprising the digits 2, 5, 6 and 7 would be divisible by 4.

Example 16.6: A committee of 7 members is to be formed from a group comprising 8 gentlemen and 5 ladies. What is the probability that the committee would comprise:

(a) 2 ladies,

(b) at least 2 ladies.

RELATIVE FREQUENCY DEFINITION OF PROBABILITY

Owing to the limitations of the classical definition of probability, there are cases when we consider the statistical definition of probability based on the concept of relative frequency. This definition of probability was first developed by the British mathematicians in connection with the survival probability of a group of people.

Let us consider a random experiment repeated a very good number of times, say n, under an identical set of conditions. We next assume that an event A occurs f_A times. Then the limiting value of the ratio of f_A to n as n tends to infinity is defined as the probability of A.

i.e. $P(A) = \lim_{n \rightarrow \infty} \frac{f_A}{n}$ (16.7)

This statistical definition is applicable if the above limit exists and tends to a finite value.

Example 16.7: The following data relate to the distribution of wages of a group of workers:

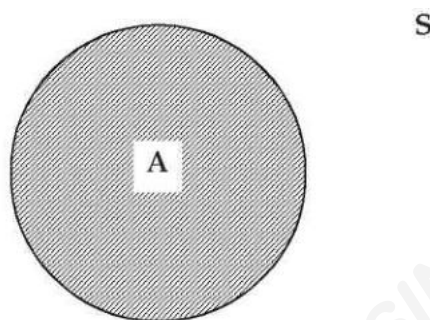
Wages in Rs.:	50-60	60-70	70-80	80-90	90-100	100-110	110-120
No. of workers:	15	23	36	42	17	12	5

If a worker is selected at random from the entire group of workers, what is the probability that

- his wage would be less than Rs. 50?
- his wage would be less than Rs. 80?
- his wage would be more than Rs. 100?
- his wages would be between Rs. 70 and Rs. 100?

OPERATIONS ON EVENTS-SET THEORETIC APPROACH TO PROBABILITY

Applying the concept of set theory, we can give a new dimension of the classical definition of probability. A sample space may be defined as a non-empty set containing all the elementary events of a random experiment as sample points. A sample space is denoted by S or Ω . An event A may be defined as a non-empty subset of S . This is shown in Figure 16.1



Showing an event A and the sample space S

As for example, if a dice is rolled once then the sample space is given by $S = \{1, 2, 3, 4, 5, 6\}$.

Next, if we define the events A , B and C such that

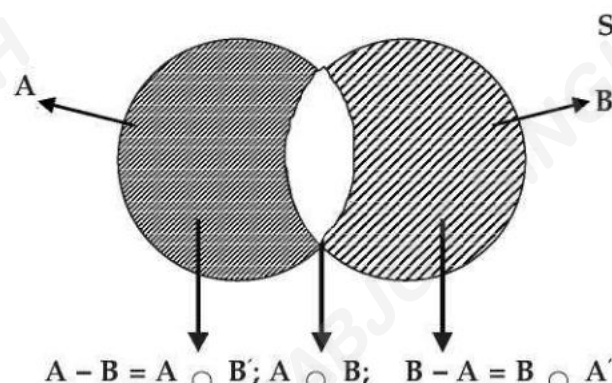
$A = \{x: x \text{ is an even no. of points in } S\}$

$B = \{x: x \text{ is an odd no. of points in } S\}$

$C = \{x: x \text{ is a multiple of 3 points in } S\}$

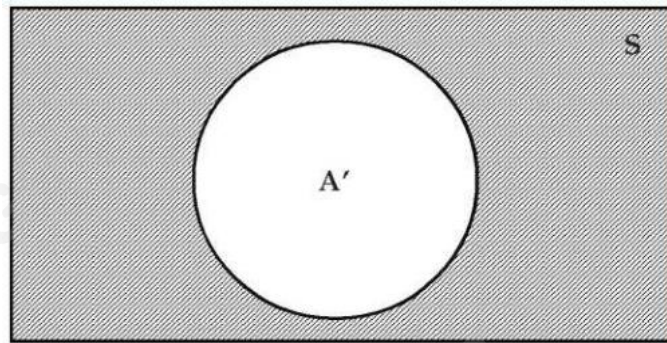
Then, it is quite obvious that

$A = \{2, 4, 6\}$, $B = \{1, 3, 5\}$ and $C = \{3, 6\}$.



Showing $(A - B)$ and $(B - A)$

Figure depicts A'



AXIOMATIC OR MODERN DEFINITION OF PROBABILITY

Let us consider a sample space S in connection with a random experiment and let A be an event defined on the sample space S i.e. $A \subseteq S$. Then a real valued function P defined on S is known as a probability measure and $P(A)$ is defined as the probability of A if P satisfies the following axioms:

(i) $P(A) > 0$ for every $A \subseteq S$ (subset) (16.15)

(ii) $P(S) = 1$
(16.16)

(iii) For any sequence of mutually exclusive events $A_1, A_2, A_3, \dots$

$$P(A_1 \cup A_2 \cup A_3 \cup \dots) = P(A_1) + P(A_2) + P(A_3) + \dots \quad (16.17)$$

ADDITION THEOREMS OR THEOREMS ON TOTAL PROBABILITY

Theorem 1 For any two mutually exclusive events A and B , the probability that either A or B occurs is given by the sum of individual probabilities of A and B .

$$\text{i.e. } P(A \cup B)$$

$$\text{or } P(A + B) = P(A) + P(B)$$

$$\text{or } P(A \text{ or } B) \quad \text{whenever } A \text{ and } B \text{ are mutually exclusive}$$

This is illustrated in the following example.

Example 16.9: A number is selected from the first 25 natural numbers. What is the probability that it would be divisible by 4 or 7?

Example 16.10: A coin is tossed thrice. What is the probability of getting 2 or more heads?

Solution: If a coin is tossed three times, then we have the following sample space.

Example 16.11: A number is selected at random from the first 1000 natural numbers. What is the probability that it would be a multiple of 5 or 9?

Example 16.12: The probability that an Accountant's job applicant has a B. Com. Degree is 0.85, that he is a CA is 0.30 and that he is both B. Com. and CA is 0.25 out of 500 applicants, how many would be B. Com. or CA?

Solution: Let the event that the applicant is a B. Com. be denoted by B and that he is a CA be

Example 16.13: If $P(A-B) = 1/5$, $P(A) = 1/3$ and $P(B) = 1/2$, what is the probability that out of the two events A and B , only B would occur?

Theorem 4 For any three events A , B and C , the probability that at least one of the events

occurs is given by

$$P(A \cup B \cup C) = P(a) + P(B) + P(c) - P(A \cap B) - P(A \cap C) - P(B \cap C) + P(A \cap B \cap C)$$

Following is an application of this theorem.

Example 16.14: There are three persons A, B and C having different ages. The probability that A survives another 5 years is 0.80, B survives another 5 years is 0.60 and C survives another 5 years is 0.50. The probabilities that A and B survive another 5 years is 0.46, B and C survive another 5 years is 0.32 and A and C survive another 5 years 0.48. The probability that all these three persons survive another 5 years is 0.26. Find the probability that at least one of them survives another 5 years.

CONDITIONAL PROBABILITY AND COMPOUND THEOREM OF PROBABILITY

Compound Probability or Joint Probability

The probability of an event, discussed so far, is technically known as unconditional or marginal probability. However, there are situations that demand the probability of occurrence of more than one event. The probability of occurrence of two events A and B simultaneously is known as the Compound Probability or Joint Probability of the events A and B and is denoted by $P(A \cap B)$. In a similar manner, the probability of simultaneous occurrence of K events $A_1, A_2, \dots, A_k$, is denoted by $P(A_1 \cap A_2 \cap \dots \cap A_k)$.

Theorem 5 For any two events A and B, the probability that A and B occur simultaneously is given by the product of the unconditional probability of A and the conditional probability of B given that A has already occurred

$$\text{i.e. } P(A \cap B) = P(a) \times P(B/A) \text{ Provided } P(a) > 0 \dots\dots\dots(16.31)$$

Theorem 6 For any three events A, B and C, the probability that they occur jointly is given by

$$P(A \cap B \cap C) = P(a) \times P(B/A) \times P(C/(A \cap B)) \text{ Provided } P(A \cap B) > 0 \dots (16.32)$$

In the event of independence of the events

(16.31) and (16.32) are reduced to

$$P(A \cap B) = P(a) \times P(B)$$

$$\text{and } P(A \cap B \cap C) = P(a) \times P(B) \times P(c)$$

which we have already discussed.

Example 16.15: Rupesh is known to hit a target in 5 out of 9 shots whereas David is known to hit the same target in 6 out of 11 shots. What is the probability that the target would be hit once they both try?

Example 16.16: A pair of dice is thrown together and the sum of points of the two dice is noted to be 10. What is the probability that one of the two dice has shown the point 4?

Example 16.17: In a group of 20 males and 15 females, 12 males and 8 females are service holders. What is the probability that a person selected at random from the group is a service holder given that the selected person is a male?

$$= 0.60$$

EXERCISE

Set A

Write down the correct answers. Each question carries 1 mark.

- Initially, probability was a branch of

- (a) Physics (b) Statistics
(c) Mathematics (d) Economics.
2. Two broad divisions of probability are
(a) Subjective probability and objective probability
(b) Deductive probability and non-deductive probability
(c) Statistical probability and Mathematical probability
(d) None of these.
3. Subjective probability may be used in
(a) Mathematics (b) Statistics
(c) Management (d) Accountancy.
4. An experiment is known to be random if the results of the experiment
(a) Can not be predicted (b) Can be predicted
(c) Can be split into further experiments (d) Can be selected at random.
5. An event that can be split into further events is known as
(a) Complex event (b) Mixed event
(c) Simple event (d) Composite event.
6. Which of the following pairs of events are mutually exclusive?
(a) A : The student reads in a school. B : He studies Philosophy.
(b) A : Raju was born in India. B : He is a fine Engineer.
(c) A : Ruma is 16 years old. B : She is a good singer.
(d) A : Peter is under 15 years of age. B : Peter is a voter of Kolkata.
7. If $P(A) = P(B)$, then
(a) A and B are the same events (b) A and B must be same events
(c) A and B may be different events (d) A and B are mutually exclusive events.
8. If $P(A \cap B) = 0$, then the two events A and B are
(a) Mutually exclusive (b) Exhaustive
(c) Equally likely (d) Independent.
9. If for two events A and B, $P(A \cup B) = 1$, then A and B are
(a) Mutually exclusive events (b) Equally likely events
(c) Exhaustive events (d) Dependent events.
10. If an unbiased coin is tossed once, then the two events Head and Tail are
(a) Mutually exclusive (b) Exhaustive
(c) Equally likely (d) All these (a), (b) and (c).
11. If $P(A) = P(B)$, then the two events A and B are
(a) Independent (b) Dependent
(c) Equally likely (d) Both (a) and (c).
12. If for two events A and B, $P(A \cap B) \neq P(A) \times P(B)$, then the two events A and B are
(a) Independent (b) Dependent

- (c) Not equally likely (d) Not exhaustive.
12. If $P(A/B) = P(A)$, then
 (a) A is independent of B (b) B is independent of A
 (c) B is dependent of A (d) Both (a) and (b).
14. If two events A and B are independent, then
 (a) A and the complement of B are independent
 (b) B and the complement of A are independent
 (c) Complements of A and B are independent
 (d) All of these (a), (b) and (c).
15. If two events A and B are independent, then
 (a) They can be mutually exclusive (b) They can not be mutually exclusive
 (c) They can not be exhaustive (d) Both (b) and (c).
16. If two events A and B are mutually exclusive, then
 (a) They are always independent (b) They may be independent
 (c) They can not be independent (d) They can not be equally likely.
17. If a coin is tossed twice, then the events 'occurrence of one head', 'occurrence of 2 heads' and 'occurrence of no head' are
 (a) Independent (b) Equally likely
 (c) Not equally likely (d) Both (a) and (b).
18. The probability of an event can assume any value between
 (a) -1 and 1 (b) 0 and 1
 (c) -1 and 0 (d) none of these.
19. If $P(A) = 0$, then the event A
 (a) will never happen (b) will always happen
 (c) may happen (d) may not happen.
20. If $P(A) = 1$, then the event A is known as
 (a) symmetric event (b) dependent event
 (c) improbable event (d) sure event.
21. If $p : q$ are the odds in favour of an event, then the probability of that event is
 (a) $\frac{p}{p+q}$ (b) $\frac{q}{p+q}$
 (c) $\frac{q}{p+q}$ (d) none of these.
22. If $P(A) = 5/9$, then the odds against the event A is
 (a) 5 : 9 (b) 5 : 4
 (c) 4 : 5 (d) 5 : 14
23. If A, B and C are mutually exclusive and exhaustive events, then $P(A) + P(B) + P(C)$ equals to
 (a) $\frac{1}{3}$ (b) 1
 (c) 0 (d) any value between 0 and 1.
24. If A denotes that a student reads in a school and B denotes that he plays cricket, then

- (a) $P(A \cap B) = 1$ (b) $P(A \cup B) = 1$
 (c) $P(A \cap B) = 0$ (d) $P(A) = P(B)$.
25. $P(B/A)$ is defined only when
 (a) A is a sure event (b) B is a sure event
 (c) A is not an impossible event (d) B is an impossible event.
26. $P(A/B')$ is defined only when
 (a) B is not a sure event (b) B is a sure event
 (c) B is an impossible event (d) B is not an impossible event.
27. For two events A and B, $P(A \cup B) = P(A) + P(B)$ only when
 (a) A and B are equally likely events (b) A and B are exhaustive events
 (c) A and B are mutually independent (d) A and B are mutually exclusive.
28. Addition Theorem of Probability states that for any two events A and B,
 (a) $P(A \cup B) = P(A) + P(B)$ (b) $P(A \cup B) = P(A) + P(B) - P(A \cap B)$
 (c) $P(A \cup B) = P(A) + P(B) - P(A \cap B)$ (d) $P(A \cup B) = P(A) \times P(B)$
29. For any two events A and B,
 (a) $P(A) + P(B) > P(A \cap B)$ (b) $P(A) + P(B) < P(A \cap B)$
 (c) $P(A) + P(B) > P(A \cap B)$ (d) $P(A) \times P(B) < P(A \cap B)$
30. For any two events A and B,
 (a) $P(A-B) = P(A) - P(B)$ (b) $P(A-B) = P(A) - P(A \cap B)$
 (c) $P(A-B) = P(B) - P(A \cap B)$ (d) $P(B-A) = P(B) + P(A \cap B)$
31. The limitations of the classical definition of probability
 (a) it is applicable when the total number of elementary events is finite
 (b) it is applicable if the elementary events are equally likely
 (c) it is applicable if the elementary events are mutually independent
 (d) (a) and (b).
32. According to the statistical definition of probability, the probability of an event A is the
 (a) limiting value of the ratio of the no. of times the event A occurs to the number of times the experiment is repeated
 (b) the ratio of the frequency of the occurrences of A to the total frequency
 (c) the ratio of the frequency of the occurrences of A to the non-occurrence of A
 (d) the ratio of the favourable elementary events to A to the total number of elementary events.
33. The Theorem of Compound Probability states that for any two events A and B.
 (a) $P(A \cap B) = P(A) \times P(B/A)$ (b) $P(A \cup B) = P(A) \times P(B/A)$

- (c) $P(A \cap B) = P(A) \times P(B)$ (d) $P(A \cup B) = P(A) + P(B) - P(A \cap B)$.
34. If A and B are mutually exclusive events, then
 (a) $P(A \cap B) = 0$ (b) $P(A \cup B) = P(A) + P(B)$
 (c) $P(A \cap B) = P(A) \times P(B)$ (d) $P(A \cup B) = P(A) \times P(B)$.
35. If $P(A-B) = P(B-A)$, then the two events A and B satisfy the condition
 (a) $P(A) = P(B)$ (b) $P(A) + P(B) = 1$
 (c) $P(A \cap B) = 0$ (d) $P(A \cup B) = 1$
36. The number of conditions to be satisfied by three events A, B and C for complete independence is
 (a) 2 (b) 3
 (c) 4 (d) any number.
37. If two events A and B are independent, then $P(A \cap B)$
 (a) equals to $P(A) + P(B)$ (b) equals to $P(A) \times P(B)$
 (c) equals to $P(A) \times P(B/A)$ (d) equals to $P(B) \times P(A/B)$.
38. Values of a random variable are
 (a) always positive numbers. (b) always positive real numbers.
 (c) real numbers. (d) natural numbers.
39. Expected value of a random variable
 (a) is always positive (b) may be positive or negative
 (c) may be positive or negative or zero (d) can never be zero.
40. If all the values taken by a random variable are equal then
 (a) its expected value is zero (b) its standard deviation is zero
 (c) its standard deviation is positive (d) its standard deviation is a real number.
41. If x and y are independent, then
 (a) $E(xy) = E(x) \times E(y)$ (b) $E(xy) = E(x) + E(y)$
 (c) $E(x - y) = E(x) + E(y)$ (d) $E(x - y) = E(x) + x E(y)$
42. If a random variable x assumes the values x_1, x_2, x_3, x_4 with corresponding probabilities p_1, p_2, p_3, p_4 then the expected value of x is
 (a) $p_1 + p_2 + p_3 + p_4$ (b) $x_1 p_1 + x_2 p_2 + x_3 p_3 + x_4 p_4$
 (c) $p_1 x_1 + p_2 x_2 + p_3 x_3 + p_4 x_4$ (d) none of these.
43. $f(x)$, the probability mass function of a random variable x satisfies
 (a) $f(x) > 0$ (b) $\sum_x f(x) = 1$
 (c) both (a) and (b) (d) $f(x) > 0$ and $\sum_x f(x) = 1$
44. Variance of a random variable x is given by
 (a) $E(x - \bar{x})^2$ (b) $E[x - E(x)]^2$
 (c) $E(x^2 - \bar{x}^2)$ (d) (a) or (b)
45. If two random variables x and y are related by $y = 2 - 3x$, then the SD of y is given by
 (a) $-3 \times \text{SD of } x$ (b) $3 \times \text{SD of } x$.
 (c) $9 \times \text{SD of } x$ (d) $2 \times \text{SD of } x$.

46. Probability of getting a head when two unbiased coins are tossed simultaneously is
(a) 0.25 (b) 0.50
(c) 0.20 (d) 0.75
47. If an unbiased coin is tossed twice, the probability of obtaining at least one tail is
(a) 0.25 (b) 0.50
(c) 0.75 (d) 1.00
48. If an unbiased die is rolled once, the odds in favour of getting a point which is a multiple of 3 is
(a) 1 : 2 (b) 2 : 1
(c) 1:3 (d) 3:1
49. A bag contains 15 one rupee coins, 25 two rupee coins and 10 five rupee coins. If a coin is selected at random from the bag, then the probability of not selecting a one rupee coin is
(a) 0.30 (b) 0.70
(c) 0.25 (d) 0.20
50. A, B, C are three mutually independent with probabilities 0.3, 0.2 and 0.4 respectively. What is $P(A \cap B \cap C)$?
(a) 0.400 (b) 0.240
(c) 0.024 (d) 0.500
51. If two letters are taken at random from the word HOME, what is the Probability that none of the letters would be vowels?
(a) 1 / 6 (b) 1 / 2
(c) 1/3 (d) 1/4
52. If a card is drawn at random from a pack of 52 cards, what is the chance of getting a Spade or an ace?
(a) 4/13 (b) 5/13
(c) 0.25 (d) 0.20
53. If x and y are random variables having expected values as 4.5 and 2.5 respectively, then the expected value of $(x - y)$ is
(a) 2 (b) 7
(c) 6 (d) 0
54. If variance of a random variable x is 23, then what is the variance of $2x + 10$?
(a) 56 (b) 33
(c) 46 (d) 92
55. What is the probability of having at least one 'six' from 3 throws of a perfect die?
(a) 5/6 (b) $(5/6)^3$
(c) $1 - (1/6)^3$ (d) $1 - (5/6)^3$

Set B

1. Two balls are drawn from a bag containing 5 white and 7 black balls at random. What is the probability that they would be of different colours?
 (a) $35/66$ (b) $30/66$
 (c) $12/66$ (d) None of these
2. What is the chance of throwing at least 7 in a single cast with 2 dice?
 (a) $5/12$ (b) $7/12$
 (c) $1/4$ (d) $17/36$
3. What is the chance of getting at least one defective item if 3 items are drawn randomly from a lot containing 6 items of which 2 are defective item?
 (a) 0.30 (b) 0.20
 (c) 0.80 (d) 0.50
4. If two unbiased dice are rolled together, what is the probability of getting no difference of points?
 (a) $1/2$ (b) $1/3$
 (c) $1/5$ (d) $1/6$
5. If A, B and C are mutually exclusive independent and exhaustive events then what is the probability that they occur simultaneously?
 (a) 1 (b) 0.50
 (c) 0 (d) any value between 0 and 1
6. There are 10 balls numbered from 1 to 10 in a box. If one of them is selected at random, what is the probability that the number printed on the ball would be an odd number greater than 4?
 (a) 0.50 (b) 0.40
 (c) 0.60 (d) 0.30
7. Following are the wages of 8 workers in rupees:
 50, 62, 40, 70, 45, 56, 32, 45
 If one of the workers is selected at random, what is the probability that his wage would be lower than the average wage?
 (a) 0.625 (b) 0.500
 (c) 0.375 (d) 0.450
8. A, B and C are three mutually exclusive and exhaustive events such that $P(A) = 2$, $P(B) = 3P(C)$. What is $P(B)$?
 (a) $6/11$ (b) $3/11$
 (c) $1/6$ (d) $1/3$
9. For two events A and B, $P(B) = 0.3$, $P(A \text{ but not } B) = 0.4$ and $P(\text{not } A) = 0.6$. The events A and B are
 (a) exhaustive (b) independent
 (c) equally likely (d) mutually exclusive
10. A bag contains 12 balls which are numbered from 1 to 12. If a ball is selected at random, what is the probability that the number of the ball will be a multiple of 5 or 6?

- (a) 0.30 (b) 0.25
(c) 0.20 (d) $1/3$
11. Given that for two events A and B, $P(A) = 3/5$, $P(B) = 2/3$ and $P(A \cup B) = 3/4$, what is $P(A/B)$?
(a) 0.655 (b) $13/60$
(c) $31/60$ (d) 0.775
12. For two independent events A and B, what is $P(A + B)$, given $P(A) = 3/5$ and $P(B) = 2/3$?
(a) $11/15$ (b) $13/15$
(c) $7/15$ (d) 0.65
12. If $P(A) = p$ and $P(B) = q$, then
(a) $P(A/B) < p/q$ (b) $P(A/B) < p/q$
(c) $P(A/B) < q/p$ (d) None of these
14. If $P(\bar{A} \cup \bar{B}) = 5/6$, $P(A) = 1/2$ and $P(\bar{B}) = 2/3$, what is $P(A \cup B)$?
(a) $1/3$ (b) $5/6$
(c) $2/3$ (d) $4/9$
15. If for two independent events A and B, $P(A \cup B) = 2/3$ and $P(A) = 2/5$, what is $P(B)$?
(a) $4/15$ (b) $4/9$
(c) $5/9$ (d) $7/15$
16. If $P(A) = 2/3$, $P(B) = 3/4$, $P(A/B) = 2/3$, then what is $P(B/A)$?
(a) $1/3$ (b) $2/3$
(c) $3/4$ (d) $1/2$
17. If $P(A) = a$, $P(B) = b$ and $P(A \cap B) = c$ then the expression of $P(A' \cap B')$ in terms of a, b and c is
(a) $1 - a - b - c$ (b) $a + b - c$
(c) $1 + a - b - c$ (d) $1 - a - b + c$
18. For three events A, B and C, the probability that only A occur is
(a) $P(A)$ (b) $P(A \cup B \cup C)$
(c) $P(A' \cap B \cap C)$ (d) $P(A \cap B' \cap C')$
19. It is given that a family of 2 children has a girl, what is the probability that the other child is also a girl?
(a) 0.50 (b) 0.75
(c) $1/3$ (d) $2/3$
20. Two coins are tossed simultaneously. What is the probability that the second coin would show a tail given that the first coin has shown a head?
(a) 0.50 (b) 0.25
(c) 0.75 (d) 0.125
21. If a random variable x assumes the values 0, 1 and 2 with probabilities 0.30, 0.50 and 0.20, then its expected value is

- (a) 1.50 (b) 3
(c) 0.90 (d) 1
22. If two random variables x and y are related as $y = -3x + 4$ and standard deviation of x is 2, then the standard deviation of y is
(a) -6 (b) 6
(c) 18 (d) 3.50
23. If $2x + 3y + 4 = 0$ and $v(x) = 6$ then $v(y)$ is
(a) $8/3$ (b) 9
(c) -9 (d) 6

Set C

- What is the probability that a leap year selected at random would contain 53 Saturdays?
(a) $1/7$ (b) $2/7$
(c) $1/12$ (d) $1/4$
- If an unbiased coin is tossed three times, what is the probability of getting more than one head?
(a) $1/8$ (b) $3/8$
(c) $1/2$ (d) $1/3$
- If two unbiased dice are rolled, what is the probability of getting points neither 6 nor 9?
(a) 0.25 (b) 0.50
- What is the probability that 4 children selected at random would have different birthdays?
(a) $\frac{364 \times 363 \times 362}{(365)^3}$ (b) $\frac{6 \times 5 \times 4}{7^3}$
(c) $1/365$ (d) $(1/7)^3$
- A box contains 5 white and 7 black balls. Two successive draws of 3 balls are made (i) with replacement (ii) without replacement. The probability that the first draw would produce white balls and the second draw would produce black balls are respectively
(a) $6/321$ and $3/926$ (b) $1/20$ and $1/30$
(c) $35/144$ and $35/108$ (d) $7/968$ and $5/264$
- There are three boxes with the following composition:
Box I: 5 Red + 7 White + 6 Blue balls
Box II: 4 Red + 8 White + 6 Blue balls
Box III: 3 Red + 4 White + 2 Blue balls
If one ball is drawn at random, then what is the probability that they would be of same colour?
(a) $89/729$ (b) $97/729$
(c) $82/729$ (d) $23/32$
- A number is selected at random from the first 1000 natural numbers. What is the

probability that the number so selected would be a multiple of 7 or 11?

(a) 0.25 (b) 0.32

(c) 0.22 (d) 0.33

8. A bag contains 8 red and 5 white balls. Two successive draws of 3 balls are made without replacement. The probability that the first draw will produce 3 white balls and the second 3 red balls is
- (a) $\frac{5}{223}$ (b) $\frac{6}{257}$
- (c) $\frac{7}{429}$ (d) $\frac{3}{548}$
9. There are two boxes containing 5 white and 6 blue balls and 3 white and 7 blue balls respectively. If one of the the boxes is selected at random and a ball is drawn from it, then the probability that the ball is blue is
- (a) $\frac{115}{227}$ (b) $\frac{83}{250}$
- (c) $\frac{137}{220}$ (d) $\frac{127}{250}$
10. A problem in probability was given to three CA students A, B and C whose chances of solving it are $\frac{1}{3}$, $\frac{1}{5}$ and $\frac{1}{2}$ respectively. What is the probability that the problem would be solved?
- (a) $\frac{4}{15}$ (b) $\frac{7}{8}$
- (c) $\frac{8}{15}$ (d) $\frac{11}{15}$
11. There are three persons aged 60, 65 and 70 years old. The survival probabilities for these three persons for another 5 years are 0.7, 0.4 and 0.2 respectively. What is the probability that at least two of them would survive another five years?
- (a) 0.425 (b) 0.456
- (c) 0.392 (d) 0.388
12. Tom speaks truth in 30 percent cases and Dick speaks truth in 25 percent cases. What is the probability that they would contradict each other?
- (a) 0.325 (b) 0.400
- (c) 0.925 (d) 0.075
13. There are two urns. The first urn contains 3 red and 5 white balls whereas the second urn contains 4 red and 6 white balls. A ball is taken at random from the first urn and is transferred to the second urn. Now another ball is selected at random from the second urn. The probability that the second ball would be red is
- (a) $\frac{7}{20}$ (b) $\frac{35}{88}$
- (c) $\frac{17}{52}$ (d) $\frac{3}{20}$
14. For a group of students, 30 %, 40% and 50% failed in Physics , Chemistry and at least one of the two subjects respectively. If an examinee is selected at random, what is the probability that he passed in Physics if it is known that he failed in Chemistry?
- (a) $\frac{1}{2}$ (b) $\frac{1}{3}$
- (c) $\frac{1}{4}$ (d) $\frac{1}{6}$
15. A packet of 10 electronic components is known to include 2 defectives. If a sample of 4 components is selected at random from the packet, what is the probability that the sample does not contain more than 1 defective?
- (a) $\frac{1}{3}$ (b) $\frac{2}{3}$
- (c) $\frac{13}{15}$ (d) $\frac{3}{15}$

16. 8 identical balls are placed at random in three bags. What is the probability that the first bag will contain 3 balls?
- (a) 0.2731 (b) 0.3256
(c) 0.1924 (d) 0.3443

17. X and Y stand in a line with 6 other people. What is the probability that there are 3 persons between them?
- (a) $\frac{1}{5}$ (b) $\frac{1}{6}$
(c) $\frac{1}{7}$ (d) $\frac{1}{3}$

18. Given that $P(A) = \frac{1}{2}$, $P(B) = \frac{1}{3}$, $P(A \cap B) = \frac{1}{4}$, what is $P(A|B)$?
- (a) $\frac{1}{2}$ (b) $\frac{7}{8}$
(c) $\frac{5}{8}$ (d) $\frac{2}{3}$

19. Four digits 1, 2, 4 and 6 are selected at random to form a four digit number. What is the probability that the number so formed, would be divisible by 4?
- (a) $\frac{1}{2}$ (b) $\frac{1}{5}$
(c) $\frac{1}{4}$ (d) $\frac{1}{3}$

20. The probability distribution of a random variable x is given below:

x :	1	2	4	5	6
P :	0.15	0.25	0.20	0.30	0.10

What is the standard deviation of x?

- (a) 1.49 (b) 1.56
(c) 1.69 (d) 1.72
21. A packet of 10 electronic components is known to include 3 defectives. If 4 components are selected from the packet at random, what is the expected value of the number of defective?
- (a) 1.20 (b) 1.21
(c) 1.69 (d) 1.72
22. The probability that there is at least one error in an account statement prepared by 3 persons A, B and C are 0.2, 0.3 and 0.1 respectively. If A, B and C prepare 60, 70 and 90 such statements, then the expected number of correct statements
- (a) 170 (b) 176
(c) 178 (d) 180
23. A bag contains 6 white and 4 red balls. If a person draws 2 balls and receives Rs. 10 and Rs. 20 for a white and red balls respectively, then his expected amount is
- (a) Rs. 25 (b) Rs. 26
(c) Rs. 29 (d) Rs. 28
24. The probability distribution of a random variable is as follows:

x :	1	2	4	6	8

P : k 2 k 3k 3k k

The variance of x is

(a) 2.1 (b) 4.41

(c) 2.32 (d) 2.47

ANSWERS

Set A

1. (c) 2. (a) 3. (c) 4. (d) 5. (d) 6. (d)
7. (c) 8. (a) 9. (c) 10. (d) 11. (c) 12. (b)
12. (d) 14. (d) 15. (b) 16. (c) 17. (c) 18. (b)
19. (a) 20. (d) 21. (b) 22. (c) 23. (b) 24. (c)
25. (c) 26. (a) 27. (d) 28. (c) 29. (c) 30. (b)
31. (d) 32. (a) 33. (a) 34. (a) 35. (a) 36. (c)
37. (b) 38. (c) 39. (c) 40. (b) 41. (a) 42. (c)
43. (d) 44. (d) 45. (b) 46. (b) 47. (c) 48. (a)
49. (b) 50. (c) 51. (a) 52. (a) 53. (a) 54. (d)
55. (d)

Set B

1. (a) 2. (b) 3. (c) 4. (d) 5. (c) 6. (d)
7. (b) 8. (b) 9. (d) 10. (d) 11. (d) 12. (b)
12. (a) 14. (c) 15. (b) 16. (c) 17. (d) 18. (d)
19. (c) 20. (a) 21. (c) 22. (b) 23. (a)

Set C

1. (b) 2. (c) 3. (c) 4. (a) 5. (d) 6. (a)
7. (c) 8. (c) 9. (c) 10. (d) 11. (d) 12. (b)
12. (b) 14. (a) 15. (c) 16. (a) 17. (c) 18. (c)
19. (d) 20. (c) 21. (a) 22. (c) 23. (d) 24. (b)

2014 - DECEMBER

1. An unbiased die is thrown twice. The probability of the sum of numbers obtained on the two faces being divisible by 4 is:

(a) $\frac{7}{36}$ (b) $\frac{1}{3}$ (c) $\frac{11}{36}$ (d) $\frac{1}{4}$

2. Let the distribution function of a random variable X be $F(X) = P(X \leq X)$.

Then $F(5) - F(2)$ is:

- (a) $P(2 < X < 5)$ (b) $P(2 \leq X < 5)$
(c) $P(2 \leq X \leq 5)$ **(d) $P(2 < X \leq 5)$**

3. A discrete random variable X takes three values -1, 2 and 3 with probabilities

$P(-1) = \frac{1}{3}$, $P(2) = \frac{1}{3}$, $P(3) = \frac{1}{3}$, then $E(|X|)$ is:

- (a) $3/2$ (b) $5/2$ **(c) 2** (d) $9/2$

2015 - JUNE

4. The sum of numbers obtained in throw of a dice twice is S . Probability of S will be maximum if S is

- (a) 5 **(b) 7** (c) 6 (d) 8

5. An unbiased coin is tossed three times. The expected value of the number of heads is

- (a) 2.5 (b) 1.0 **(c) 1.5** (d) 2.0

6. For two events A_1 and A_2 , let $P(A_1) = \frac{2}{3}$ and $P(A_2) = \frac{3}{8}$ and $P(A_1 \cap A_2) = \frac{1}{4}$, then

- (a) mutually exclusive but not independent (b) mutually exclusive and independent
(c) independent but not mutually exclusive (d) none of these

7. From 6 positive and 8 negative numbers, 4 numbers are chosen at random without replacement and are then multiplied. The probability that the product of the chosen numbers will be positive number is

- (a) $\frac{409}{1001}$ (b) $\frac{70}{1001}$ **(c) $\frac{505}{1001}$** (d) $\frac{420}{1001}$

2015 - DECEMBER

8. If an unbiased die is rolled once, the odds in favour of getting a point which is multiple of 3 is:

- (a) 1:2** (b) 2:1 (c) 1:3 (d) 3:1

9. A bag contains 15 one rupee coins, 25 two rupees coins and 10 five rupees coins, if a coin is selected at random then probability for not - selecting a one rupee coin is:

- (a) 0.30 (b) 0.20 (c) 0.25 **(d) 0.70**

10. Three coins are tossed together, the probability of getting exactly two head is:

- (a) $\frac{5}{8}$ **(b) $\frac{3}{8}$** (c) $\frac{1}{8}$ (d) None

11. If two letters are taken at random from the word "HOME", what is the probability that none of the letters would be vowels?

- (a) $\frac{1}{6}$ (b) $\frac{1}{2}$ (c) $\frac{1}{3}$ (d) $\frac{1}{4}$

2016 JUNE

12. In a game, cards are thoroughly shuffled and distributed equally among four players. What is the probability that a specific player gets all the four kings?

- (a) $\frac{{}^{13}C_4 + {}^{48}C_{13}}{{}^{52}C_{13}}$ (b) $\frac{{}^4C_4 + {}^{48}C_9}{{}^{52}C_{13}}$
(c) $\frac{{}^{13}C_4 + {}^{52}C_4}{{}^{52}C_{13}}$ (d) $\frac{{}^4C_4 + {}^{39}C_9}{{}^{52}C_{13}}$

13. A bag contains 4 Red and 5 Black balls. Another bag contains 5 Red and 3 Black balls. If one ball is drawn at random from each bag. Then the probability that one Red and one Black drawn is -

- (a) $\frac{12}{72}$ (b) $\frac{25}{72}$ (c) $\frac{37}{72}$ (d) $\frac{13}{72}$

14. If $P(A) = \frac{2}{3}$, $P(B) = \frac{3}{5}$ and $P(A \cup B) = \frac{5}{8}$ then $P\left(\frac{A}{B^c}\right)$ is

- (a) $\frac{7}{12}$ (b) $\frac{5}{12}$ (c) $\frac{1}{4}$ (d) $\frac{1}{2}$

15. If two unbiased dice are rolled, what is the probability of getting points neither 3 nor 6?

- (a) 0.25 (b) 0.50 (c) 0.75 (d) 0.80

16. Two dice are tossed. What is the probability that the total is divisible by 3 or 4.

- (a) $\frac{20}{36}$ (b) $\frac{21}{36}$ (c) $\frac{14}{35}$ (d) None of these. (1 mark)

2016 - DECEMBER

17. If two events A, B, $P(A) = \frac{1}{2}$, $P(B) = \frac{1}{3}$ and $P(A \cup B) = \frac{2}{3}$ then $P(A \cap B)$ is:

- (a) $\frac{1}{4}$ (b) $\frac{1}{6}$ (c) $\frac{2}{3}$ (d) $\frac{1}{2}$

18. A bag contains 6 white and 5 red balls. One ball is drawn. The probability that it is red is:

- (a) $\frac{5}{11}$ (b) $\frac{6}{11}$ (c) $\frac{1}{11}$ (d) None of these

19. For two events A, B let $P(A) = \frac{2}{3}$, $P(B) = \frac{3}{4}$ and $P(A \cap B) = \frac{1}{4}$ then A and B are:

- (a) Mutually exclusive but not independent
(b) Independent but not mutually exclusive
(c) Mutually exclusive and independent

(d) None of these

2017-JUNE

20. Let A and B are two events with $P(A) = \frac{2}{3}$, $P(B) = \frac{1}{4}$ and $P(A \cap B) = \frac{1}{12}$, then $P(B/A)$ will be :

- (a) $7/8$ (b) $1/3$ (c) $1/8$ (d) $8/7$

21. What is the probability of having at least one 'SIX' from 3 throws of an unbiased die?

- (a) $\frac{5}{6}$ (b) $\left(\frac{5}{6}\right)^3$ (c) $1 - \left(\frac{1}{6}\right)^3$ (d) $1 - \left(\frac{5}{6}\right)^3$

22. For any two events A and B:

- (a) $P(A - B) = P(A) - P(B)$ (b) $P(A - B) = P(A) - P(A \cap B)$
(c) $P(A - B) = P(B) - P(A \cap B)$ (d) $P(B - A) = P(B) + P(A \cap B)$

Answer:

(b) If A & B two events $P(A - B) = P(A \cap B)$
 $= P(A) - P(A \cap B)$

2017 - DECEMBER

23. If for two mutually exclusive events A and B $P(A \cup B) = \frac{2}{3}$ and $P(A) = \frac{2}{5}$ then what is the value of $P(B)$?

- (a) $\frac{4}{15}$ (b) $\frac{4}{9}$ (c) $\frac{5}{9}$ (d) $\frac{7}{15}$

24. The probability distribution of the demand for a commodity is given below:

Demand (x)	5	6	7	8	9	10
probability [P(x)]	0.05	0.10	0.30	0.40	0.10	0.05

The expected value of demand will be

- (a) **7.55** (b) 7.85 (c) 1.25 (d) 8.35

25. Given $P(A) = \frac{1}{2}$, $P(B) = \frac{1}{3}$ and $P(A \cap B) = \frac{1}{4}$, the value of $P(A/B)$ is

- (a) $1/2$ (b) $1/6$ (c) $2/3$ (d) **$3/4$**

26. A brother and his sister appear in an interview for two vacancies for the same post. The probability of brother's selection is $\frac{1}{7}$ and the probability of sister's selection is $\frac{1}{5}$. The probability that (i) both are selected (ii) only one of them is selected and (iii) none of them is selected will be:

- (a) $\frac{1}{35}, \frac{10}{35}, \frac{24}{35}$ (b) $\frac{24}{35}, \frac{1}{35}, \frac{10}{35}$ (c) $\frac{10}{35}, \frac{1}{35}, \frac{24}{35}$ (d) $\frac{24}{35}, \frac{10}{35}, \frac{1}{35}$

2018 - MAY

27. Two broad divisions of probability are:

(a) Subjective probability and objective probability

(b) Deductive probability and mathematical probability

(c) Statistical probability and mathematical probability

(d) None of these

28. The term "chance" and probability are synonyms:

(a) True (b) False (c) Both (d) None

Answer:

(a) The terms "chance" and probability are synonyms is True.

29. The theorem of compound probability states that for any two events A and B

(a) $P(A \cap B) = P(A) \times P(B/A)$ (b) $P(A \cup B) = P(A) \times P(B/A)$

(c) $P(A \cap B) = P(A) \times P(B)$ (d) $P(A \cup B) = P(A) + P(B) - P(A \cap B)$

30. Variance of a random variable x is given by

(a) $E(X-\mu)^2$ (b) $E[X - E(X)]^2$ (c) $E(X^2 - \mu)$ **(d) (a) or (b)**

31. If two random variables x and y are related by $y=2-3x$, then the SD of y is given by

(a) $-3 \times \text{SD of } x$ **(b) $3 \times \text{SD of } x$**

(c) $9 \times \text{SD of } x$ (d) $2 \times \text{SD of } x$

32. What is the probability of having at least one 'six' in 3 throws of a project die?

(a) $5/6$ (b) $(5/6)^3$ (c) $1-(1/6)^3$ **(d) $1-(5/6)^3$**

33. Sum of all probabilities mutually exclusive and exhaustive events is equal to

(a) 0 (b) $1/2$ (c) $1/4$ **(d) 1**

2018 - NOVEMBER

34. If, $P(A) = \frac{1}{2}$, $P(B) = \frac{1}{3}$, and $P(A \cap B) = \frac{1}{4}$, then $P(A \cup B)$ is equal to

(a) $\frac{11}{12}$ (b) $\frac{10}{12}$ **(c) $\frac{7}{12}$** (d) $\frac{1}{6}$

35. The probability that a leap year has 53 Wednesday is

(a) $\frac{2}{7}$ (b) $\frac{3}{5}$ (c) $\frac{2}{3}$ (d) $\frac{1}{7}$

36. A coin is tossed six times, then the probability of obtaining heads and tails alternatively is

- (a) $\frac{1}{2}$ (b) $\frac{1}{64}$ (c) $\frac{1}{32}$ (d) $\frac{1}{16}$

37. Ram is known to hit a target in 2 out of 3 shots where as Shyam is known to hit the same target in 5 out of 11 shots. What is the probability that the target would be hit if they both try?

- (a) $\frac{9}{11}$ (b) $\frac{3}{11}$ (c) $\frac{10}{33}$ (d) $\frac{6}{11}$

38. Two different dice are thrown simultaneously, then the probability, that the sum of two numbers appearing on the top of dice is 9 is:

- (a) $\frac{8}{9}$ (b) $\frac{1}{9}$ (c) $\frac{7}{9}$ (d) None of the above
(a) 0.3 (b) 0.5 (c) 0.7 (d) 0.9

2019-JUNE

39. If $Y \geq x$ then mathematical expectation is

- (a) $E(X) > E(Y)$ (b) $E(X) \leq E(Y)$
(c) $E(X) = E(Y)$ (d) $E(X) \cdot E(Y) = 1$

40. Two event A and B are such that they do not occurs simultaneously then they are called _____ events

- (a) Mutually exhaustive (b) **Mutually exclusive**
(c) Mutually independent (d) Equally likely

41. According to bayee's theorem,

$$P(E_K/A) = \frac{P(E_K) P(A/E_K)}{\sum_{i=1}^n P(E_i) P(A/E_i)} \text{ here}$$

- (a) **$E_1, E_2, \dots$ are mutually exclusive**
(b) $P(E/A_1), P(E/A_2), \dots$ are equal to 1
(c) $P(A_1/E), P(A_2/E), \dots$ are equal to 1
(d) A & E_1 's are disjoint sets. (1 mark)

42. If a coin is tossed 5 times then the probability of getting Tail and Head occurs alternatively is

- (a) $\frac{1}{8}$ (b) $\frac{1}{16}$ (c) $\frac{1}{32}$ (d) $\frac{1}{64}$

43. When 2 - dice are thrown Simultaneously then the probability of getting at least one 5 is

- (a) $\frac{11}{36}$ (b) $\frac{5}{36}$ (c) $\frac{8}{15}$ (d) $\frac{1}{7}$

2019 - NOVEMBER

44. Two letters are choosen from the word HOME. What is the probability that the letters choosen are not vowels.

- (a) $\frac{1}{2}$ (b) **$\frac{1}{6}$** (c) $\frac{2}{3}$ (d) 0

45. If A, B, C are three mutually exclusive and exhaustive events such that:
 $P(A) = 2P(B) = 3P(C)$ what is $P(B)$?

- (a) $\frac{6}{11}$ (b) **$\frac{3}{11}$** (c) $\frac{1}{6}$ (d) $\frac{1}{3}$

46. What is the probability of getting 7 or 11 when two dices are thrown?

- (a) **$\frac{2}{9}$** (b) $\frac{6}{36}$ (c) $\frac{10}{36}$ (d) $\frac{2}{36}$

47. A bag contains 15 one rupee coins, 25 two rupees coins and 10 five rupee coins if a coin is selected at random then probability for not selecting a one rupee coin is:

- (a) 0.30 (b) 0.20 (c) 0.25 (d) **0.70**

48. What is the probability of occurring 4 or more than 4 accidents.

No. of acc.	1	2	3	4	5	6	7
Frequency	8	17	15	24	27	18	9
(a) 24	(b) 69	(c) 78	(d) 80				

2020 - NOVEMBER

49. When 2 fair dice are thrown what is the probability of getting the sum which is a multiple of 3?

- (a) $\frac{4}{36}$ (b) $\frac{13}{36}$ (c) $\frac{2}{36}$ (d) **$\frac{12}{36}$**

50. When two coins are tossed simultaneously the probability of getting at least one tail?

- (a) 1 (b) **0.75** (c) 0.5 (d) 0.25

51. When 3 dice are rolled simultaneously the probability of a number on the third die is greater than the sum of the numbers on two dice.

- (a) $\frac{12}{216}$ (b) $\frac{36}{216}$ (c) $\frac{48}{216}$ (d) **$\frac{20}{216}$**

52. If A speaks 75% of truth and B speaks 80% of truth. In what percentage both of them likely contradict with each other in narrating the same questions?

- (a) 0.60 (b) **0.45** (c) 0.65 (d) 0.35

2021 - January

53. An event that can be subdivided into further events is called as.

- (a) A composite event (b) A complex event
(c) A mixed event (d) A simple event

54. Three identical and balanced dice are rolled. The probability that the same number will appear on each of them is.

- (a) $\frac{1}{6}$ (b) $\frac{1}{18}$ (c) $\frac{1}{36}$ (d) $\frac{1}{24}$

55. A basket contains 15 white balls, 25 red balls and 10 blue balls. If a ball is selected at random, the probability of selecting not a white ball.

- (a) 0.20 (b) 0.25 (c) 0.60 (d) **0.70**

56. Two dice are thrown simultaneously. The probability of a total score of 5 from the out comes of dice is.

- (a) $\frac{1}{18}$ (b) $\frac{1}{12}$ (c) $\frac{1}{9}$ (d) $\frac{2}{5}$

57. If an unbiased coin is tossed twice, then the probability of obtaining at least one tail is.

- (a) 1 (b) 0.5 (c) **0.75** (d) 0.25

58. If an unbiased coin is tossed three times, what is the probability of getting more than one head ?

- (a) $\frac{1}{2}$ (b) $\frac{3}{8}$ (c) $\frac{7}{8}$ (d) $\frac{1}{3}$

2021 - July

59. If there are 48 marbles marked with numbers 1 to 48, then the probability of selecting a marble having the number divisible by 4 is:

- (a) $1/2$ (b) $2/3$ (c) $1/3$ (d) **$1/4$**

60. A bag contains 7 blue and 5 Green balls. One ball is drawn at random. The probability of getting a blue ball is _____.

- (a) $5/12$ (b) $12/35$ (c) **$7/12$** (d) 0

61. The probability that a football team losing a match at Kolkata is $3/5$ and winning a match at Bengaluru is $6/7$; the probability of the team winning at least one match is _____.

62. If in a class, 60% of the student study. Mathematics and science and 90% of the student study science, then the probability of a student studying mathematics given that he/she is already studying science is:

- (a) $1/4$ (b) **$2/3$** (c) 1 (d) $1/2$

63. A biased coin is such that the probability of getting a head is thrice the probability of getting a tail, if the coin is tossed 4 times, what is the probability of getting a head all the times?

- (a) $2/5$ (b) $81/128$ (c) **$81/256$** (d) $81/64$

64. If there are 16 phones, 10 of them are Android and 6 of them are of Apple, then the probability of 4 randomly selected phones to include 2 Android and 2 Apple phone is:

- (a) 0.47 (b) 0.51 (c) 0.37 (d) 0.27

65. The value of K for the probability density function of a variate X is equal to:

X	0	1	2	3	4	5	6
P(x)	5k	3k	4k	6k	7k	9k	11k

- (a) 39 (b) $\frac{1}{40}$ (c) $\frac{1}{49}$ (d) $\frac{1}{45}$

2021 - DECEMBER

66. For any two dependent events A and B, $P(A) = 5/9$ and $P(B) = 6/11$ and $P(A \cap B) = 10/33$. What are the values of $P(A/B)$ and $P(B/A)$?

- (a) **5/9, 6/11** (b) 5/6, 6/11 (c) 1/9, 2/9 (d) 2/9, 4/9

67. Which of the following pair of events E and F are mutually exclusive?

- (a) **E = {Ram's age is 13} and F = {Ram is studying in a college}**
 (b) E = {Sita studies in a school} and F = {Sita is a play back singer}
 (c) E = {Raju is an elder brother in a family} and F = {Raju's father has more than one son}
 (d) E = {Banu studied B.A. English literature and} F = {Banu can read English novels} (1 mark)

68. Assume that the probability for rain on a day is 0.4. An umbrella salesman can earn Rs. 400 per day in case of rain on that day and will lose Rs. 100 per day if there is no rain. The expected earnings in (in Rs.) per day of the salesman is

- (a) 400 (b) 200 (c) **100** (d) 0

69. The probability distribution of a random variable x is given below:

x:	1	2	4	5	6
P:	0.15	0.25	0.2	0.3	0.1

What is the standard deviation of x?

- (a) 1.49 (b) 1.56 (c) **1.69** (d) 1.72

70. In a group of 20 males and 15 females, 12 males and 8 females are service holders. What is the probability that a person selected at random from the group is a service holder given that the selected person is a male?

- (a) 0.40 (b) **0.60** (c) 0.45 (d) 0.55

71. There are 3 boxes with the following composition:

Box I: 7 Red + 5 White + 4 Blue balls

Box II: 5 Red + 6 White + 3 Blue balls

Box III: 4 Red + 3 White + 2 Blue balls

One of the boxes is selected at random and a ball is drawn from it. What is the probability the drawn ball is red?

- (a) **1249/3024** (b) 1247/3004 (c) 1147/3024 (d) 1/2

72. For a probability distribution, probability is given by, $P(X_i) = \frac{x_i}{k}$, $X_i, = 1, 2, \dots, 9$. The value of k is

- (a) 55 (b) 9 (c) **45** (d) 81

JUNE 2022

73. A dice is rolled Twice . find the probability of getting numbers multiple of 3 or 5 ?

- (a) 1/3 (b) 1/4 (c) **1/2** (d) 1/6

74. What is the probability of occurrence of leap year having 53 Sunday?

- (a) 1/7 (b) **2/7** (c) 3/7 (d) 4/7

75. In a bag of 30 balls numbered from 1 to 30 .two balls are drawn find the probability of getting a ball being multiple of 2 or 5 .

- (a) 108/465 (b) **117/ 435** (c) 117/300 (d) 116/485

76. What is the chance of throwing that one appears at least in one of dice?

- (a) 7/36 (b) **11/36** (c) 9/36 (d) 15/36

77. Given that for two events A and B, $P(A) = 0.3$, $P(B) = 0.8$ and $P(B/A) = 0.5$ find $P(A \cup B)$

- (a) 0.85 (b) **0.95** (c) 0.55 (d) 0.5

78. If p : q are the odds in favour of an event, then the probability of that event is

- (a) $\frac{p}{p+q}$ (b) $\frac{p}{q}$
(c) $\frac{q}{p+q}$ (d) none of these.

DEC 22

79. A machine is made of two parts A and B. The manufacturing process of each part is such that probability of defective in part A is 0.08 and that B is 0.05. What is the probability that the assembled part will not have any defect?

A. 0.934

B. 0.864

C. 0.85

D. 0.874

80. If $P(A) = \frac{1}{3}$, $P(B) = \frac{3}{4}$ and $P(A \cup B) = \frac{11}{12}$ then $P\left(\frac{B}{A}\right)$ is:

A. $\frac{1}{6}$

B. $\frac{4}{9}$

C. $\frac{1}{2}$

D. $\frac{1}{8}$

81. The probability that a leap year has 53 Monday in:

A. $\frac{1}{7}$

B. $\frac{2}{3}$

C. $\frac{2}{7}$

D. $\frac{3}{5}$

82. Suppose A and B are two independent events with probabilities $P(A) \neq 0$ and $P(B) \neq 0$. Let A' and B' be their complements. Which one of the following statements is FALSE?

A. $P(A \cap B) = P(A)P(B)$

B. $P(A / B) = P(A)$

C. $P(A \cup B) = P(A) + P(B)$

D. $P(A' \cap B') = P(A')P(B')$

83. The Theorem of Compound Probability states that for any two events A and B.

A. $P(A \cap B) = P(A) \times P(B/A)$

B. $P(A \cup B) = P(A) \times P(B/A)$

C. $P(A \cap B) = P(A) \times P(B)$

D. $P(A \cup B) = P(A) + P(B) - P(A \cap B)$

84. If three coins are tossed simultaneously, what is the probability of getting two heads together?

A. $\frac{1}{4}$

B. $\frac{1}{8}$

C. $\frac{5}{8}$

D. $\frac{3}{8}$

85. If a number is selected at random from the first 50 natural numbers, what will be the probability that the selected number is a multiple of 3 and 4 ?

A. 5/50

B. 2/25

C. 3/50

D. 4/25

JUNE 2023

86. Four person are choose at random frame a group of 3 men , 2 women and 4 children's. the probability that exactly 2 of them are children's .

A. 10/21

B. 1/12

C. 1/5 D. 1/9

87. If $P(A) = \frac{1}{3}$, $P(B) = \frac{1}{4}$ and $P\left(\frac{A}{B}\right) = \frac{1}{6}$ Then $P\left(\frac{B}{A}\right)$ is:

A. $\frac{1}{8}$

B. $\frac{1}{4}$

C. $\frac{3}{8}$

D. $\frac{1}{2}$

88. For two events A, B let $P(A) = \frac{2}{3}$, $P(B) = \frac{3}{8}$ and $P(A \cap B) = \frac{1}{4}$ then A and B are:

(a) Mutually exclusive but not independent

(b) Independent but not mutually exclusive

(c) Mutually exclusive and independent

(d) None of these

89. The probability that a 4 digits numbers comprising the digit 2, 5, 6 and 7 without refection of digit would be divisible by 4

(a) $\frac{1}{2}$ (b) $\frac{3}{4}$ (c) $\frac{1}{4}$ (d) $\frac{1}{3}$

90. The probability distribution of the demand for a commodity is given below:

(x)	-1	-2	0	1	2
[F(x)]	$\frac{1}{3}$	$\frac{1}{6}$	$\frac{1}{5}$	$\frac{1}{6}$	$\frac{1}{3}$

The expected value of x will be

(a) $\frac{1}{6}$ (b) $\frac{1}{2}$ (c) $\frac{1}{6}$ (d) $\frac{1}{5}$

91. The probability distribution of X

(x)	1	0	Total
Probability	p	1-p	1

The expected value of x will be

(a) p (b) 1-p (c) 0 (d) 1

ADDITIONAL QUESTION BANK

1. All possible outcomes of a random experiment forms the
(a) events (b) sample space (c) both (d) none
2. If one of outcomes cannot be expected to occur in preference to the other in an experiment the events are
(a) simple events (b) compound events
(c) favourable events (d) equally likely events
3. If two events cannot occur simultaneously in the same trial then they are
(a) mutually exclusive events (b) simple events
(c) favourable events (d) none
4. When the number of cases favourable to the event A is none then $P(A)$ is equal to
(a) 1 (b) 0 (c) $\frac{1}{2}$ (d) none
5. A card is drawn from a well-shuffled pack of playing cards. The probability that it is a spade is
(a) $\frac{1}{13}$ (b) $\frac{1}{4}$ (c) $\frac{1}{13}$ (d) none
6. A card is drawn from a well-shuffled pack of playing cards. The probability that it is a king is
(a) $\frac{1}{13}$ (b) $\frac{1}{4}$ (c) $\frac{4}{13}$ (d) none
7. A card is drawn from a well-shuffled pack of playing cards. The probability that it is the ace of clubs is
(a) $\frac{1}{13}$ (b) $\frac{1}{4}$ (c) $\frac{1}{52}$ (d) none
8. In a single throw with two dice the probability of getting a sum of five on the two dice is
(a) $\frac{1}{9}$ (b) $\frac{5}{36}$ (c) $\frac{5}{9}$ (d) none
9. In a single throw with two dice, the probability of getting a sum of six on the two dice is
(a) $\frac{1}{9}$ (b) $\frac{5}{36}$ (c) $\frac{5}{9}$ (d) none
10. The probability that exactly one head appears in a single throw of two fair coins is
(a) $\frac{3}{4}$ (b) $\frac{1}{2}$ (c) $\frac{1}{4}$ (d) none
11. The probability that at least one head appears in a single throw of three fair coins is
(a) $\frac{1}{8}$ (b) $\frac{7}{8}$ (c) $\frac{1}{3}$ (d) none
12. The definition of probability fails when the no of possible outcomes of the experiment is infinite
(a) True (b) false (c) both (d) none

13. The following table gives distribution of wages of 100 workers -

Wages (in Rs.)	120-140	140-160	160-180	180-200	200-220	220-240	240-260
No. of workers	9	20	0	10	8	35	18

- The probability that his wages are under Rs. 140 is
 (a) 20/100 (b) 9/100 (c) 29/100 (d) none
14. An individual is selected at random from the above group. The probability that his wages are under Rs. 160 is
 (a) 9/100 (b) 20/100 (c) 29/100 (d) none
15. For the above table the probability that his wages are above Rs. 200 is
 (a) 43/100 (b) 35/100 (c) 53/100 (d) 61/100
16. For the above table the probability that his wages between Rs. 160 and 220 is
 (a) 30/100 (b) 10/100 (c) 38/100 (d) 18/100
17. The table below shows the history of 1000 men :
- | | | | | |
|-------------------|------|-----|-----|----|
| Life (in years) : | 60 | 70 | 80 | 90 |
| No. survived : | 1000 | 500 | 100 | 60 |
- The probability that a man will survived to age 90 is
 (a) 60/1000 (b) 160/1000 (c) 660/1000 (d) none
18. The terms "chance" and probability are synonymous
 (a) True (b) false (c) both (d) none
19. If probability of drawing a spade from a well-shuffled pack of playing cards is $\frac{1}{4}$ then the probability that of the card drawn from a well-shuffled pack of playing cards is 'not a spade' is
 (a) 1 (b) $\frac{1}{2}$ (c) $\frac{1}{4}$ (d) $\frac{3}{4}$
20. Probability of the sample space is
 (a) 0 (b) $\frac{1}{2}$ (c) 1 (d) none
21. Sum of all probabilities of mutually exclusive and exhaustive events is equal to
 (a) 0 (b) $\frac{1}{2}$ (c) $\frac{3}{4}$ (d) 1
22. Let a sample space be $S = \{X_1, X_2, X_3\}$ which of the following defines probability space on S ?
 (a) $P(X_1) = \frac{1}{2}, P(X_2) = \frac{1}{3}, P(X_3) = \frac{1}{6}$ (b) $P(X_1) = 0, P(X_2) = \frac{1}{3}, P(X_3) = \frac{2}{3}$
 (c) $P(X_1) = \frac{2}{3}, P(X_2) = \frac{1}{3}, P(X_3) = \frac{2}{3}$ (d) none
23. Let P be a probability function on $S = \{X_1, X_2, X_3\}$ if $P(X_1) = \frac{1}{4}$ and $P(X_3) = \frac{1}{3}$ then $P(X_2)$ is equal to
 (a) 5/12 (b) 7/12 (c) 3/4 (d) none
24. The chance of getting a sum of 10 in a single throw with two dice is
 (a) 10/36 (b) 1/12 (c) 5/36 (d) none
25. The chance of getting a sum of 6 in a single throw with two dice is

- (a) $\frac{3}{36}$ (b) $\frac{4}{36}$ (c) $\frac{6}{36}$ (d) $\frac{5}{36}$
26. P (B/A) defines the probability that event B occurs on the assumption that A has happened
(a) Yes (b) no (c) both (d) none
27. The complete group of all possible outcomes of a random experiment given an set of events.
(a) mutually exclusive (b) exhaustive (c) both (d) none
28. When the event is 'certain' the probability of it is
(a) 0 (b) $\frac{1}{2}$ (c) 1 (d) none
29. The classical definition of probability is based on the feasibility at subdividing the possible outcomes of the experiments into
(a) mutually exclusive and exhaustive
(b) mutually exclusive and equally likely
(c) exhaustive and equally likely
(d) mutually exclusive, exhaustive and equally likely cases.
30. Two unbiased coins are tossed. The probability of obtaining 'both heads' is
(a) $\frac{1}{4}$ (b) $\frac{2}{4}$ (c) $\frac{3}{4}$ (d) none
31. Two unbiased coins are tossed. The probability of obtaining one head and one tail is
(a) $\frac{1}{4}$ (b) $\frac{2}{4}$ (c) $\frac{3}{4}$ (d) none
32. Two unbiased coins are tossed. The probability of obtaining both tail is
(a) $\frac{2}{4}$ (b) $\frac{3}{4}$ (c) $\frac{1}{4}$ (d) none
33. Two unbiased coins are tossed. The probability of obtaining at least one head is
(a) $\frac{1}{4}$ (b) $\frac{2}{4}$ (c) $\frac{3}{4}$ (d) none
34. When two unbiased coins are tossed, the probability of obtaining 3 heads is
(a) $\frac{2}{4}$ (b) $\frac{1}{4}$ (c) $\frac{3}{4}$ (d) none
35. When two unbiased coins are tossed, the probability of obtaining not more than 3 heads is
(a) $\frac{3}{4}$ (b) $\frac{1}{2}$ (c) 1 (d) 0
36. When two unbiased coins are tossed, the probability of getting both heads or both tails is
(a) $\frac{1}{2}$ (b) $\frac{3}{4}$ (c) $\frac{1}{4}$ (d) none
37. Two dice with face marked 1, 2, 3, 4, 5, 6 are thrown simultaneously and the points on the dice are multiplied together. The probability that product is 12 is
(a) $\frac{4}{36}$ (b) $\frac{5}{36}$ (c) $\frac{12}{36}$ (d) none
38. A bag contain 6 white and 5 black balls. One ball is drawn. The probability that it is

- white is
- (a) 5/11 (b) 1 (c) 6/11 (d) 1/11
39. Probability of occurrence of at least one of the events A and B is denoted by
(a) $P(AB)$ (b) $P(A + B)$ (c) $P(A/B)$ (d) none
40. Probability of occurrence of A as well as B is denoted by
(a) $P(AB)$ (b) $P(A + B)$ (c) $P(A/B)$ (d) none
41. Which of the following relation is true ?
(a) $P(A) - P(A^c) = 1$ (b) $P(A) + P(A^c) = 1$ (c) $P(A) - P(A^c) = 1$
(d) none
42. If events A and B are mutually exclusive, the probability that either A or B occurs is given by
(a) $P(A + B) = P(A) - P(B)$ (b) $P(A + B) = P(A) + P(B) - P(AB)$
(c) $P(A + B) = P(A) - P(B) + P(AB)$ (d) $P(A + B) = P(A) + P(B)$
43. The probability of occurrence of at least one of the 2 events A and B (which may not be mutually exclusive) is given by
(a) $P(A + B) = P(A) - P(B)$ (b) $P(A + B) = P(A) + P(B) - P(AB)$
(c) $P(A + B) = P(A) - P(B) + P(AB)$ (d) $P(A + B) = P(A) + P(B)$
44. If events A and B are independent, the probability of occurrence of A as well as B is given by
(a) $P(AB) = P(A/B)$ (b) $P(AB) = P(A)P(B)$
(c) $P(AB) = P(A)P(B)$ (d) None
45. For the condition $P(AB) = P(A)P(B)$ two events A and B are said to be
(a) dependent (b) independent (c) equally like (d) none
46. The conditional probability of an event B on the assumption that another event A has actually occurred is given by
(a) $P(B/A) = P(AB)/P(A)$ (b) $P(A/B) = P(AB)/P(B)$
(c) $P(B/A) = P(AB)$ (d) $P(A/B) = P(AB)/P(A)P(B)$
47. Given $P(A) = \frac{1}{2}$, $P(B) = \frac{1}{3}$, $P(AB) = \frac{1}{4}$, the value of $P(A + B)$ is
(a) $\frac{3}{4}$ (b) $\frac{7}{12}$ (c) $\frac{5}{6}$ (d) $\frac{1}{6}$
48. Given $P(A) = \frac{1}{2}$, $P(B) = \frac{1}{3}$, $P(AB) = \frac{1}{4}$, the value of $P(A/B)$ is
(a) $\frac{1}{2}$ (b) $\frac{1}{6}$ (c) $\frac{2}{3}$ (d) $\frac{3}{4}$
49. If $P(A) = \frac{1}{3}$, $P(B) = \frac{1}{4}$, the events A & B are
(a) not equally likely (b) mutually exclusive
(c) equally likely (d) none
50. If events A and B are independent then
(a) A^c and B^c are dependent (b) A^c and B are dependent
(c) A and B^c are dependent (d) A^c and B^c are also independent

51. A card is drawn from each of two well-shuffled packs of cards. The probability that at least one of them is an ace is
 a) $\frac{1}{69}$ b) $\frac{25}{169}$ c) $\frac{2}{13}$ d) none
52. When a die is tossed, the sample space is
 a) $S = (1, 2, 3, 4, 5)$ b) $S = (1, 2, 3, 4)$ c) $S = (1, 2, 3, 4, 5, 6)$ d) none
53. If $P(A) = \frac{1}{4}$, $P(B) = \frac{2}{5}$, $P(A + B) = \frac{1}{2}$ then $P(AB)$ is equal to
 a) $\frac{3}{4}$ b) $\frac{2}{20}$ c) $\frac{13}{20}$ d) $\frac{3}{20}$
54. If events A and B are independent and $P(A) = \frac{2}{3}$, $P(B) = \frac{3}{5}$ then $P(A + B)$ is equal to
 a) $\frac{13}{15}$ b) $\frac{6}{15}$ c) $\frac{1}{15}$ d) none
55. The expected number of head in 100 tosses of an unbiased coin is
 a) 100 b) 50 c) 25 d) none
56. A and B are two events such that $P(A) = \frac{1}{3}$, $P(B) = \frac{1}{4}$, $P(A + B) = \frac{1}{2}$, then $P(B/A)$ is equal to
 a) $\frac{1}{4}$ b) $\frac{1}{3}$ c) $\frac{1}{2}$ d) none
57. Probability mass function is always
 a) 0 b) greater than 0
 c) greater than equal to 0 d) less than 0
58. The sum of probability mass function is equal to
 a) -1 b) 0 c) 1 d) none
59. When X is a continuous function f(x) is called
 a) probability mass function b) probability density function
 c) both d) none
60. Which of the following set of function define a probability space on $S = \{a_1, a_2, a_3\}$
 a) $P(a_1) = \frac{1}{3}$, $P(a_2) = \frac{1}{2}$, $P(a_3) = \frac{1}{4}$ b) $P(a_1) = \frac{1}{3}$, $P(a_2) = \frac{1}{6}$, $P(a_3) = \frac{1}{2}$
 c) $P(a_1) = P(a_2) = \frac{2}{3}$, $P(a_3) = \frac{1}{2}$ d) None
61. If $p(a_1) = 0$, $P(a_2) = \frac{1}{3}$, $P(a_3) = \frac{4}{3}$ then $S = \{a_1, a_2, a_3\}$ is a probability space,
 a) true b) false c) both d) none
62. If two events are independent then
 a) $P(B/A) = P(AB) P(A)$ b) $P(B/A) = P(AB) P(B)$
 c) $P(B/A) = P(B)$ d) $P(B/A)P(A)$

63. When expected value is negative the result is
 a) favourable b) unfavourable
 c) both d) none to the above
64. The expected value of X, the sum of the scores, when two dice are rolled is
 a) 9 b) 8 c) 6 d) 7
65. Let A and B be the events with $P(A) = 1/3$, $P(B) = 1/4$ and $P(AB) = 1/12$ then $P(A/B)$ is equal to
 a) $\frac{1}{3}$ b) $\frac{1}{4}$ c) $\frac{3}{4}$ d) $\frac{2}{3}$
66. Let A and B be the events with $P(A) = 2/3$, $P(B) = 1/4$ and $P(AB) = 1/12$ then $P(B/A)$ is equal to
 a) $\frac{7}{8}$ b) $\frac{1}{3}$ c) $\frac{1}{8}$ d) none
67. The odds in favour of one student passing a test are 3:7. The odds against another student passing are 3:5. The probability that both pass is
 a) $\frac{7}{16}$ b) $\frac{21}{80}$ c) $\frac{9}{80}$ d) $\frac{3}{16}$
68. The odds in favour of one student passing a test are 3:7. The odds against another student passing are 3:5. The probability that both fail is
 a) $\frac{7}{16}$ b) $\frac{21}{80}$ c) $\frac{9}{80}$ d) $\frac{3}{16}$
69. In formula $P(B/A)$, $P(a)$ is
 a) greater than zero b) less than zero
 c) equal to zero d) greater than equal to zero
70. Two events A and B are mutually exclusive means they are
 a) not disjoint b) disjoint c) equally likely d) none
71. A bag contains 10 white and 10 black balls. A ball is drawn from it. The probability that it will be white is
 (a) $\frac{1}{10}$ (b) 1 (c) $\frac{1}{2}$ (d) none
72. Two dice are thrown at a time. The probability that the numbers shown are equal is
 (a) $\frac{2}{6}$ (b) $\frac{5}{6}$ (c) $\frac{7}{18}$ (d) none
73. Two dice are thrown at a time. The probability that 'the difference of numbers shown is 1' is
 (a) $\frac{11}{18}$ (b) $\frac{5}{18}$ (c) $\frac{7}{18}$ (d) none
74. Two dice are thrown together. The probability that 'the event the difference of numbers shown is 2' is
 (a) $\frac{2}{9}$ (b) $\frac{5}{9}$ (c) $\frac{4}{9}$ (d) $\frac{7}{9}$
75. The probability space in tossing two coins is
 (a) $\{(H,H),(H,T),(T,H)\}$ (b) $\{(H,T),(T,H),(T,T)\}$

- (c) $\{(H,H),(H,T),(T,H), (T,T)\}$ (d) none
76. The probability of drawing a white ball from a bag containing 3 white and 8 balls is
(a) $3/5$ (b) $3/11$ (c) $8/11$ (d) none
77. Two dice are thrown together. The probability of the event that the sum of numbers shown is greater than 5 is
(a) $13/18$ (b) $15/18$ (c) 1 (d) none
78. A traffic census show that out of 1000 vehicles passing a junction point on a highway 600 turned to the right. The probability of an automobile turning the right is
(a) $2/5$ (b) $3/5$ (c) $4/5$ (d) none
79. Three coins are tossed together. The probability of getting three tails is
(a) $5/8$ (b) $3/8$ (c) $1/8$ (d) none
80. Three coins are tossed together. The probability of getting exactly two heads is
(a) $5/8$ (b) $3/8$ (c) $1/8$ (d) none
81. Three coins are tossed together. The probability of getting at least two heads is
(a) $1/2$ (b) $3/8$ (c) $1/8$ (d) none
82. 4 coins are tossed. The probability that there are 2 heads is
(a) $1/2$ (b) $3/8$ (c) $1/8$ (d) none
83. If 4 coins are tossed. The chance that there should be two tails is
(a) $1/2$ (b) $3/8$ (c) $1/8$ (d) none
84. If A is an event and A^c its complementary event then
(a) $P(A) = P(A^c) - 1$ (b) $P(A^c) = 1 - P(A)$ (c) $P(A) = 1 + P(A^c)$ (d) none
85. If $P(A) = 3/8$, $P(B) = 1/3$ and $P(AB) = -$ then $P(A^c)$ is equal to
(a) $5/8$ (b) $3/8$ (c) $1/8$ (d) none
86. If $P(A) = 3/8$, $P(B) = 1/3$ then $P(B)$ is equal to
(a) 1 (b) $1/3$ (c) $2/3$ (d) none
87. If $P(A) = 3/8$, $P(B) = 1/3$ and $P(AB) = \frac{1}{4}$ then $P(A + B)$ is
(a) $13/24$ (b) $11/24$ (c) $17/24$ (d) none
88. If $P(A) = 1/5$, $P(B) = 1/2$ and A and B are mutually exclusive then $P(AB)$ is
(a) $7/10$ (b) $3/10$ (c) $1/5$ (d) none
89. The probability of throwing more than 4 in a single throw from an ordinary die is
(a) $2/3$ (b) $1/3$ (c) 1 (d) none
90. The probability that a card drawn at random from the pack of playing cards may be either a queen or an ace is
(a) $2/13$ (b) $11/13$ (c) $9/13$ (d) none
91. The chance of getting 7 or 11 in a throw of 2 dice is
(a) $7/9$ (b) $5/9$ (c) $2/9$ (d) none
92. If the probability of a horse A winning a race is $1/6$ and the probability of a horse B winning the same race is $1/4$, what is the probability that one of the horses will win
(a) $5/12$ (b) $7/12$ (c) $1/12$ (d) none
93. If the probability of a horse A winning a race is $1/6$ and the probability of a horse B

- winning the same race is $\frac{1}{4}$, What is the probability that none of them will win
 (a) $\frac{5}{12}$ (b) $\frac{7}{12}$ (c) $\frac{1}{12}$ (d) none
94. If $P(A) = \frac{7}{8}$ then $P(A^c)$ is equal to
 (a) 1 (b) 0 (c) $\frac{7}{8}$ (d) $\frac{1}{8}$
95. The value of $P(S)$ where S is the sample space is
 (a) -1 (b) 0 (c) 1 (d) none
96. A man can kill a bird once in three shots. The probabilities that a bird is not killed is
 (a) $\frac{1}{3}$ (b) $\frac{2}{3}$ (c) 1 (d) 0
97. If on an average 9 ships out of 10 return safely to a port, the probability of one ship returns safely is
 (a) $\frac{1}{10}$ (b) $\frac{8}{10}$ (c) $\frac{9}{10}$ (d) none
98. If on an average 9 ships out of 10 return safely to a port, the probability of one ship does not reach safely is
 (a) $\frac{1}{10}$ (b) $\frac{8}{10}$ (c) $\frac{9}{10}$ (d) none
99. The probability of winning of a person is $\frac{6}{11}$ and at a result he gets Rs. 77/-. The expectation of this person is
 (a) Rs. 35/- (b) ' 42/- (c) ' 58/- (d) none
100. A family has 2 children. The probability that both of them are boys if it is known that one of them is a boy
 (a) 1 (b) $\frac{1}{2}$ (c) $\frac{3}{4}$ (d) none
101. The Probability of the occurrence of a number greater than 2 in a throw of a die if it is known that only even numbers can occur is
 (a) $\frac{1}{3}$ (b) $\frac{1}{2}$ (c) $\frac{2}{3}$ (d) none
102. A player has 7 cards in hand of which 5 are red and of these five 2 are kings. A card is drawn at random. The probability that it is a king, it being known that it is red is
 (a) $\frac{2}{5}$ (b) $\frac{3}{5}$ (c) $\frac{4}{5}$ (d) none
103. In a class 40 % students read Mathematics, 25 % Biology and 15 % both Mathematics and Biology. One student is select at random. The probability that he reads Mathematics if it is known that he reads Biology is
 (a) $\frac{2}{5}$ (b) $\frac{3}{5}$ (c) $\frac{4}{5}$ (d) none
104. In a class 40 % students read Mathematics, 25 % Biology and 15 % both Mathematics and Biology. One student is select at random. The probability that he reads Biology if he reads Mathematics
 (a) $\frac{7}{8}$ (b) $\frac{1}{8}$ (c) $\frac{3}{8}$ (d) none
105. Probability of throwing an odd no with an ordinary six faced die is
 (a) $\frac{1}{2}$ (b) 1 (c) $-\frac{1}{2}$ (d) 0
106. For a event A which is certain, P (a) is equal to
 (a) 1 (b) 0 (c) -1 (d) none
107. When none of the outcomes is favourable to the event then the event is said to be
 (a) certain (b) sample (c) impossible (d) none

ANSWERS

1.	(b)	2.	(d)	3.	(a)	4.	(b)	5.	(b)
6.	(a)	7.	(c)	8.	(a)	9.	(b)	10.	(b)
11.	(b)	12.	(a)	13.	(b)	14.	(c)	15.	(d)
16.	(d)	17.	(a)	18.	(a)	19.	(d)	20.	(c)
21.	(d)	22.	(b)	23.	(a)	24.	(b)	25.	(d)
26.	(a)	27.	(b)	28.	(c)	29.	(d)	30.	(a)
31.	(b)	32.	(c)	33.	(c)	34.	(d)	35.	(c)
36.	(a)	37.	(a)	38.	(c)	39.	(b)	40.	(a)
41.	(b)	42.	(d)	43.	(b)	44.	(c)	45.	(b)
46.	(a)	47.	(b)	48.	(d)	49.	(a)	50.	(d)
51.	(b)	52.	(c)	53.	(d)	54.	(a)	55.	(b)
56.	(a)	57.	(c)	58.	(c)	59.	(b)	60.	(b)
61.	(a)	62.	(c)	63.	(b)	64.	(d)	65.	(a)
66.	(c)	67.	(d)	68.	(b)	69.	(a)	70.	(b)
71.	(c)	72.	(c)	73.	(b)	74.	(a)	75.	(c)
76.	(b)	77.	(a)	78.	(b)	79.	(c)	80.	(b)
81.	(a)	82.	(b)	83.	(b)	84.	(b)	85.	(a)
86.	(c)	87.	(b)	88.	(d)	89.	(b)	90.	(a)
91.	(c)	92.	(a)	93.	(b)	94.	(d)	95.	(c)
96.	(b)	97.	(c)	98.	(a)	99.	(b)	100.	(d)
101.	(c)	102.	(a)	103.	(b)	104.	(c)	105.	(a)
106.	(a)	107.	(c)						

THEORETICAL DISTRIBUTION

INTRODUCTION

In chapter nine, it may be recalled, we discussed frequency distribution. In a similar manner, we may think of a probability distribution where just like distributing the total frequency to different class intervals, the total probability (i.e. one) is distributed to different mass points in case of a discrete random variable or to different class intervals in case of a continuous random variable. Such a probability distribution is known as Theoretical Probability Distribution, since such a distribution exists in theory. We need to study theoretical probability distribution for the following important factors:

- (a) An observed frequency distribution, in many a case, may be regarded as a sample i.e. a representative part of a large, unknown, boundless universe or population and we may be interested to know the form of such a distribution. By fitting a theoretical probability distribution to an observed frequency distribution of, say, the lamps produced by a manufacturer, it may be possible for the manufacturer to specify the length of life of the lamps produced by him up to a reasonable degree of accuracy. By studying the effect of a particular type of missiles, it may be possible for our scientist to suggest the number of such missiles necessary to destroy an army position. By knowing the distribution of smokers, a social activist may warn the people of a locality about the nuisance of active and passive smoking and so on.*
- (b) Theoretical probability distribution may be profitably employed to make short term projections for the future.*
- (c) Statistical analysis is possible only on the basis of theoretical probability distribution. Setting confidence limits or testing statistical hypothesis about population parameter(s) is based on the probability distribution of the population under consideration.*

*A probability distribution also possesses all the characteristics of an observed distribution. We define mean ($\bar{x}$), median ($\tilde{x}$), mode (x_o), standard deviation (σ) etc. exactly same way we have done earlier. Again a probability distribution may be either a discrete probability distribution or a Continuous probability distribution depending on the random variable under study. **Two important discrete probability distributions are (a) Binomial Distribution and (b) Poisson distribution.***

Some important continuous probability distributions are
Normal Distribution

BINOMIAL DISTRIBUTION

One of the most important and frequently used discrete probability distribution is Binomial Distribution. It is derived from a particular type of random experiment known as Bernoulli process named after the famous mathematician Bernoulli. Noting that a 'trial' is an attempt to produce a particular outcome which is neither certain nor impossible, the characteristics of Bernoulli trials are stated below:

- (i) Each trial is associated with two mutually exclusive and exhaustive outcomes, the occurrence of one of which is known as a 'success' and as such its non occurrence as a 'failure'. As an example, when a coin is tossed, usually occurrence of a head is known as a success and its non-occurrence i.e. occurrence of a tail is known as a failure.
- (ii) The trials are independent.
- (iii) The probability of a success, usually denoted by p , and hence that of a failure, usually denoted by $q = 1 - p$, remain unchanged throughout the process.
- (iv) The number of trials is a finite positive integer.

A discrete random variable x is defined to follow binomial distribution with parameters n and p , to be denoted by $x \sim B(n, p)$, if the probability mass function of x is given by

$$f(x) = p(X = x) = {}^n C_x p^x q^{n-x} \text{ for } x = 0, 1, 2, \dots, n \\ = 0, \text{ otherwise}$$

We may note the following important points in connection with binomial distribution:

- (a) As $n > 0$, $p, q \geq 0$, it follows that $f(x) > 0$ for every x
- (b) Binomial distribution is known as biparametric distribution as it is characterised by two parameters n and p . This means that if the values of n and p are known, then the distribution is known completely.
- (c) The mean of the binomial distribution is given by $\bar{x} = np$
- (d) Depending on the values of the two parameters, binomial distribution may be unimodal or bi-modal. $\bar{x}_0$, the mode of binomial distribution, is given by $\bar{x}_0 =$ the largest integer contained in $(n + 1)p$ if $(n + 1)p$ is a non-integer $(n + 1)p$ and $(n + 1)p - 1$ if $(n + 1)p$ is an integer
- (e) The variance of the binomial distribution is given by

$$\sigma^2 = npq \quad (17.5)$$
 Since p and q are numerically less than or equal to 1, $npq < np$
 $\Rightarrow$ variance of a binomial variable is always less than its mean.
 Also variance of X attains its maximum value at $p = q = 0.5$ and this maximum value is $n/4$.
- (f) Additive property of binomial distribution.
 If X and Y are two independent variables such that
 $X \sim B(n, P)$
 and $Y \sim B(n_2, P)$
 Then $(X + Y) \sim B(n_1 + n_2, P)$

Applications of Binomial Distribution

Binomial distribution is applicable when the trials are independent and each trial has just two outcomes success and failure. It is applied in coin tossing experiments, sampling inspection plan, genetic experiments and so on.

Example 17.1: A coin is tossed 10 times. Assuming the coin to be unbiased, what is the probability of getting

- (i) 4 heads?
- (ii) at least 4 heads?
- (iii) at most 3 heads?

Solution: We apply binomial distribution as the tossing are independent of each other. With every

Example 17.2: If 15 dates are selected at random, what is the probability of getting two Sundays?

Example 17.3: The incidence of occupational disease in an industry is such that the workmen have a 10% chance of suffering from it. What is the probability that out of 5 workmen, 3 or more will contract the disease?

Example 17.4: Find the probability of a success for the binomial distribution satisfying the following relation $4P(x=4) = P(x=2)$ and having the parameter n as six.

Example 17.5: Find the binomial distribution for which mean and standard deviation are 6 and 2 respectively.

Example 17.6: Fit a binomial distribution to the following data:

x:	0	1	2	3	4	5
f:	3	<u>6</u>	10	<u>8</u>	3	2

Example 17.7: 6 coins are tossed 512 times. Find the expected frequencies of heads. Also, compute the mean and SD of the number of heads.

Example 17.8: An experiment succeeds thrice as after it fails. If the experiment is repeated 5 times, what is the probability of having no success at all ?

Example 17.9: What is the mode of the distribution for which mean and SD are 10 and $\sqrt{5}$ respectively.

Example 17.10: If x and y are 2 independent binomial variables with parameters 6 and $1/2$ and 4 and $1/2$ respectively, what is $P(x+y \geq 1)$?

POISSON DISTRIBUTION

Poisson distribution is a theoretical discrete probability distribution which can describe many processes. Simon Denis Poisson of France introduced this distribution way back in the year 1837.

Poisson Model

Let us think of a random experiment under the following conditions:

- I. The probability of finding success in a very small time interval $(t, t + dt)$ is kt , where $k (>0)$ is a constant.
- II. The probability of having more than one success in this time interval is very low.

- III. The probability of having success in this time interval is independent of t as well as earlier successes.

The above model is known as Poisson Model. The probability of getting x successes in a relatively long time interval T containing m small time intervals t i.e. $T = mt$. is given by

$$\frac{e^{-kt} \cdot (kt)^x}{x!}$$

for $x = 0, 1, 2$

- (i) Since $e^{-m} = 1/e^m > 0$, whatever may be the value of m , $m > 0$, it follows that $f(x) \geq 0$ for every x .

Also it can be established that $\sum_x f(x) = 1$ i.e. $f(0) + f(1) + f(2) + \dots = 1$ (17.10)

- (ii) Poisson distribution is known as a uniparametric distribution as it is characterised by only one parameter m .

- (iii) The mean of Poisson distribution is given by m i.e. $\bar{x} = m$. (17.11)

- (iv) The variance of Poisson distribution is given by $\sigma^2 = m$ (17.12)

- (v) Like binomial distribution, Poisson distribution could be also unimodal or bimodal depending upon the value of the parameter m .

We have $\mu_0 =$ The largest integer contained in m if m is a non – integer

$= m$ and $m - 1$ if m is an integer (17.13)

- (vi) Poisson approximation to Binomial distribution

If n , the number of independent trials of a binomial distribution, tends to infinity and p , the probability of a success, tends to zero, so that $m = np$ remains finite, then a binomial distribution with parameters n and p can be approximated by a Poisson distribution with parameter $m (= np)$.

In other words when n is rather large and p is rather small so that $m = np$ is moderate then

$$P(n, p) \cong P(m). \quad \dots\dots\dots (17.14)$$

- (vii) Additive property of Poisson distribution

If X and Y are two independent variables following Poisson distribution with parameters m_1 and m_2 respectively, then $Z = X + Y$ also follows Poisson distribution with parameter $(m_1 + m_2)$.

i.e. if $X \sim P(m_1)$

and $Y \sim P(m_2)$

and X and Y are independent, then

$$Z = X + Y \sim P(m_1 + m_2) \quad \dots\dots\dots (17.15)$$

Application of Poisson distribution

Poisson distribution is applied when the total number of events is pretty large but the probability of occurrence is very small. Thus we can apply Poisson distribution, rather profitably, for the following cases:

- The distribution of the no. of printing mistakes per page of a large book.
- The distribution of the no. of road accidents on a busy road per minute.
- The distribution of the no. of radio – active elements per minute in a fusion process.
- The distribution of the no. of demands per minute for health centre and so on.

Example 17.11: Find the mean and standard deviation of x where x is a Poisson variate satisfying the condition $P(x = 2) = P(x = 3)$.

Example 17.12: The probability that a random variable x following Poisson distribution would assume a positive value is $(1 - e^{-27})$. What is the mode of the distribution?

Example 17.13: The standard deviation of a Poisson variate is 1.732. What is the probability that the variate lies between -2.3 to 3.68 ?

Example 17.14: X is a Poisson variate satisfying the following relation:

$$P(X = 2) = 9P(X = 4) + 90P(X = 6).$$

What is the standard deviation of X ?

Example 17.15: Between 9 and 10 AM, the average number of phone calls per minute coming into the switchboard of a company is 4. Find the probability that during one particular minute, there will be,

1. no phone calls
2. at most 3 phone calls (given $e^{-4} = 0.018316$)

Example 17.16: If 2 per cent of electric bulbs manufactured by a company are known to be defectives, what is the probability that a sample of 150 electric bulbs taken from the production process of that company would contain

1. exactly one defective bulb?
2. more than 2 defective bulbs?

$$= 1 - 0.4232$$

$$= 0.5768$$

$$= 0.58$$

Example 17.17: The manufacturer of a certain electronic component is certain that two per cent of his product is defective. He sells the components in boxes of 120 and guarantees that not more than two per cent in any box will be defective. Find the probability that a box, selected at random, would fail to meet the guarantee? Given that $e^{-240} = 0.0907$.

Solution: Let x denote the number of electric components. Then x follows binomial distribution

Example 17.18: A discrete random variable x follows Poisson distribution. Find the values of

- (i) $P(X = \text{at least } 1)$
- (ii) $P(X \leq 2 / X \geq 1)$

NORMAL OR GAUSSIAN DISTRIBUTION

The two distributions discussed so far, namely binomial and Poisson, are applicable when the random variable is discrete. In case of a continuous random variable like height or weight, it is impossible to distribute the total probability among different mass points because between any two unequal values, there remains an infinite number of values. Thus a continuous random variable is defined in term of its probability density function $f(x)$, provided, of course, such a function really exists, $f(x)$ satisfies the following condition:

$$f(x) \geq 0 \text{ for } x \in (-\infty, \infty)$$

$$\text{and } \int_{-\infty}^{+\infty} f(x) = 1$$

The most important and universally accepted continuous probability distribution is known as normal distribution. Though many mathematicians like De-Moivre, Laplace etc. contributed towards the development of normal distribution, Karl Gauss was instrumental for deriving normal distribution and as such normal distribution is also referred to as Gaussian Distribution.

A continuous random variable x is defined to follow normal distribution with parameters μ and σ^2 , to be denoted by

$$X \sim N(\mu, \sigma^2) \quad \dots\dots\dots (17.16)$$

(d) The normal distribution is known as biparametric distribution as it is characterised by two parameters μ and σ . Once the two parameters are known, the normal distribution is completely specified.

Properties of Normal Distribution

1. Since $\mu = 22/7$, $e^{-\mu} = 1/e > 0$, whatever 0 may be, it follows that $f(x) \geq 0$ for every x .
It can be shown that

$$\int_{-\infty}^{\infty} f(x) dx = 1$$

2. The mean of the normal distribution is given by μ . Further, since the distribution is symmetrical about $x = \mu$, it follows that the mean, median and mode of a normal distribution coincide, all being equal to μ .

3. The standard deviation of the normal distribution is given by σ .

Mean deviation of normal distribution is

$$\sigma\sqrt{2} \cong 0.8\sigma \quad \dots\dots\dots (17.21)$$

The first and third quartiles are given by

$$Q_1 = \mu - 0.675\sigma \quad \dots\dots\dots (17.22)$$

$$\text{and } Q_3 = \mu + 0.675\sigma \quad \dots\dots\dots (17.22)$$

$$\text{so that, quartile deviation} = 0.675\sigma \quad \dots\dots\dots (17.24)$$

4. The normal distribution is symmetrical about $x = \mu$. As such, its skewness is zero i.e. the normal curve is neither inclined move towards the right (negatively skewed) nor towards the left (positively skewed).
5. The normal curve $y = f(x)$ has two points of inflexion to be given by $x = \mu - a$ and $x = \mu + \sigma$ i.e. at these two points, the normal curve changes its curvature from concave to convex and from convex to concave.
6. If $x \sim N(\mu, \sigma^2)$ then $z = (x - \mu) / \sigma \sim N(0, 1)$, z is known as standardised normal variate or normal deviate.

$$\text{We also have } P(z \leq k) = \phi(k) \quad \dots\dots\dots (17.25)$$

The values of $\phi(k)$ for different k are given in a table known as "Biometrika."

Example 17.20: For a random variable x , the probability density function is given by

$$f(x) = \frac{e^{-(x-4)^2}}{\sqrt{4}}$$

for $-\infty < x < \infty$.

Identify the distribution and find its mean and variance.

Example 17.21: If the two quartiles of a normal distribution are 47.30 and 52.70 respectively, what is the mode of the distribution? Also find the mean deviation about median of this distribution.

Example 17.22: Find the points of inflexion of the normal curve

$$f(x) = \frac{1}{4 \times \sqrt{2\pi}} e^{-\frac{(x-10)^2}{32}}$$

for $-\infty < x < \infty$.

Example 17.23: If x is a standard normal variable such that

$$P(0 \leq x \leq b) = a, \text{ what is the value of } P(|x| > b)?$$
$$= 1 - 2a$$

Example 17.24: X follows normal distribution with mean as 50 and variance as 100. What is $P(x \geq 60)$? Given $\phi(1) = 0.8413$

Example 17.25: If a random variable x follows normal distribution with mean as 120 and standard deviation as 40, what is the probability that $P(x \leq 150 / x > 120)$?

Given that the area of the normal curve between $z = 0$ to $z = 0.75$ is 0.2734.

Example 17.26: X is a normal variable with mean = 25 and SD 10. Find the value of b such that the probability of the interval $[25, b]$ is 0.4772 given $\phi(2) = 0.9772$.

$$\Rightarrow b = 25 + 2 \times 10 = 45.$$

Example 17.27: In a sample of 500 workers of a factory, the mean wage and SD of wages are found to be Rs. 500 and Rs. 48 respectively. Find the number of workers having wages:

- (i) more than Rs. 600
- (ii) less than Rs. 450
- (iii) between Rs. 548 and Rs. 600.

Example 17.28: The distribution of wages of a group of workers is known to be normal with mean Rs. 500 and SD Rs. 100. If the wages of 100 workers in the group are less than Rs. 430, what is the total number of workers in the group?

Example 17.29: The mean height of 2000 students at a certain college is 165 cms and SD 9 cms. What is the probability that in a group of 5 students of that college, 3 or more students would have height more than 174 cm?

Example 17.30: The mean of a normal distribution is 500 and 16 per cent of the values are greater than 600. What is the standard deviation of the distribution?

Example 17.31: In a business, it is assumed that the average daily sales expressed in

Rupees follows normal distribution.

Example 17.32: x and y are independent normal variables with mean 100 and 80 respectively and standard deviation as 4 and 3 respectively. What is the distribution of $(x + y)$?

Standard Normal Distribution:

If a continuous random variable z follows standard normal distribution, to be denoted by $z \sim N(0, 1)$, then the probability density function of z is given by

$$f(z) = \frac{1}{\sqrt{2\pi}} e^{-z^2/2} \quad \text{for } -\infty < z < \infty \dots\dots\dots (17.35)$$

Some important properties of z are listed below :

- (i) z has mean, median and mode all equal to zero.
- (ii) The standard deviation of z is 1. Also the approximate values of mean deviation and quartile deviation are 0.8 and 0.675 respectively.
- (iii) The standard normal distribution is symmetrical about $z = 0$.

- (iv) The two points of inflexion of the probability curve of the standard normal distribution are **-1** and **1**.

- (v) The two tails of the standard normal curve never touch the horizontal axis.

- (vi) The upper and lower p per cent points of the standard normal variable z are given by

$$P(Z > z_p) = p \dots\dots\dots (17.36)$$

$$\text{And } p(Z < z_{1-p}) = p$$

$$\text{i.e. } P(Z < -z_p) = p \text{ respectively ... } (17.37)$$

(since for a standard normal distribution $z_{1-p} = -z_p$)

EXERCISE

Set : A

Write down the correct answers. Each question carries 1 mark.

1. A theoretical probability distribution.
 - (a) does not exist. (b) exists only in theory.
 - (c) exists in real life. (d) both (b) and (c).
2. Probability distribution may be
 - (a) discrete. (b) continuous. (c) infinite. (d) (a) or (b).
3. An important discrete probability distribution is
 - (a) Poisson distribution. (b) Normal distribution.
 - (c) Cauchy distribution. (d) Log normal distribution.
4. An important continuous probability distribution
 - (a) Binomial distribution. (b) Poisson distribution.
 - (c) Geometric distribution. (d) Normal distribution.
5. Parameter is a characteristic of

- (a) population. (b) sample.
(c) probability distribution. (d) both (a) and (b).
6. An example of a parameter is
(a) sample mean. (b) population mean.
(c) binomial distribution. (d) sample size.
7. A trial is an attempt to
(a) make something possible.
(b) make something impossible.
(c) prosecute an offender in a court of law.
(d) produce an outcome which is neither certain nor impossible.
8. The important characteristic(s) of Bernoulli trials
(a) each trial is associated with just two possible outcomes.
(b) trials are independent.
(c) trials are infinite.
(d) both (a) and (b).
9. The probability mass function of binomial distribution is given by
(a) $f(x) = p^x q^{n-x}$. (b) $f(x) = {}^n C_x p^x q^{n-x}$.
(c) $f(x) = {}^n C_x q^x p^{n-x}$. (d) $f(x) = {}^n C_x p^{n-x} q^x$.
10. If x is a binomial variable with parameters n and p , then x can assume
(a) any value between 0 and n .
(b) any value between 0 and n , both inclusive.
(c) any whole number between 0 and n , both inclusive.
(d) any number between 0 and infinity.
11. A binomial distribution is
(a) never symmetrical. (b) never positively skewed.
(c) never negatively skewed. (d) symmetrical when $p = 0.5$.
12. The mean of a binomial distribution with parameter n and p is
(a) $n(1-p)$. (b) $np(1-p)$. (c) np . (d) $\sqrt{np(1-p)}$
13. The variance of a binomial distribution with parameters n and p is
(a) $np^2(1-p)$. (b) $\sqrt{np(1-p)}$ (c) $nq(1-q)$. (d) $n^2p^2(1-p)^2$.
14. An example of a bi – parametric discrete probability distribution is
(a) binomial distribution.
(b) poisson distribution.
(c) normal distribution.
(d) both (a) and (b).
15. For a binomial distribution, mean and mode
(a) are never equal. (b) are always equal.
(c) are equal when $q = 0.50$. (d) do not always exist.

16. The mean of binomial distribution is
 (a) always more than its variance. (b) always equal to its variance.
 (c) always less than its variance. (d) always equal to its standard deviation.
17. For a binomial distribution, there may be
 (a) one mode. (b) two modes. (c) (a). (d) (a) or (b).
18. The maximum value of the variance of a binomial distribution with parameters n and p is
 (a) $n/2$. (b) $n/4$. (c) $np(1-p)$. (d) $2n$.
19. The method usually applied for fitting a binomial distribution is known as
 (a) method of least square.
 (b) method of moments.
 (c) method of probability distribution.
 (d) method of deviations.
20. Which one is not a condition of Poisson model?
 (a) the probability of having success in a small time interval is constant.
 (b) the probability of having success more than one in a small time interval is very small.
 (c) the probability of having success in a small interval is independent of time and also of earlier success.
 (d) the probability of having success in a small time interval $(t, t + dt)$ is kt for a positive constant k .
21. Which one is uniparametric distribution?
 (a) Binomial. (b) Poisson. (c) Normal. (d) Hyper geometric.
22. For a Poisson distribution,
 (a) mean and standard deviation are equal.
 (b) mean and variance are equal.
 (c) standard deviation and variance are equal.
 (d) both (a) and (b).
23. Poisson distribution may be
 (a) unimodal. (b) bimodal. (c) Multi – modal. (d) (a) or (b).
24. Poisson distribution is
 (a) always symmetric. (b) always positively skewed.
 (c) always negatively skewed. (d) symmetric only when $m = 2$.
25. A binomial distribution with parameters n and p can be approximated by a Poisson distribution with parameter $m = np$ is
 (a) $n \rightarrow \infty$. (b) $p \rightarrow 0$.
 (c) $n \rightarrow \infty$ and $p \rightarrow 0$. (d) $n \rightarrow \infty$ and $p \rightarrow 0$ so that np remains finite..
26. For Poisson fitting to an observed frequency distribution,
 (a) we equate the Poisson parameter to the mean of the frequency distribution.
 (b) we equate the Poisson parameter to the median of the distribution.

- (c) we equate the Poisson parameter to the mode of the distribution.
 (d) none of these.
27. The most important continuous probability distribution is known as
 (a) Binomial distribution.
 (b) Normal distribution.
 (c) Chi – square distribution.
 (d) Sampling distribution.
28. The probability density function of a normal variable x is given by
 (a) $f(x) = \frac{1}{\sigma\sqrt{2\pi}} \cdot e^{-\frac{1}{2}\left(\frac{x-\mu}{\sigma}\right)^2}$ for $-\infty < x < \infty$.
 (b) $f(x) = f(x) \frac{1}{\sigma\sqrt{2\pi}} \cdot e^{-\frac{(x-\mu)^2}{2\sigma^2}}$ for $0 < x < \infty$.
 (c) $f(x) = \frac{1}{\sqrt{2\pi}\sigma} \cdot e^{-\frac{(x-\mu)^2}{2\sigma^2}}$ for $-\infty < x < \infty$.
 (d) none of these.
29. The total area of the normal curve is
 (a) one. (b) 50 per cent.
 (c) 0.50. (d) any value between 0 and 1.
30. The normal curve is
 (a) Bell-shaped. (b) U- shaped.
 (c) J-shaped. (d) Inverted J-shaped.
31. The normal curve is
 (a) positively skewed. (b) negatively skewed.
 (c) symmetrical. (d) all these.
32. Area of the normal curve
 (a) between $-\infty$ to μ is 0.50. (b) between μ to ∞ is 0.50.
 (c) between $-\infty$ to ∞ is 0.50. (d) both (a) and (b).
33. The cumulative distribution function of a random variable X is given by
 (a) $F(x) = P(X \leq x)$. (b) $F(X) = P(X \leq x)$.
 (c) $F(x) = P(X \geq x)$. (d) $F(x) = P(X = x)$.
34. The mean and mode of a normal distribution
 (a) may be equal. (b) may be different.
 (c) are always equal. (d) (a) or (b).
35. The mean deviation about median of a standard normal variate is
 (a) 0.675σ . (b) 0.675. (c) 0.80σ . (d) 0.80.
36. The quartile deviation of a normal distribution with mean 10 and SD 4 is
 (a) 0.675. (b) 67.50. (c) 2.70. (d) 3.20.
37. For a standard normal distribution, the points of inflexion are given by

- (a) $\mu - \sigma$ and $\mu + \sigma$ (b) $-\sigma$ and σ (c) -1 and 1 (d) 0 and 1 .
38. The symbol $\wedge$ (a) indicates the area of the standard normal curve between (a) 0 to a . (b) a to ∞ . (c) $-\infty$ to a . (d) $-\infty$ to ∞ .
39. The interval $(\mu - 3\sigma, \mu + 3\sigma)$ covers (a) 95% area of a normal distribution. (b) 96% area of a normal distribution. (c) 99% area of a normal distribution. (d) all but 0.27% area of a normal distribution.
40. Number of misprints per page of a thick book follows (a) Normal distribution. (b) Poisson distribution. (c) Binomial distribution. (d) Standard normal distribution.
41. The results of ODI matches between India and Pakistan follows (a) Binomial distribution. (b) Poisson distribution. (c) Normal distribution. (d) (b) or (c).
42. The wage of workers of a factory follow (a) Binomial distribution. (b) Poisson distribution. (c) Normal distribution. (d) Chi – square distribution.
43. If X and Y are two independent normal random variables, then the distribution of $(X + Y)$ is (a) normal. (b) standard normal. (c) T. (d) chi – square.

Write down the correct answers. Each question carries 1 marks.

- What is the standard deviation of the number of recoveries among 48 patients when the probability of recovering is 0.75?
(a) 36. (b) 81. (c) 9. (d) 3.
- X is a binomial variable with $n = 20$. What is the mean of X if it is known that x is symmetric?
(a) 5. (b) 10. (c) 2. (d) 8.
- If $X \sim B(n, p)$, what would be the greatest value of the variance of x when $n = 16$?
(a) 2. (b) 4. (c) 8. (d) $\sqrt{5}$.
- If x is a binomial variate with parameter 15 and $1/3$, what is the value of mode of the distribution?
(a) 5 and 6. (b) 5. (c) 5.50. (d) 6.
- What is the number of trials of a binomial distribution having mean and SD as 3 and

- 1.5 respectively?
- (a) 2. (b) 4. (c) 8. (d) 12.
6. What is the probability of getting 3 heads if 6 unbiased coins are tossed simultaneously?
- (a) 0.50. (b) 0.25. (c) 0.3125. (d) 0.6875.
7. If the overall percentage of success in an exam is 60, what is the probability that out of a group of 4 students, at least one has passed?
- (a) 0.6525. (b) 0.9744. (c) 0.8704. (d) 0.0256.
8. What is the probability of making 3 correct guesses in 5 True – False answer type questions?
- (a) 0.3125. (b) 0.5676. (c) 0.6875. (d) 0.4325.
9. If the standard deviation of a Poisson variate X is 2, what is $P(1.5 < X < 2.9)$?
- (a) 0.231. (b) 0.158. (c) 0.15. (d) 0.144.
10. If the mean of a Poisson variable X is 1, what is $P(X = \text{takes the value at least } 1)$?
- (a) 0.456. (b) 0.821. (c) 0.632. (d) 0.254.
11. If $X \sim P(m)$ and its coefficient of variation is 50, what is the probability that X would assume only non – zero values?
- (a) 0.018. (b) 0.982. (c) 0.989. (d) 0.976.
12. If 1.5 per cent of items produced by a manufacturing units are known to be defective, what is the probability that a sample of 200 items would contain no defective item?
- (a) 0.05. (b) 0.15. (c) 0.20. (d) 0.22.
13. For a Poisson variate X , $P(X = 1) = P(X = 2)$. What is the mean of X ?
- (a) 1.00. (b) 1.50. (c) 2.00. (d) 2.50.
14. If 1 per cent of an airline's flights suffer a minor equipment failure in an aircraft, what is the probability that there will be exactly two such failures in the next 100 such flights?
- (a) 0.50. (b) 0.184. (c) 0.265. (d) 0.256.
15. If for a Poisson variable X , $f(2) = 3 f(4)$, what is the variance of X ?
- (a) 2. (b) 4. (c) $\sqrt{2}$. (d) 3.
16. What is the coefficient of variation of x , characterised by the following probability density function
- $$\text{function: } f(x) = \frac{1}{4\sqrt{2\pi}} e^{-(x-10)^2/32} \quad \text{for } -\infty < x < \infty$$
- (a) 50. (b) 60. (c) 40. (d) 30.
17. What is the first quartile of X having the following probability density function?
- $$f(x) = \frac{1}{\sqrt{72\pi}} e^{-(x-10)^2/72} \quad \text{for } -\infty < x < \infty$$
- (a) 4. (b) 5. (c) 5.95. (d) 6.75.
18. If the two quartiles of $N(\mu, \sigma^2)$ are 14.6 and 25.4 respectively, what is the standard deviation of the distribution?
- (a) 9. (b) 6. (c) 10. (d) 8.
19. If the mean deviation of a normal variable is 16, what is its quartile deviation?

- (a) 10.00. (b) 13.50. (c) 15.00. (d) 12.05.
20. If the points of inflexion of a normal curve are 40 and 60 respectively, then its mean deviation is
(a) 40. (b) 45. (c) 50. (d) 60.
21. If the quartile deviation of a normal curve is 4.05, then its mean deviation is
(a) 5.26. (b) 6.24. (c)) 4.24. (d) 4.80.
22. If the 1st quartile and mean deviation about median of a normal distribution are 13.25 and 8 respectively, then the mode of the distribution is
(a) 20. (b) 10. (c) 15. (d) 12.
23. If the area of standard normal curve between $z = 0$ to $z = 1$ is 0.3413, then the value of $\Phi(1)$ is
(a) 0.5000. (b) 0.8413. (c) -0.5000 . (d) 1.
24. If X and Y are 2 independent normal variables with mean as 10 and 12 and SD as 3 and 4, then $(X + Y)$ is normally distributed with
(a) mean = 22 and SD = 7. (b) mean = 22 and SD = 25.
(c) mean = 22 and SD = 5. (d) mean = 22 and SD = 49.

ANSWERS

Set : A

1. (d) 2. (d) 3. (a) 4. (d) 5. (a) 6. (b) 7. (d) 8. (d)
9. (b) 10. (c) 11. (d) 12. (c) 13. (c) 14. (a) 15. (c) 16. (a)
17. (c) 18. (b) 19. (b) 20. (a) 21. (b) 22. (b) 23. (d) 24. (b)
25. (d) 26. (a) 27. (b) 28. (a) 29. (a) 30. (a) 31. (c) 32. (d)
33. (a) 34. (c) 35. (d) 36. (c) 37. (c) 38. (c) 39. (d) 40. (b)
41. (a) 42. (c) 43. (a)

Set : B

1. (d) 2. (b) 3. (b) 4. (b) 5. (d) 6. (c) 7. (b) 8. (a)
9. (d) 10. (c) 11. (b) 12. (a) 13. (c) 14. (b) 15. (a) 16. (c)
17. (c) 18. (d) 19. (b) 20. (a) 21. (d) 22. (a) 23. (b) 24. (c)

PAST YEARS VQUESTION

2014 - JUNE

1. Mean and Variance of a binomial variance are 4 and $\frac{4}{3}$ respectively
then $P(x > 1)$ will be _____.

- (a) $\frac{728}{729}$ (b) $\frac{1}{729}$ (c) $\frac{723}{729}$ (d) None of the above.

Answer:

(a) For Binomial Variable

$$\text{Mean} = np = 4 \dots\dots\dots(1)$$

$$\text{Variance} = npq = \frac{4}{3} \dots\dots\dots(2)$$

From (1) & (2)

$$4 \times q = \frac{4}{3}$$

$$q = \frac{1}{3}$$

$$p = 1 - \frac{1}{3} = \frac{2}{3}$$

$$np = 4$$

$$n \times \frac{2}{3} = 4$$

$$n = \frac{12}{2} = 6$$

$$p(x \geq 1) = 1 - p(x < 1)$$

$$= 1 - p(x = 0)$$

$$= 1 - {}^6C_0 \cdot \left(\frac{2}{3}\right)^0 \cdot \left(\frac{1}{3}\right)^6$$

$$= 1 - 1 \times \frac{1}{729} = 1 - \frac{1}{729} = \frac{728}{729}$$

2. 5,000 students were appeared in an examination. The mean of marks was 39.5 with a Standard Deviation 12.5 marks. Assuming the distribution to be normal, find the number of students recorded more than 60% marks.

Given: When $Z = 1.64$, Area of normal curve = 0.4495

- (a) 1,000 (b) 505 **(c) 252** (d) 2,227

Answer:

(c) Probability that students recorded more than 60% marks = $P(x > 60)$

$$= 1 - P(x \leq 60)$$

$$= 1 - P\left(\frac{x - \bar{x}}{\sigma} \leq \frac{60 - 39.5}{12.5}\right)$$

$$= 1 - P(Z \leq 1.64)$$

$$= 1 - \phi(1.64)$$

$$= 1 - (0.4495 + 0.5)$$

$$= 1 - 0.9495$$

$$= 0.0505$$

Thus, the Number of students having marks more than 60%

$$= 5000 \times 0.0505$$

$$= 252.5$$

3. If a variate X has, mean > variance, then its distribution will be _____.

- (a) Binomial distribution (b) Poisson distribution
(c) Normal distribution (d) T-distribution

Answer:

(a) In Binomial distribution

Mean > Variance

2014 - DECEMBER

4. If six coins are tossed simultaneously. The probability of obtaining exactly two heads are:

- (a) 1/64 (b) 63/64 **(c) 15/64** (d) None of these

Answer:

(c) Here Total trial $(n) = 6$

For coin $p = \frac{1}{2}$, $q = 1 - \frac{1}{2} = \frac{1}{2}$

$$P(X = x) = {}^nC_x p^x q^{n-x}$$

$$P(X = 2) = {}^6C_2 \left(\frac{1}{2}\right)^2 \times \left(\frac{1}{2}\right)^{6-2}$$

$$= \frac{6 \times 5}{2 \times 1} \times \left(\frac{1}{2}\right)^2 \times \left(\frac{1}{2}\right)^4$$

$$= 15 \times \left(\frac{1}{2}\right)^{2+4}$$

$$= 15 \times \left(\frac{1}{2}\right)^6$$

$$= \left(\frac{15}{64}\right)$$

5. If x and y are two independent normal random variables, then the distribution of $x + y$ is:

- (a) Normal (b) T-distribution (c) Chi-square (d) F-distribution

Answer:

(a) If x and y are two independent Normal random variables, then the distribution of $x + y$ is Normal.

6. For a normal distribution having mean - 2 and variance = 4, the fourth central moment μ_4 is:

- (a) 16 (b) 32 (c) 48 (d) 64

Answer:

(c) For Normal Distribution Mean = 2, Variance = 4

Fourth central moments $\mu_4 = ?$

We know that Normal-curve is always

Meso kurtic then $\beta_2 = 3$

moment coefficient of kurtosis

$$(\beta_2) = \frac{\mu_4}{\mu_2^2}$$

Here, $\mu_2 = \text{Variance} = 4$, $\beta = 3$

$$3 = \frac{\mu_4}{4^2}$$

$$\mu_4 = 3 \times 4^2 = 3 \times 16 = 48$$

Shortcut: [Fourth moments $\mu_4 = 3\sigma^4 = 3(4)^2 = 48$

7. T-test can be used only when the sample has been taken from

- (a) Binomial Population (b) Poisson Population
(c) Normal Population (d) Exponential Population

Answer:

(c) t-test can be used only when the sample has been taken from Normal Population.

8. For a binomial distribution with mean = 4 and variance = 3, the third central moment μ_3 is:

- (a) 5/2 (b) 7/4 (c) 3/2 (d) 1/3

Answer:

(c) For Binomial distribution

Mean = 4 Variance = 3

$$np = 4 \quad (1) \quad npq = 3 \quad (2)$$

$$4q = 3$$

$$q = 3/4$$

$$\text{then } p = 1 - q = 1 - \frac{3}{4} = \frac{1}{4}$$

Putting $p = 1/4$ in equation (1)

$$n \times \frac{1}{4} = 4 \Rightarrow n = 16$$

The third central moment

$$\mu_3 = npq (q - p)$$

$$= 16 \times \frac{1}{4} \times \frac{3}{4} \left(\frac{3}{4} - \frac{1}{4} \right)$$

$$= 3 \left(\frac{2}{4} \right) = \frac{3}{2}$$

2015 - JUNE

9. If x is a binomial variable with parameters n and p , then x can assume

- (a) any value between 0 and n
(b) any value between 0 and n , both inclusive
(c) **any whole number between 0 and n , both inclusive**
(d) any number between 0 and infinity (1 mark)

Answer:

(c) If x is a binomial variable with parameters n & p , then x can assume any whole number between 0 and n , both inclusive.

10. In _____ distribution, mean = variance

- (a) Normal (b) Binomial (c) Poisson (d) None

Answer:

(c) In Poisson Distribution, Mean = Variance

11. Under a normal curve $\bar{x} \pm 3\sigma$ covers _____

- (a) 100% of the area (item values) (b) 99% (c) **99.73%** (d) 99.37%

Answer:

(c) Under a normal curve ($\bar{x} \pm 3\sigma$) covers 99.73% of the Area

2015 - DECEMBER

12. If 'x' is a binomial variable with parameter 15 and $\frac{1}{3}$, then the value of the mode of the distribution:

- (a) 5 (b) 5 and 6 (c) 5.50 (d) 6

Answer:

(a) In Binomial Variable (Distribution)

$$x \sim B(n, p)$$

$$x \sim B(15, \frac{1}{3})$$

$$n = 15, P = \frac{1}{3}$$

$$\text{Mode} = (n + 1)P$$

$$= (15 + 1) \cdot \frac{1}{3}$$

$$= 16 \times \frac{1}{3} = 5.33 \text{ (which is non Integer)}$$

$$= 5$$

13. Standard deviation of binomial distribution is:

- (a) $\sqrt{np}$ (b) $(np)^2$ (c) $\sqrt{npq}$ (d) $(npq)^2$

Answer:

(c) Standard Deviation of binomial distribution is $\sqrt{npq}$

14. The wages of workers of factory follows:

- (a) Binomial distribution (b) Poisson distribution
(c) **Normal distribution** (d) Chi-square distribution

Answer:

(c) The wages of workers of factory follow Normal Distribution.

2016 - JUNE

15. The normal curve is:

- (a) Positively skewed (b) Negatively skewed
(c) **Symmetrical** (d) All these

Answer:

(c) Normal curve is symmetrical.

16. For a Poisson variate X, $P(X = 1) = P(X = 2)$, what is the mean of X ?

- (a) 1 (b) $\frac{3}{2}$ (c) 2 (d) $\frac{5}{2}$

Answer:

(c) For $x \sim P(m)$

$$P(x = 1) = P(x = 2)$$

$$\frac{e^{-m} \cdot m^1}{1!} = \frac{e^{-m} \cdot m^2}{2!}$$

$$\frac{m}{1} = \frac{m^2}{2}$$

$$[m = 2]$$

17. In a discrete random variable X follows uniform distribution and assumes only the values 8, 9, 11, 15, 18, 20. Then $P(X \leq 15)$ is _____

- (a) $\frac{1}{2}$ (b) $\frac{1}{3}$ (c) $\frac{2}{3}$ (d) $\frac{2}{5}$

Answer:

(c) Given data

8, 9, 11, 15, 18, 20

Total No. of data $n(s) = 6$

$$P(x \leq 15) = \frac{n(A)}{n(S)} = \frac{4}{6} = \frac{2}{3}$$

2016- DECEMBER

18. If x and y are independent normal variates with Mean and Standard Deviation as μ_1 and μ_2 and σ_1 and σ_2 respectively, then $z = x + y$ also follows normal distribution with

- (a) Mean = $\mu_1 + \mu_2$ and S.D. = 0 respectively (b) Mean = 0 and S.D. = $\sigma_1^2 + \sigma_2^2$
 (c) Mean = $\mu_1 + \mu_2$ and S.D. = $\sqrt{\sigma_1^2 + \sigma_2^2}$ (d) None of these.

Answer:

(c) If x and y are two Independent variables of Normal Distribution

if $x \sim N(\mu_1, \sigma_1^2)$

and $y \sim N(\mu_2, \sigma_2^2)$

then $z = x + y$

$z = N(\mu_1, \sigma_1^2) + N(\mu_2, \sigma_2^2)$

$z = N(\mu_1 + \mu_2, \sigma_1^2 + \sigma_2^2)$

Mean = $\mu_1 + \mu_2$, Variance = $\sigma_1^2 + \sigma_2^2$

$$S.D = \sqrt{\sigma_1^2 + \sigma_2^2}$$

19. A Poisson random variable has $\mu_4 = 2$, its variance i.e. μ_2 is

- (a) $\frac{2}{3}$ (b) $\frac{1}{2}$ (c) $\frac{1}{3}$ (d) $\frac{3}{2}$

Answer:

(a) If $X \sim P(m)$ Fourth moment of Poisson distribution

$$\mu_2 = 3 \mu_2$$

$$2 = 3\sigma^2 [\because \mu_2 \rightarrow \sigma^2]$$

$$\sigma^2 = \frac{2}{3}$$

$$\text{Variance} = \frac{2}{3}$$

20. Name the distribution which has Mean = Variance

- (a) Binomial (b) **Poisson** (c) Normal (d) Chi-square

Answer:

(b) In Poisson distribution, mean and variance are equal.

21. An example of a bi-parametric continuous probability distribution:

- (a) Binomial (b) Poisson (c) **Normal** (d) (a) and (b)

Answer:

(c) Normal distribution is the example of bi-parametric probability distribution.

If x is a continuous variable.

2017 - JUNE

22. If $X \sim N(50, 16)$, then which of the following is not possible:

- (a) $P(X > 60) = 0.30$ (b) $P(X < 50) = 0.50$
(c) **$P(X < 60) = 0.40$** (d) $P(X > 50) = 0.50$

Answer:

(c) If $X \sim N(50, 16)$ then $P(X < 60) = 0.40$ is not possible.

23. If for a distribution mean = variance, then the distribution is said to be:

- (a) Normal (b) Binomial (c) **Poisson** (d) None of the above.

Answer:

(c) In Poisson distribution mean and variance are equal.

24. For a Binomial distribution if variance = (Mean)², then the values of n and p will be:

- (a) **1 and $\frac{1}{2}$** (b) 2 and $\frac{1}{2}$ (c) 3 and $\frac{1}{2}$ (d) 1 and 1

Answer:

(a) Given, In Binomial Distribution

we know that mean = np

Variance = npq

Given, Variance = (Mean)²

Here option (A) we have $n = 1$, $p = \frac{1}{2}$, $q = 1 - \frac{1}{2} = \frac{1}{2}$

$$(\text{Mean})^2 = (np)^2 = \left(1 \times \frac{1}{2}\right)^2 = \frac{1}{4}$$

$$\text{variance} = npq = 1 \times \frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$$

So that Variance = (Mean)²

∴ Option a is correct.

2017 - DECEMBER

25. In a normal distribution about 95 per cent of the observations lie between _____ and _____.

- (a) $\mu - 2\sigma$, $\mu + 2\sigma$ (b) $\mu - 3\sigma$, $\mu + 3\sigma$
(c) $\mu - 1.96\sigma$, $\mu + 1.96\sigma$ (d) $\mu - 2.58\sigma$, $\mu + 2.58\sigma$

Answer:

(c) In a Normal distribution about 95% of the observations lies b/w $\mu - 1.96\sigma$ and $\mu + 1.96\sigma$.

26. An example of a bi-parametric discrete probability distribution is

- (a) **Binomial distribution** (b) Poisson distribution
(c) Normal distribution (d) Both (a) and (b)

Answer:

(a) An example of a bi-parametric discrete probability distribution is Binomial distribution.

27. In _____ distribution, mean = variance

- (a) Normal (b) Binomial (c) **Poisson** (d) None of the above.

Answer:

(c) In **Poisson** Distribution, Mean = Variance

2018- MAY

28. The variance of a binomial distribution with parameters n and p is:

- (a) $np^2(1-p)$ (b) $\sqrt{np(1-p)}$
(c) $nq(1-q)$ (d) $n^2p^2(1-P)^2$

Answer:

(c) The variance of a binomial distribution

$$= npq$$

$$= nqp$$

$$= nq(1-q)$$

[87] X is a poisson variate satisfying the following condition $9 P(X = 4) + 90 P(X = 6) = P(X = 2)$. What is the value of $P(X \leq 1)$?

- (a) 0.5655 (b) 0.6559 (c) **0.7358** (d) 0.8201

Answer:

(c) Given $X \sim P(m)$

$$P(x = 2) = 9 P(x = 4) + 90 P(x = 6)$$

$$\frac{e^{-m} \cdot m^2}{2!} = 9 \frac{e^{-m} \cdot m^4}{4!} + 90 \frac{e^{-m} \cdot m^6}{6!}$$

$$\frac{90 \cdot e^{-m} \cdot m^6}{6!} + \frac{9 \cdot e^{-m} \cdot m^4}{4!} - \frac{e^{-m} \cdot m^2}{2!} = 0$$

$$e^{-m} \cdot m^2 \left[\frac{90 \cdot m^4}{6!} + \frac{9m^2}{4!} - \frac{1}{2!} \right] = 0$$

$$e^{-m} \cdot m^2 \left[\frac{90 \cdot m^4}{720} + \frac{9m^2}{24} - \frac{1}{2} \right] = 0$$

$$\frac{e^{-m} \cdot m^2}{2} \left[\frac{90 \cdot m^4}{360} + \frac{9m^2}{12} - 1 \right] = 0$$

$$\frac{e^{-m} \cdot m^2}{2} \left[\frac{m^4}{4} + \frac{3m^2}{4} - 1 \right] = 0$$

$$\frac{e^{-m} \cdot m^2}{2} \left[\frac{m^4 + 3m^2 - 4}{4} \right] = 0$$

$$\frac{e^{-m} \cdot m^2}{8} (m^4 + 3m^2 - 4) = 0$$

$$m^4 + 3m^2 - 4 = 0$$

$$m^4 + 4m^2 - m^2 - 4 = 0$$

$$m^2 (m^2 + 4) - 1 (m^2 + 4) = 0$$

$$(m^2 + 4) (m^2 - 1) = 0$$

$$\text{if } m^2 + 4 = 0 \text{ if } m^2 - 1 = 0$$

$$m^2 = -4 \text{ if } m^2 = +1$$

$$m^2 = \pm \sqrt{1}$$

$$m^2 = \pm 1$$

$$m = (\because m > 0)$$

$$P(x \leq 1) = P(x = 0) + P(x = 1)$$

$$= \frac{e^{-1} \cdot 1^0}{0!} + \frac{e^{-1} \cdot 1^1}{1!} = \frac{1}{e} + \frac{1}{e} = \frac{2}{e}$$

$$\frac{2}{2.7182} = 0.7358$$

29. What is the first quartile of x having the following probability density function?

$$f(x) = \frac{1}{\sqrt{72}\pi} e^{-(x-10)^2/72} \text{ for } -\infty < x < \infty$$

- (a) 4 (b) 5 (c) **5.95** (d) 6.75

Answer:

(c) Given $f(x) = \frac{1}{\sqrt{72}\pi} \cdot e^{\frac{-(x-10)^2}{72}}$ for $-\infty < x < \infty$

$$f(x) = \frac{1}{\sigma\sqrt{2\pi}} \cdot e^{\frac{-1(x-\mu)^2}{72}}$$

on company

$$f(x) = \frac{1}{\sigma\sqrt{2\pi}} \cdot e^{\frac{-1(x-\mu)^2}{2\sigma^2}}$$

We get

$$\sigma = 6, \mu = 10$$

$$\text{First quartile } Q_1 = \mu - 0.675 \sigma$$

$$= 10 - 0.675 \times 6$$

$$= 10 - 4.05$$

$$= 5.95$$

30. An example of a bi-parametric discrete probability distribution is

- (a) **binomial distribution** (b) Poisson distribution
(c) normal distribution (d) both (a) and (b)

Answer:

(a) Binomial distribution is example of a bi-parametric discrete probability distribution.

31. Probability distribution may be

- (a) discrete (b) continuous (c) infinite (d) **(a) or (b)**

Answer:

(d) Probability distribution may be discrete or continuous _____.

32. If the area of standard normal curve between $z = 0$ to $z = 1$ is 0.3412, then the value of $\phi(1)$ is.

- (a) 0.5000 (b) **0.8413** (c) -0.5000 (d) 1

Answer:

(b) The area of standard normal curve between $z = 0$ to $z = 1$ is 0.3413

then $\phi(1) = 0.3413 + 0.5$

$= 0.8413$

2018 - NOVEMBER

33. For a Poisson variate X , $P(X = 2) = 3P(X = 4)$, then the standard deviation of X is

- (a) 2 (b) 4 (c) $\sqrt{2}$ (d) 3

Answer:

(c) For a Poisson Variate X ,

$P(X = 2) = 3P(X = 4)$,

$$\frac{e^{-m} m^2}{2!} = \frac{3e^{-m} m^4}{4!}$$

$$\frac{m^2}{2} = \frac{3m^4}{24}$$

$$6m^4 = 24m^2$$

$$m^2 = \frac{24}{6}$$

$$m^2 = 4$$

$$m = 2$$

$$S.D = \sqrt{m} = \sqrt{2}$$

34. The mean of the Binomial distribution $B\left(4, \frac{1}{3}\right)$ is equal to

- (a) $\frac{3}{5}$ (b) $\frac{8}{3}$ (c) $\frac{3}{4}$ (d) $\frac{4}{3}$

Answer:

(d) $X \sim B(n, P) = B\left(4, \frac{1}{3}\right)$

We get $n = 4$, $P = 1/3$

Mean (μ) = np

$$= 4 \times 1/3 = 4/3$$

35. If for a normal distribution $Q_1 = 54.52$ and $Q_3 = 78.86$, then the median of the distribution is

- (a) 12.17 (b) 39.43 (c) **66.69** (d) None of these

Answer:

(c) For a Normal Distribution

$Q_1 = 54.52$ and $Q_3 = 78.86$

We know that

$$Q_1 = \mu - 0.675 = 54.52 \text{ _____ (1)}$$

$$Q_3 = \mu + 0.675 = 78.86 \text{ _____ (2)}$$

On Adding _____

$$2\mu = 133.38$$

$$\mu = \frac{133.38}{2}$$

$$\mu = 66.69$$

In Normal Distribution Mean, Median and Mode are equal.

So, Median = Mean = 66.69

36. What is the mean of X having the following density function?

$$f(x) = \frac{1}{4\sqrt{2\pi}} \cdot e^{-\frac{(x-10)^2}{32}} \text{ for } -\infty < x < \infty$$

- (a) 10 (b) 4 (c) 40 (d) None of the above

Answer:

(a) Given Normal distribution

$$f(x) = \frac{1}{4\sqrt{2\pi}} e^{-\frac{(x-10)^2}{32}} \text{ for } -\infty < x < \infty$$

On comparing from

$$f(x) = \frac{1}{\sigma\sqrt{2\pi}} \cdot e^{-\frac{(x-\mu)^2}{2\sigma^2}}$$

We get:

$$\text{Mean } (\mu) = 10$$

37. The probability that a student is not a swimmer is $\frac{1}{5}$, then the probability that out of five students four are swimmer is

- (a) $\left(\frac{4}{5}\right)^4 \left(\frac{1}{5}\right)$ (b) ${}^5C_1 \left(\frac{1}{5}\right)^4 \left(\frac{4}{5}\right)$
 (c) ${}^5C_4 \left(\frac{4}{5}\right)^1 \left(\frac{1}{5}\right)^4$ (d) None of the above

Answer:

(d) Given:

$$\text{Probability that a student is not a swimmer } (q) = \frac{1}{5}$$

$$\text{Probability that a student is a swimmer } (p) = 1 - q = 1 - \frac{1}{5} = \frac{4}{5}$$

$$\text{Total No. of students } (n) = 5$$

P(Exactly 4 students are swimmer)

$$= P(x = n) = {}^5C_4 \cdot \left(\frac{4}{5}\right)^4 \left(\frac{1}{5}\right)^1$$

$\{\because P(x = n) = {}^nC_x \cdot p^x \cdot q^{n-x}\}$ So, ans. (d)

2019-JUNE

38.4 coins were tossed 1600 times. What is the probability that all 4 coins do not turn head upward at a time?

- (a) $1600 e^{-100}$ **(b) $1000 e^{-100}$**
(c) $100 e^{-1600}$ (d) e^{-100}

Answer:

(B) Probability of getting a head in a throw of a coin = $\frac{1}{2}$

Probability of getting 4 heads in a throw of four coins = $\frac{1}{2^4} = \frac{1}{16}$

Here, $n = 1600$

Mean = $m = np$

$$= 1600 \times \frac{1}{16}$$

$$= 100$$

$P(\text{No. Head}) = P(X=0)$

$$= \frac{e^{-100} \cdot (100)^0}{0!}$$

$$= \frac{e^{-100} \cdot 1}{1}$$

$$= e^{-100}$$

39. If mean and variance are 5 and 3 respectively then relation between p and q is:

- (a) $p > q$ **(b) $p < q$** (c) $p = q$ (d) p is symmetric

Answer:

(b) Mean = 5, Variance = 3

$np = 5 \dots (1)$, $npq = 3 \dots (2)$

$eq(2)/eq(1)$

$$\frac{npq}{np} = \frac{3}{5}$$

$$q = 3/5$$

$$p = 1 - q$$

$$= 1 - 3/5 = 2/5$$

Here, $p < q$

40. In a Poisson distribution if $P(x = 4) = P(x = 5)$ then the parameter of Poisson distribution is:

- (a) $\frac{4}{5}$ (b) $\frac{5}{4}$ (c) 4 **(d) 5**

Answer:

(d) In Poisson distribution $P(x = 4) = P(x = 5)$

$$\frac{e^{-m} \cdot m^4}{4} = \frac{e^{-m} \cdot m^5}{5!}$$

$$\frac{1}{4!} = \frac{m}{5!}$$

$$\frac{1}{24} = \frac{m}{120}$$

$$24m = 120$$

$$m = 5$$

41. Area between = 1.96 to + 1.96 in a normal distribution is:

- (a) 95.45% **(b) 95%** (c) 96% (d) 99%

Answer:

(b) Area between -1.96 to +1.96 in a Normal distribution is 95%.

42. If the points of inflexion of a normal curve are 40 and 60 respectively, then its mean deviation is:

- (a) 8** (b) 45 (c) 50 (d) 60

Answer:

(a) If the point of Inflexion of a Normal Distribution are 40 and 60. Then

$$\mu - \sigma = 40 \text{ ————— (1)}$$

$$\mu + \sigma = 60 \text{ ————— (2)}$$

Solving eq. (1) and (2) we get

$$\mu = 50, \quad \sigma = 10$$

$$\text{Then M.O} = \frac{4}{5} \text{ S.D}$$

$$= \frac{4}{5} \times 10$$

$$= 8$$

2019- NOVEMBER

43. Area under $U \pm 3\sigma$

- (a) 99.73%** (b) 99% (c) 100% (d) 99.37%

Answer:

(a) We know that 99.73 per cent of the values of a normal variable lies between $(u - 3\sigma)$ and $(u + 3\sigma)$

Thus probability that a value of x lies. Outside the limit is as low as $(100 - 99.73) = 0.27\%$.

44. For a Poisson distribution:

- (a) mean and SD are equal **(b) mean and variance are equal**

(c) SD and Variance

(d) both a and b

Answer:

(b) Poisson distribution is theoretical discrete probability distribution which can describe many processes

Mean is given by m i.e, $U = m$

Variance is also given by m i.e. $\sigma^2 = m$

So in Poisson distribution mean and variance are equal.

45. Find mode when $n = 15$ and $p = \frac{1}{4}$ in binomial distribution?

(a) 4

(b) 4 and 3

(c) 4.2

(d) 3.75

Answer:

(b) In binomial distribution,

$$m = (n + 1) p$$

$$m = (15 + 1) \times \frac{1}{4}$$

$$m = 4$$

Since 4 is an integer so there will be 2 modes 4 and (4 - 1)

Mode = 4 and 3

46. In Poisson distribution, if $P(x = 2) = \frac{1}{2} P(x = 3)$ find m ?

(a) 3

(b) 1/6

(c) 6

(d) 1/3

Answer:

(c) In Poisson distribution $P(x = x) = \frac{e^{-m} \cdot m^x}{x!}$

$$\text{Here } P(x = 2) = \frac{1}{2} P(x = 3)$$

$$\frac{e^{-m} \cdot m^2}{2!} = \frac{1}{2} \times \frac{e^{-m} \cdot m^3}{3!}$$

$$\frac{e^{-m} \cdot m^2}{2} = \frac{1 \times e^{-m} \cdot m^3}{2 \times 6}$$

$$m = 6$$

[106] In a binomial distribution $B(n, p)$

$n = 4$ $P(x = 2) = 3 \times P(x = 3)$ find P

(a) 1/3

(b) 2/3

(c) 6/4

(d) 4/3

Answer:

(a) $n = 4$

we know $P(x = r) = {}^n C_r (p)^r (q)^{n-r}$

here $p(x = 2) = 3 \times P(x = 3)$

$${}^4C_2(p)^2 (q)^{4-2} = 3 \times {}^4C_3(p)^3 (q)^1$$

$$\frac{4!}{(4-2)!2!} (p)^2 (1-p)^2 = 3 \times \frac{4!}{(4-3)!1 \times 3!} \times (p)^3 (1-p)$$

$$\text{Since } {}^nC_r = \frac{n!}{(n-r)!r!}$$

$$6 \times (1-p) = 3 \times 4p$$

$$6-6p = 12p$$

$$18p = 6$$

$$p = \frac{1}{3}$$

47. What is the SD and mean

$$x \text{ if } f(x) = \frac{\sqrt{2}}{\sqrt{\pi}} e^{-2(x-3)^2}, -\infty < x < \infty.$$

(a) $3, \frac{1}{2}$ (b) $3, \frac{1}{4}$ (c) $2, \frac{1}{2}$ (d) $2, \sqrt{2}$

Answer:

(a) The standard form of probability density function is

$$f(x) = \frac{1}{\sqrt{2\pi}} \cdot e^{\frac{-(x-\mu)^2}{2\sigma^2}} \text{-----(1)}$$

$$\text{Here, } \sqrt{\frac{2}{\pi}} \cdot e^{-2(x-3)^2}$$

$$= \sqrt{\frac{2}{\pi}} \cdot e^{-\left(\frac{1-3}{1/2}\right)^2}$$

on comparing with Equation -----(1)

$$2\sigma^2 = \frac{1}{2} u = 3$$

$$\sigma^2 = \frac{1}{4}$$

$$\sigma = \frac{1}{2}$$

$$\text{So SD} = \frac{1}{2}, \text{ mean} = 3$$

2020 - NOVEMBER

48. Which of the following is uni-parametric distribution?

(a) **Poisson** (b) Normal (c) Binomial (d) Hyper geometric

Answer:

(a) Poisson distribution is uni parametric distribution.

49. If the probability of success in a binomial distribution is less than one-half, then the binomial distribution _____.

- (a) is skewed to left (b) is skewed to right
(c) has two modes (d) has median at a point $> \text{mean} + 1/2$

Answer:

(a) is skewed to left.

50. If we change the parameter(s) of a _____ distribution the shape of probability curve does not change.

- (a) Normal (b) Binomial (c) Poisson (d) Non-Gaussian

Answer:

(a) Normal Distribution.

51. Which one of the following has Poisson distribution?

- (a) The number of days to get a complete cure.
(b) The number of defects per meter on long roll of coated polythene sheet.
(c) The errors obtained in repeated measuring of the length of a rod.
(d) The number of claims rejected by an insurance agency. (1 mark)

Answer:

(b) The Number of defects per meter on long roll of coated polythene sheet is the example of Poisson distribution.

52.] For a Poisson distributed variable X , we have $P(X = 7) = 8 P(X = 9)$, the mean of the distribution is:

- (a) 3 (b) 4 (c) 7 (d) 9

Answer:

(a) If $p(x = 7) = 8 p(x = 9)$

$$\frac{e^{-m} \cdot m^7}{7!} = 8 \cdot \frac{e^{-m} \cdot m^9}{9!}$$

$$\frac{9!}{8 \times 7!} = \frac{m^9}{m^7}$$

$$\frac{9 \times 8 \times 7!}{8 \times 7!} = m^2$$

$$m^2 = 9$$

$$m = 3$$

mean of Poisson distribution

$$= m = 3$$

53. The quartile deviation of a normal distribution with mean 10 and standard deviation 4 is _____.

- (a) 54.24 (b) 23.20 (c) 0.275 (d) 2.70

Answer:

(d) For Normal Distribution

Given Mean (μ) = 10

S.D. (σ) = 4

Quartile Deviation

Q.D. = 0.675σ

= 0.675×4

= 2.70

54. If the parameter of Poisson distribution is m and (Mean + S. D.) = $6/25$ then find m :

(a) $3/25$

(b) $1/25$

(c) $4/25$

(d) $3/5$

Answer:

(b) In Poisson distribution Mean = m S.D. = $\sqrt{m}$

Given Mean + S.D. = $\sqrt{m}$

$$m + \sqrt{m} = \frac{6}{25} \quad (1)$$

By Hits and Trial

option (b) satisfied the eq. (1)

Here, $m = \frac{1}{25}$ putting in eq. (1)

$$\text{L.H.S.} = \frac{1}{25} + \sqrt{\frac{1}{25}} = \frac{1}{25} + \frac{1}{5} = \frac{6}{25} = \text{R.H.S.}$$

So, option (b) is correct. (1 mark)

2021 - JANUARY

55. A coin with probability for head as $\frac{1}{5}$ is tossed 100 times. The standard deviation of the number of head 5 turned up is.

(a) 3

(b) 2

(c) 4

(d) 6

Answer:

(c) Here $n = 100$

Probability of success (p) = $\frac{1}{5}$

Probability of failure (q) = $1 - p$

$$= 1 - \frac{1}{5}$$

$$= \frac{4}{5}$$

S.D. = $\sqrt{npq}$

$$= \sqrt{100 \times \frac{1}{5} \times \frac{4}{5}}$$

$$= \sqrt{4 \times 4}$$

= 4

56. If x is a Poisson variable and $P(x = 1) = P(x = 2)$, then $P(x = 4)$ is

- (a) $\frac{2}{3} e^2$ (b) $\frac{2}{3} e^4$ (c) $\frac{3}{2} e^{-2}$ (d) $\frac{3}{2} e^4$

Answer:

(a) If $X \sim P(m)$

and $P(x=1) = P(x = 2)$

$$\frac{e^{-m} \cdot m^1}{1!} = \frac{e^{-m} \cdot m^2}{2!}$$

$$\frac{m}{1} = \frac{m^2}{2}$$

$$2m = m^2$$

$$[2 = m]$$

$$m = 2$$

$$P(x = x) = \frac{e^{-m} \cdot m^x}{x!}$$

$$R(x = 4) = \frac{e^{-2} \cdot 2^4}{4!}$$

$$= \frac{e^{-2} \cdot 16}{24}$$

$$= \frac{2e^{-2}}{3}$$

57. Which one of the following is an uniparametric distribution?

- (a) **Poisson** (b) Normal (c) Binomial (d) Hyper geometric

Answer:

(a) **Poisson distribution** is an uniparametric distribution.

58. For a normal distribution, the value of third moment about mean is.

- (a) **0** (b) 1 (c) 2 (d) 3

Answer:

(a) For a Normal Distribution the value of third moment about mean is [Zero].

2021 - JULY

59. In normal distribution, Mean, Median and Mode are:

- (a) Zero (b) Not Equal (c) **Equal** (d) Null

Answer:

(c) In Normal Distribution, Mean, Median and Mode are equal.

60. It is Poisson variate such that $P(x = 1) = 0.7$, $P(x = 2) = 0.3$, then $P(x = 0) =$

- (a) $e^{6/7}$ (b) $e^{-6/7}$ (c) $e^{-2/3}$ (d) $e^{-1/3}$

Answer:

(b) In a poisson variate

$$p(x = 1) = 0.7$$

and

$$p(x = 2) = 0.3$$

$$\frac{e^{-m} \cdot m^1}{1!} = 0.7$$

$$\frac{e^{-m} \cdot m^2}{2!} = 0.3$$

$$e^{-m} \cdot m = 0.7 \quad \text{_____ (1)}$$

$$e^{-m} \cdot m^2 = 0.3 \times 2!$$

$$e^{-m} \cdot m^2 = 0.3 \times 2$$

$$e^{-m} \cdot m^2 = 0.6 \quad \text{_____ (2)}$$

eq (1)/ eq (2)

$$\frac{e^{-m} \cdot m}{e^{-m} \cdot m^2} = \frac{0.7}{0.6}$$

$$\frac{1}{m} = \frac{7}{6}$$

$$m = 6/7$$

$$\text{Now, } p(x = 0) = \frac{e^{-m} \cdot m^0}{0!}$$

$$= \frac{e^{-6/7} \cdot 1}{1}$$

$$= e^{-6/7}$$

61. Which of the following diagram is the most appropriate to represents various heads in total cost?

- (a) Pie chart (b) Bar graph (c) Multiple Line chart (d) Scatter Plot

Answer:

(a) Pie chart is the most appropriate to represents various heads in total cost.

62. If x is a binomial variate with $P=1/3$, for the experiment of 90 trials, then the standard deviation is equal to:

- (a) $-\sqrt{5}$ (b) $\sqrt{5}$ (c) $2\sqrt{5}$ (d) $\sqrt{15}$

Answer:

(c) P if $x \sim B(n, p)$

Here $n = 90$, $p = 1/3$, $q = 1 - p$

$$= 1 - \frac{1}{3}$$

$$= \frac{2}{3}$$

$$S.D = \sqrt{npq}$$

$$= \sqrt{90 \times \frac{1}{3} \times \frac{2}{3}}$$

$$= \sqrt{20}$$

$$\text{S.D} = 2\sqrt{5}$$

63. For a certain type of mobile, the length of time between charges of the battery is normally distributed with a mean of 50 hours and a standard deviation of 15 hours. A person owns one of these mobiles and want to know the probability that the length of time will be between 50 and 70 hours is (given $\varphi(1.33) = 0.9082$, $\varphi(0) = 0.5$)?

- (a) -0.4082 (b) 0.5 **(c) 0.4082** (d) -0.5

Answer:

(c) Here mean (μ) = 50 hours

S- D (σ) = 15 hours

$$P(50 < x < 70) = P\left(\frac{50 - 50}{15} < \frac{x - \mu}{\sigma} < \frac{70 - 50}{15}\right)$$

$$= P(0 < z < 1.33)$$

$$= \varphi(1.33) - \varphi(0)$$

$$= 0.9082 - 0.5000$$

$$= 0.4082$$

2021 - DECEMBER

64. The average number of advertisements per page appearing in a newspaper is 3. What is the probability that in a particular page zero number of advertisements are there?

- (a) e^{-3} (b) e^0 (c) e^{+3} (d) e^{-1}

Answer:

(a) Given $m = 3$; $x = 0$

As per Poisson Distribution, $P(x) = \frac{e^{-m} m^x}{x!}$

$$P(x = 0) = \frac{e^{-3} 3^0}{0!} = e^{-3}$$

65. Four unbiased coins are tossed simultaneously. The expected number of heads is:

- (a) 1 **(b) 2** (c) 3 (d) 4

Answer:

(b) Since four coins are being tossed, we have $n = 4$.

Probability of getting a "heads" in each trial (p) = $\frac{1}{2}$

Expected number of Heads = $np = 4 \times \frac{1}{2} = 2$.

66. If, for a Poisson distributed random variable X , the probability for X taking value 2 is 3 times the probability for X taking value 4, then the variance of X is

- (a) 4 (b) 3 **(c) 2** (d) 5

Answer:

(c) In Poisson Distribution, $P(x) = \frac{e^{-m} m^x}{x!}$

$$P(x = 2) = 3P(x = 4)$$

$$\frac{e^{-m} m^2}{2!} = 3 \times \frac{e^{-m} m^4}{4!}$$

$$\frac{1}{2} = \frac{3m^2}{24}$$

$$\frac{6m^2}{24} = 1$$

$$m^2 = \frac{24}{6} = 4$$

$$m = \sqrt{4} = 2$$

67. Let X be normal distribution with mean 2.5 and variance 1. If $P[a < X < 2.5] = 0.4772$ and that the cumulative normal probability value at 2 is 0.9772, then a = ?

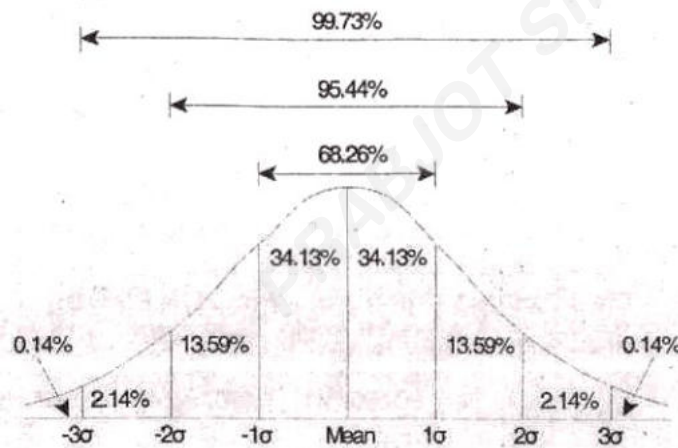
- (a) 0.5 (b) 3 (c) -3.5 (d) -4.5

Answer:

(a) We know that for a standard normal deviate, $z = \frac{x - \mu}{\sigma}$

Therefore, for $x = 2.5$, $z = \frac{2.5 - 2.5}{1} = 0$

Therefore, we need the area of 0.4772 from the mean till a certain point on the left-hand side.



From the graph above, we can see that the area from mean till -2σ is 47.72%, i.e., 0.4772.

Thus, the corresponding z for the value of $x = a$ should be -2.

Therefore, $-2 = \frac{a - 2.5}{1}$

$$-2 = a - 2.5$$

$$2.5 - 2 = a$$

$$a = 0.5$$

68. The manufacturer of a certain electronic component is certain that 2% of his product is defective. He sells the components in boxes of 120 and guarantees that not more than 2% in any box will be defective. Find the probability that a box, selected at random would fail to meet the guarantee? (Given that $e^{-2.4} = 0.0907$)

- (a) 0.49 (b) 0.39 (c) 0.37 (d) **0.43**

Answer:

(d) Here, $n = 120$; $p = \frac{2}{100} = 0.02$

$$m = np = 120 \times 0.02 = 2.40$$

As per Poisson Distribution, $P(x) = \frac{e^{-m} \cdot m^x}{x!}$

A box, selected at random would fail to meet the guarantee if more than 2.40 components turn out to be defective.

$$P(x > 2.40) = 1 - P(x \leq 2.40)$$

$$P(x > 2.40) = 1 - [P(x = 0) + P(x = 1) + P(x = 2)]$$

$$P(x > 2.40) = 1 - \left[\frac{e^{-2.40} \cdot (2.40)^0}{0!} + \frac{e^{-2.40} \cdot (2.40)^1}{1!} + \frac{e^{-2.40} \cdot (2.40)^2}{2!} \right]$$

$$P(x > 2.40) = 1 - \left[\frac{0.0907 \times 1}{1} + \frac{0.0907 \times 2.40}{1} + \frac{0.0907 \times (2.40)^2}{2} \right]$$

$$P(x > 2.40) \approx 0.43$$

69. A renowned hospital usually admits 200 patients everyday. One percent patients, on an average, require special room facilities. On one particular morning, it was found that only one special room is available. What is the probability that more than 3 patients would require special room facilities?

- (a) **0.1428** (b) 0.1732 (c) 0.2235 (d) 0.3450

Answer:

(a) Here $n = 200$; $p = \frac{1}{100}$

$$\text{Therefore, } m = np = 200 \times \frac{1}{100} = 2$$

As per Poisson Distribution, $P(x) = \frac{e^{-m} \cdot m^x}{x!}$

$$P(x > 3) = 1 - P(x \leq 3)$$

$$P(x > 3) = 1 - [P(x = 0) + P(x = 1) + P(x = 2) + P(x = 3)]$$

$$P(x > 3) = 1 - \left[\frac{e^{-2} \times 2^0}{0!} + \frac{e^{-2} \times 2^1}{1!} + \frac{e^{-2} \times 2^2}{2!} + \frac{e^{-2} \times 2^3}{3!} \right]$$

$$P(x > 3) = 1 - \left[\frac{(271828)^{-2} \times 2^0}{0!} + \frac{(271828)^{-2} \times 2^1}{1!} + \frac{(271828)^{-2} \times 2^2}{2!} + \frac{(271828)^{-2} \times 2^3}{3!} \right]$$

$$P(x > 3) = 2 - \left[\frac{1}{(2.71828)^2} + \frac{2}{(2.71828)^2} + \frac{4}{2 \times (2.71828)^2} + \frac{8}{6 \times (2.71828)^2} \right]$$

$$P(x > 3) = 1 - \left[\frac{1}{(2.71828)^2} \left\{ 1 + 2 + \frac{4}{2} + \frac{8}{6} \right\} \right]$$

$$P(x > 3) = 1 - [0.8571] = 0.1428$$

JUNE 2022:

1. If standard deviation is 1.732 then what is the value of poisson distribution the $p[-2.48 < x < 3.54]$ is
(a) 0.73 (b) **0.65** (c) 0.86 (d) 0.81
2. In a normal distribution, variance is 16 then the value of mean deviation
(a) 4.2 (b) **3.2** (c) 4.5 (d) 2.5
3. For a normal distribution, there may be -
(a) one mode (b) Two mode (c) **Multi mode** (d) no mode

Dec 2022

4. Skewness of Normal Distribution is
A. Negative B. Positive C. **Zero** D. Undefined
5. If a Poisson distribution is such that $P(X = 9) = P(X = 3)$ then the variance of the distribution is
A. $\sqrt{3}$ B. **3** C. 6 D. 9
6. The Standard Deviation of Binomial distribution is
A. npq B. $\sqrt{npq}$ C. np D. $\sqrt{np}$
7. The speeds of a number of bikes follow a normal distribution model with a mean of 83km/hr and a standard deviation of 9.4km/hr. Find the probability that a bike picked at random is travelling at more than 95km/hr ?
A. **0.1003** B. 0.38 C. 0.49 D. 0.278

June 2023:

1. The incidence of skin disease in chemical plant occurs in such a way that its workers have 20% chances of suffering from it. What is the probability that 6 workers 4 or more will have skin diseases ?
(a) 0.1696 (b) **0.01696** (c) 0.1643 (d) 0.01643
2. Between 9 and 10 am average numbers of phone calls per minutes coming into the switch board of a company is 4. Find the probability that during one particular minute, there will be either two phone calls or no phone calls.

- (a) 0.156 **(b) 0.165** (c) 0.149 (d) 0.194

3. It is Poisson variate such that $P(x = 2) = 1/3$ ($x=3$) = 0.3, then

- (a) 4 **(b) 3** (c) 2 (d) 14

ADDITIONAL QUESTION BANK

1. When a coin is tossed 10 times then we use
(a) Normal Distribution (b) Poisson Distribution
(c) Binomial Distribution (d) None
2. In Binomial Distribution 'n' means
(a) Number of trials of the experiment (b) the probability of getting success
(c) Number of success (d) none
3. Binomial probability Distribution is a
(a) Continuous (b) discrete
(c) both (d) none
4. When there are a fixed number of repeated trial of any experiments under identical conditions for which only one of two mutually exclusive outcomes, success or failure can result in each trial then, we use
(a) Normal Distribution (b) Binomial Distribution
(c) Poisson Distribution (d) None
5. In Binomial Distribution 'p' denotes Probability of
(a) Success (b) Failure (c) Both (d) None
6. When $p = 0.5$ 5, the binomial distribution is
(a) asymmetrical (b) symmetrical (c) Both (d) None
7. When 'p' is larger than 0. 5, the binomial distribution is
(a) asymmetrical (b) symmetrical (c) Both (d) None
8. Mean of Binomial distribution is
(a) npq (b) np (c) both (d) none
9. Variance of Binomial distribution is
(a) npq (b) np (c) both (d) none
10. When $p = 0.1$ the binomial distribution is skewed to the

- (a) left (b) right (c) both (d) none
11. If in Binomial distribution $np = 9$ and $npq = 2.25$ then q is equal to
(a) 0.25 (b) 0.75 (c) 1 (d) none
12. In Binomial Distribution
(a) mean is greater than variance (b) mean is less than variance
(c) mean is equal to variance (d) none
13. Standard deviation of binomial distribution is
(a) $(npq)^2$ (b) $\sqrt{npq}$
(c) $(np)^2$ (d) $\sqrt{np}$
14. distribution is a limiting case of Binomial distribution
(a) Normal (b) Poisson (c) Both (d) none

15. When the number of trials is large and probability of success is small then we use the distribution
 (a) Normal (b) Poisson
 (c) Binomial (d) none
16. In Poisson Distribution, probability of success is very close to
 (a) 1 (b) -1 (c) 0 (d) none
17. In Poisson Distribution np is
 (a) finite (b) infinite (c) 0 (d) none
18. In distribution, mean = variance
 (a) Normal (b) Binomial (c) Poisson (d) none
19. In Poisson distribution mean is equal to
 (a) $(A,)$ (b) np (c) square root mp (d) square root mpq
20. In Binomial distribution standard deviation is equal to
 (a) $\sqrt{np}$ (b) $(np)^2$ (c) $\sqrt{npq}$ (d) $(npq)^2$
21. For continuous events distribution is used.
 (a) Normal (b) Poisson (c) Binomial (d) none
22. Probability density function is associated with
 (a) discrete random variable (b) continuous random variables
 (c) both (d) none
23. Probability density function is always
 (a) greater than 0 (b) greater than equal to 0
 (c) less than 0 (d) less than equal to 0
24. For continuous random variables probability of the entire space is
 (a) 0 (b) -1 (c) 1 (d) none
25. For discrete random variables the probability of the entire space is
 (a) 0 (b) 1 (c) -1 (d) none
26. Binomial distribution is symmetrical if
 (a) $p > q$ (b) $p < q$ (c) $p = q$ (d) none
27. The Poisson distribution tends to be symmetrical if the mean value is
 (a) high (b) low (c) zero (d) none
28. The curve of distribution has single peak
 (a) Poisson (b) Binomial (c) Normal (d) none
29. The curve of distribution is unimodal and bell shaped with the highest point over the mean
 (a) Poisson (b) Normal (c) Binomial (d) none
30. Because of the symmetry of Normal distribution the median and the mode have the value as that of the mean
 (a) greater (b) smaller (c) same (d) none
31. For a Normal distribution, the total area under the normal curve is
 (a) 0 (b) 1 (c) 2 (d) -1

32. In Normal distribution the probability has the maximum value at the
 (a) mode (b) mean (c) median (d) none
33. In Normal distribution the probability decreases gradually on either side of the mean but never touches the axis.
 (a) True (b) false (c) both (d) none
34. Whatever may be the parameter of distribution, it has same shape.
 (a) Normal (b) Binomial (c) Poisson (d) none
35. In Standard Normal distribution
 (a) mean = 1, S.D = 0 (b) mean = 1, S.D = 1
 (c) mean = 0, S.D = 1 (d) mean = 0, S.D = 0
36. The Number of methods for fitting the normal curve is
 (a) 1 (b) 2 (c) 3 (d) 4
37. distribution is symmetrical around $t = 0$
 (a) Normal (b) Poisson (c) Binomial (d) t
38. As the degree of freedom increases, the distribution approaches the Standard Normal distribution
 (a) t (b) Binomial (c) Poisson (d) Normal
39. distribution is asymptotic to the horizontal axis.
 (a) Binomial (b) Normal (c) Poisson (d) t
40. distribution has a greater spread than Normal distribution curve
 (a) t (b) Binomial (c) Poisson (d) none
41. In Binomial Distribution if n is infinitely large, the probability p of occurrence of event' is close to and q is close to
 (a) 0, 1 (b) 1, 0 (c) 1, 1 (d) none
42. Poisson distribution approaches a Normal distribution as n
 (a) increase infinitely (b) decrease (c) increases moderately (d) none
43. If neither p nor q is very small but n sufficiently large, the Binomial distribution is very closely approximated by distribution
 (a) Poisson (b) Normal (c) t (d) none
44. For discrete random variable x , Expected value of x (i.e $E(x)$) is defined as the sum of products of the different values and the corresponding probabilities.
 (a) True (b) false (c) both (d) none
45. For a probability distribution, ... is the expected value of x .
 (a) median (b) mode (c) mean (d) none
46. is the expected value of $(x - m)^2$, where m is the mean.
 (a) median (b) variance (c) standard deviation (d) mode
47. The probability distribution of x is given below :
- | | | | |
|----------------|-----|---------|-------|
| value of x : | 1 | 0 | Total |
| probability : | p | $1 - p$ | 1 |
- Mean is equal to

- (a) p (b) $1 - p$ (c) 0 (d) 1
48. For n independent trials in Binomial distribution the sum of the powers of p and q is always n , whatever be the no. of success.
(a) True (b) false (c) both (d) none
49. In Binomial distribution parameters are
(a) n and q (b) n and p (c) p and q (d) none
50. In Binomial distribution if $n = 4$ and $p = 1/3$ then the value of variance is
(a) $8/3$ (b) $8/9$ (c) $4/3$ (d) none
51. In Binomial distribution if mean = 20, S.D. = 4 then q is equal to
(a) $2/5$ (b) $3/8$ (c) $1/5$ (d) $4/5$
52. If in a Binomial distribution mean = 20, S.D. = 4 then p is equal to
(a) $2/5$ (b) $3/5$ (c) $1/5$ (d) $4/5$
53. If is a Binomial distribution mean = 20, S.D. = 4 then n is equal to
(a) 80 (b) 100 (c) 90 (d) none
54. Poisson distribution is a probability distribution .
(a) discrete (b) continuous (c) both (d) none
55. Number of radio – active atoms decaying in a given interval of time is an example of
(a) Binomial distribution (b) Normal distribution
(c) Poisson distribution (d) None
56. distribution is sometimes known as the "distribution of rare events".
(a) Poisson (b) Normal (c) Binomial (d) none
57. The probability that x assumes a specified value in continuous probability distribution is
(a) 1 (b) 0 (c) -1 (d) none
58. In Normal distribution mean, median and mode are
(a) equal (b) not equal (c) zero (d) none
59. In Normal distribution the quartiles are equidistant from
(a) median (b) mode (c) mean (d) none
60. In Normal distribution as the distance from the increases, the curve comes closer and closer to the horizontal axis.
(a) median (b) mean (c) mode (d) none
61. A discrete random variable x follows uniform distribution and takes only the values 6, 8, 11, 12, 17.
The probability of $P(x = 8)$ is
(a) $1/5$ (b) $3/5$ (c) $2/8$ (d) $3/8$
62. A discrete random variable x follows uniform distribution and takes the values 6, 9, 10, 11, 13.
The probability of $P(x = 12)$ is
(a) $1/5$ (b) $3/5$ (c) $4/5$ (d) 0
63. A discrete random variable x follows uniform distribution and takes the values 6, 8, 11, 12, 17
The probability of $P(x \leq 12)$ is

- (a) $\frac{3}{5}$ (b) $\frac{4}{5}$ (c) $\frac{1}{5}$ (d) none
64. A discrete random variable x follows uniform distribution and takes the values 6, 8, 10, 12, 18
- The probability of $P(x < 12)$ is
- (a) $\frac{1}{5}$ (b) $\frac{4}{5}$ (c) $\frac{3}{5}$ (d) none
65. A discrete random variable x follows uniform distribution and takes the values 5, 7, 12, 15, 18
- The probability of $P(x > 10)$ is
- (a) $\frac{3}{5}$ (b) $\frac{2}{5}$ (c) $\frac{4}{5}$ (d) none
66. The probability density function of a continuous random variable is defined as follows :
 $f(x) = c$ when $-1 \leq x \leq 1 = 0$, otherwise the value of c is
- (a) 1 (b) -1 (c) $\frac{1}{2}$ (d) 0
67. A continuous random variable x has the probability density fn. $f(x) = V - ax$, $0 \leq x \leq 4$
 When 'a' is a constant. The value of 'a' is
- (a) $\frac{7}{8}$ (b) $\frac{1}{8}$ (c) $\frac{3}{16}$ (d) none
68. A continuous random variable x follows uniform distribution with probability density function
 $f(x) = V$, $(4 \leq x \leq 6)$. Then $P(4 \leq x \leq 5)$
- (a) 0.1 (b) 0.5 (c) 0 (d) none
69. An unbiased die is tossed 500 times. The mean of the number of 'Sixes' in these 500 tosses is
- (a) $\frac{50}{6}$ (b) $\frac{500}{6}$ (c) $\frac{5}{6}$ (d) none
70. An unbiased die is tossed 500 times. The Standard deviation of the number of 'sixes' in these 500 tossed is
- (a) $\frac{50}{6}$ (b) $\frac{500}{6}$ (c) $\frac{5}{6}$ (d) none
71. A random variable x follows Binomial distribution with mean 2 and variance 1.2. then the value of n is
- (a) 8 (b) 2 (c) 5 (d) none
72. A random variable x follows Binomial distribution with mean 2 and variance 1.6 then the value of p is
- (a) $\frac{1}{5}$ (b) $\frac{4}{5}$ (c) $\frac{3}{5}$ (d) none
73. "The mean of a Binomial distribution is 5 and standard deviation is 3".
- (a) True (b) false (c) both (d) none
74. The expected value of a constant k is the constant
- (a) k (b) $k - 1$ (c) $k + 1$ (d) none
75. The probability distribution whose frequency function $f(x) = \frac{1}{n}$ ($x = x_1, x_2, \dots, x_n$) is known as
- (a) Binomial distribution (b) Poisson distribution
 (c) Uniform distribution (d) Normal distribution
76. Theoretical distribution is a
- (a) Random distribution (b) Standard distribution

- (c) Probability distribution (d) None
77. Probability function is known as
 (a) frequency function (b) continuous function
 (c) discrete function (d) none
78. The number of points obtained in a single throw of an unbiased die follows :
 (a) Binomial distribution (b) Poisson distribution
 (c) Uniform distribution (d) None
79. The Number of points in a single throw of an unbiased die has frequency function
 (a) $f(x) = 1/4$ (b) $f(x) = 1/5$ (c) $f(x) = 1/6$ (d) none
80. In uniform distribution random variable x assumes n values with
 (a) equal probability (b) unequal probability
 (c) zero (d) none
81. In a discrete random variable x follows uniform distribution and assumes only the values 8, 9, 11, 15, 18, 20. Then $P(x = 9)$ is
 (a) $2/6$ (b) $1/7$ (c) $1/5$ (d) $1/6$
82. In a discrete random variable x follows uniform distribution and assumes only the values 8, 9, 11, 15, 18, 20. Then $P(x = 12)$ is
 (a) $1/6$ (b) 0 (c) $1/7$ (d) none
83. In a discrete random variable x follows uniform distribution and assumes only the values 8, 9, 11, 15, 18, 20. Then $P(x < 15)$ is
 (a) $1/2$ (b) $2/3$ (c) 1 (d) none
84. In a discrete random variable x follows uniform distribution and assumes only the values 8, 9, 11, 15, 18, 20. Then $P(x < 15)$ is
 (a) $2/3$ (b) $1/3$ (c) 1 (d) none
85. In a discrete random variable x follows uniform distribution and assumes only the values 8, 9, 11, 15, 18, 20. Then $P(x > 15)$ is
 (a) $2/3$ (b) $1/3$ (c) 1 (d) none
86. In a discrete random variable x follows uniform distribution and assumes only the values 8, 9, 11, 15, 18, 20. Then $P(|x - 14| < 5)$ is
 (a) $1/3$ (b) $2/3$ (c) $1/2$ (d) 1
87. When $f(x) = 1/n$ then mean is
 (a) $(n - 1)/2$ (b) $(n + 1)/2$ (c) $n/2$ (d) none
88. In continuous probability distribution $P(x < t)$ means
 (a) Area under the probability curve to the left of the vertical line at t .
 (b) Area under the probability curve to the right of the vertical line at t .
 (c) both
 (d) none
89. In continuous probability distribution $F(x)$ is called.
 (a) frequency distribution function (b) cumulative distribution function

- (c) probability density function (d) none
90. The probability density function of a continuous random variable is $y = k(x - 1)$, ($1 < x < 2$) then the value of the constant k is
- (a) -1 (b) 1 (c) 2 (d) 0

ANSWERS

1. (c)	2. (a)	3. (b)	4. (b)	5. (a)
6. (b)	7. (a)	8. (b)	9. (a)	10. (b)
11. (a)	12. (a)	13. (b)	14. (b)	15. (b)
16. (c)	17. (a)	18. (c)	19. (a)	20. (c)
21. (a)	22. (b)	23. (b)	24. (c)	25. (b)
26. (c)	27. (a)	28. (c)	29. (b)	30. (c)
31. (b)	32. (b)	33. (a)	34. (a)	35. (c)
36. (b)	37. (d)	38. (a)	39. (d)	40. (a)
41. (a)	42. (a)	43. (b)	44. (a)	45. (c)
46. (b)	47. (a)	48. (a)	49. (b)	50. (b)
51. (d)	52. (c)	53. (b)	54. (a)	55. (c)
56. (a)	57. (b)	58. (a)	59. (c)	60. (b)
61. (a)	62. (d)	63. (b)	64. (c)	65. (a)
66. (c)	67. (b)	68. (b)	69. (b)	70. (a)
71. (c)	72. (a)	73. (b)	74. (a)	75. (c)
76. (c)	77. (a)	78. (c)	79. (c)	80. (a)
81. (d)	82. (b)	83. (a)	84. (a)	85. (b)
86. (c)	87. (b)	88. (a)	89. (b)	90. (c)

CORRELATION AND REGRESSION

INTRODUCTION

Correlation analysis, it may be noted, helps us to find an association or the lack of it between the two variables x and y . Thus if x and y stand for profit and investment of a firm or the marks in Statistics and Mathematics for a group of students, then we may be interested to know whether x and y are associated or independent of each other. The extent or amount of correlation between x and y is provided by different measures of Correlation namely Product Moment Correlation Coefficient or Rank Correlation Coefficient or Coefficient of Concurrent Deviations. In Correlation analysis, we must be careful about a cause and effect relation between the variables under consideration because there may be situations where x and y are related due to the influence of a third variable although no causal relationship exists between the two variables.

Regression analysis, on the other hand, is concerned with predicting the value of the dependent variable corresponding to a known value of the independent variable on the assumption of a mathematical relationship between the two variables and also an average relationship between them.

BIVARIATE DATA

When data are collected on two variables simultaneously, they are known as bivariate data and the corresponding frequency distribution, derived from it, is known as Bivariate Frequency Distribution. If x and y denote marks in Maths and Stats for a group of 30 students, then the corresponding bivariate data would be (x_i, y_i) for $i = 1, 2, \dots, 30$ where (x_1, y_1) denotes the marks in Mathematics and Statistics for the student with serial number or Roll Number 1, (x_2, y_2) , that for the student with Roll Number 2 and so on and lastly (x_{30}, y_{30}) denotes the pair of marks for the student bearing Roll Number 30.

We consider the following measures of correlation:

- (a) Scatter diagram
- (b) Karl Pearson's Product moment correlation coefficient
- (c) Spearman's rank correlation co-efficient
- (d) Co-efficient of concurrent deviations

(a) SCATTER DIAGRAM

This is a simple diagrammatic method to establish correlation between a pair of variables. Unlike product moment correlation co-efficient, which can measure correlation only when the variables are having a linear relationship, scatter diagram can be applied for any type of correlation - linear as well as non-linear i.e. curvilinear. Scatter diagram can distinguish between different types of correlation although it fails to measure the extent of relationship between the variables.

Each data point, which in this case a pair of values (x_i, y_i) is represented by a point in the rectangular axes of coordinates. The totality of all the plotted points forms the scatter diagram. The pattern of the plotted points reveals the nature of correlation. In case of a positive correlation, the plotted points lie from lower left corner to upper right corner, in case of a negative correlation the plotted points concentrate from upper left to lower right and in case of zero correlation, the plotted points would be equally distributed without depicting any particular pattern. The following figures show different types of correlation and the one to one correspondence between scatter diagram and product moment correlation coefficient.

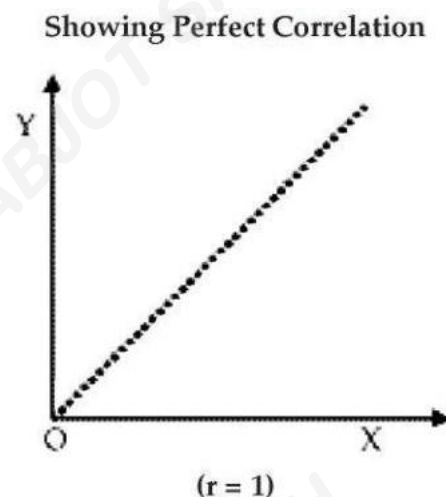
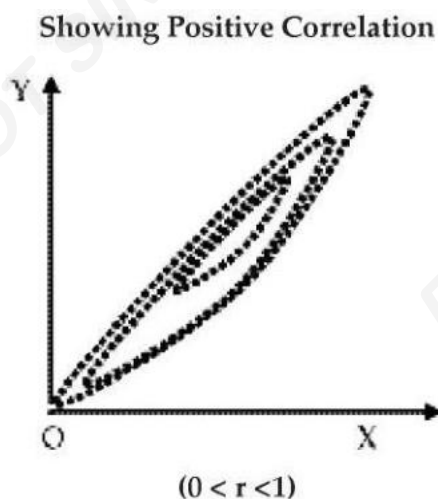
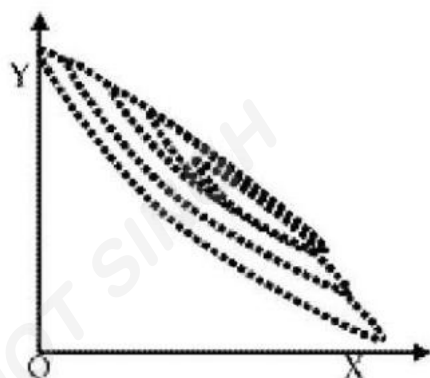


Figure 18.3

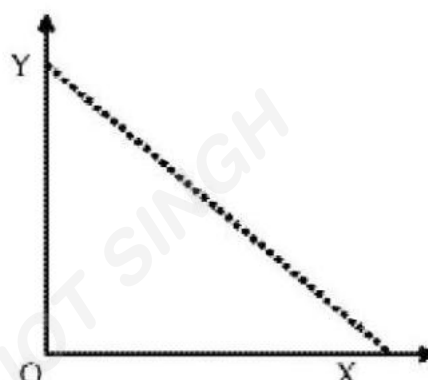
Showing Negative
Correlation



$$(-1 < r < 0)$$

Figure 18.4

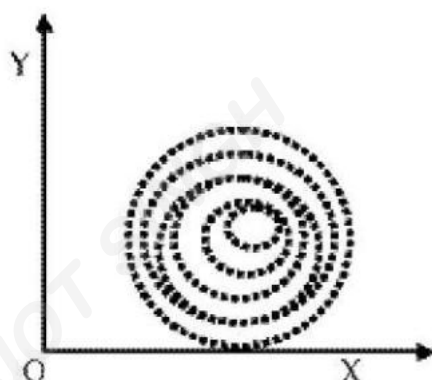
Showing Perfect Negative
Correlation



$$(r = -1)$$

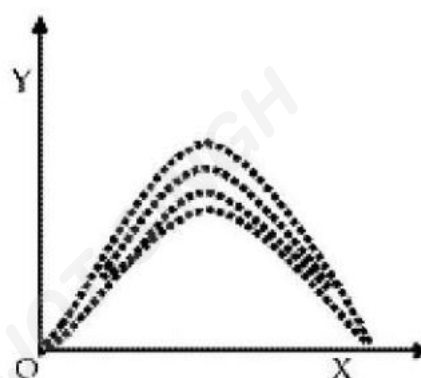
Figure 18.5 Figure 18.6

Showing No
Correlation



$$(r = 0)$$

Showing Curvilinear
Correlation



$$(r = 0)$$

•

EXERCISE

Set A

Write the correct answers. Each question carries 1 mark.

1. Bivariate Data are the data collected for
 - (a) Two variables
 - (b) More than two variables
 - (c) Two variables at the same point of time
 - (d) Two variables at different points of time.

2. For a bivariate frequency table having $(p + q)$ classification the total number of cells is
(a) p (b) $p + q$
(c) q (d) pq
3. Some of the cell frequencies in a bivariate frequency table may be
(a) Negative (b) Zero
(c) a or b (d) Non of these
4. For a $p \times q$ bivariate frequency table, the maximum number of marginal distributions is
(a) p (b) $p + q$
(c) 1 (d) 2
5. For a $p \times q$ classification of bivariate data, the maximum number of conditional distributions is
(a) p (b) $p + q$
(c) pq (d) p or q
6. Correlation analysis aims at
(a) Predicting one variable for a given value of the other variable
(b) Establishing relation between two variables
(c) Measuring the extent of relation between two variables
(d) Both (b) and (c).
7. Regression analysis is concerned with
(a) Establishing a mathematical relationship between two variables
(b) Measuring the extent of association between two variables
(c) Predicting the value of the dependent variable for a given value of the independent variable
(d) Both (a) and (c).
8. What is spurious correlation?
(a) It is a bad relation between two variables.
(b) It is very low correlation between two variables.
(c) It is the correlation between two variables having no causal relation.
(d) It is a negative correlation.
9. Scatter diagram is considered for measuring
(a) Linear relationship between two variables
(b) Curvilinear relationship between two variables

- (c) Neither (a) nor (b)
(d) Both (a) and (b).
10. If the plotted points in a scatter diagram lie from upper left to lower right, then the correlation is
(a) Positive (b) Zero
(c) Negative (d) None of these.
11. If the plotted points in a scatter diagram are evenly distributed, then the correlation is
(a) Zero (b) Negative
(c) Positive (d) (a) or (b).
11. If all the plotted points in a scatter diagram lie on a single line, then the correlation is
(a) Perfect positive (b) Perfect negative
(c) Both (a) and (b) (d) Either (a) or (b).
13. The correlation between shoe-size and intelligence is
(a) Zero (b) Positive
(c) Negative (d) None of these.
14. The correlation between the speed of an automobile and the distance travelled by it after applying the brakes is
(a) Negative (b) Zero
(c) Positive (d) None of these.
15. Scatter diagram helps us to
(a) Find the nature correlation between two variables
(b) Compute the extent of correlation between two variables
(c) Obtain the mathematical relationship between two variables
(d) Both (a) and (c).
16. Pearson's correlation coefficient is used for finding
(a) Correlation for any type of relation
(b) Correlation for linear relation only
(c) Correlation for curvilinear relation only
(d) Both (b) and (c).
17. Product moment correlation coefficient is considered for
(a) Finding the nature of correlation

- (b) Finding the amount of correlation
(c) Both (a) and (b)
(d) Either (a) and (b).
18. If the value of correlation coefficient is positive, then the points in a scatter diagram tend to cluster
(a) From lower left corner to upper right corner
(b) From lower left corner to lower right corner
(c) From lower right corner to upper left corner
(d) From lower right corner to upper right corner.
19. When $r = 1$, all the points in a scatter diagram would lie
(a) On a straight line directed from lower left to upper right
(b) On a straight line directed from upper left to lower right
(c) On a straight line
(d) Both (a) and (b).
20. Product moment correlation coefficient may be defined as the ratio of
(a) The product of standard deviations of the two variables to the covariance between them
(b) The covariance between the variables to the product of the variances of them
(c) The covariance between the variables to the product of their standard deviations
(d) Either (b) or (c).
21. The covariance between two variables is
(a) Strictly positive (b) Strictly negative
(c) Always 0 (d) Either positive or negative or zero.
22. The coefficient of correlation between two variables
(a) Can have any unit.
(b) Is expressed as the product of units of the two variables
(c) Is a unit free measure
(d) None of these.
23. What are the limits of the correlation coefficient?
(a) No limit (b) -1 and 1
(c) 0 and 1, including the limits (d) -1 and 1, including the limits
24. In case the correlation coefficient between two variables is 1, the relationship between the two variables would be

(a) $y = a + bx$ (b) $y = a + bx, b > 0$

(c) $y = a + bx, b < 0$ (d) $y = a + bx$, both a and b being positive.

25. If the relationship between two variables x and y is given by $2x + 3y + 4 = 0$, then the value of the correlation coefficient between x and y is

(a) 0 (b) 1

(c) -1 (d) negative.

26. For finding correlation between two attributes, we consider

(a) Pearson's correlation coefficient

(b) Scatter diagram

(c) Spearman's rank correlation coefficient

(d) Coefficient of concurrent deviations.

27. For finding the degree of agreement about beauty between two Judges in a Beauty Contest, we use

(a) Scatter diagram (b) Coefficient of rank correlation

(c) Coefficient of correlation (d) Coefficient of concurrent deviation.

28. If there is a perfect disagreement between the marks in Geography and Statistics, then what would be the value of rank correlation coefficient?

(a) Any value (b) Only 1

(c) Only -1 (d) (b) or (c)

29. When we are not concerned with the magnitude of the two variables under discussion, we consider

(a) Rank correlation coefficient (b) Product moment correlation coefficient

(c) Coefficient of concurrent deviation (d) (a) or (b) but not (c).

30. What is the quickest method to find correlation between two variables?

(a) Scatter diagram (b) Method of concurrent deviation

(c) Method of rank correlation (d) Method of product moment correlation

23. What are the limits of the coefficient of concurrent deviations?

(a) No limit

(b) Between -1 and 0, including the limiting values

(c) Between 0 and 1, including the limiting values

(d) Between -1 and 1, the limiting values inclusive

24. If there are two variables x and y , then the number of regression equations could be

- (a) 1 (b) 2
(c) Any number (d) 3.
25. Since Blood Pressure of a person depends on age, we need consider
(a) The regression equation of Blood Pressure on age
(b) The regression equation of age on Blood Pressure
(c) Both (a) and (b)
(d) Either (a) or (b).
26. The method applied for deriving the regression equations is known as
(a) Least squares (b) Concurrent deviation
(c) Product moment (d) Normal equation.
27. The difference between the observed value and the estimated value in regression analysis is known as
(a) Error (b) Residue
(c) Deviation (d) (a) or (b).
28. The errors in case of regression equations are
(a) Positive (b) Negative
(c) Zero (d) All these.
29. The regression line of y on x is derived by
(a) The minimisation of vertical distances in the scatter diagram
(b) The minimisation of horizontal distances in the scatter diagram
(c) Both (a) and (b)
(d) (a) or (b).
30. The two lines of regression become identical when
(a) $r = 1$ (b) $r = -1$
(c) $r = 0$ (d) (a) or (b).
31. What are the limits of the two regression coefficients?
(a) No limit
(b) Must be positive
(c) One positive and the other negative
(d) Product of the regression coefficient must be numerically less than unity.
40. The regression coefficients remain unchanged due to a

- (a) Shift of origin (b) Shift of scale
(c) Both (a) and (b) (d) (a) or (b).

41. If the coefficient of correlation between two variables is -0.9, then the coefficient of determination is

- (a) 0.9 (b) 0.81
(c) 0.1 (d) 0.19.

42. If the coefficient of correlation between two variables is 0.7 then the percentage of variation unaccounted for is

- (a) 70% (b) 30%
(c) 51% (d) 49%

Set B

Answer the following questions by writing the correct answers. Each question carries 1 marks.

1. If for two variable x and y, the covariance, variance of x and variance of y are 40, 16 and 256 respectively, what is the value of the correlation coefficient?

- (a) 0.01 (b) 0.625
(c) 0.4 (d) 0.5

2. If $\text{cov}(x, y) = 15$, what restrictions should be put for the standard deviations of x and y?

- (a) No restriction.
(b) The product of the standard deviations should be more than 15.
(c) The product of the standard deviations should be less than 15.
(d) The sum of the standard deviations should be less than 15.

3. If the covariance between two variables is 20 and the variance of one of the variables is 16, what would be the variance of the other variable?

- (a) More than 100 (b) More than 10
(c) Less than 10 (d) More than 1.25

4. If $y = a + bx$, then what is the coefficient of correlation between x and y?

- (a) 1 (b) -1

- (c) 1 or -1 according as $b > 0$ or $b < 0$ (d) none of these.
5. If $r = 0.6$ then the coefficient of non-determination is
(a) 0.4 (b) -0.6
(c) 0.36 (d) 0.64
6. If $u + 5x = 6$ and $3y - 7v = 20$ and the correlation coefficient between x and y is 0.58 then what would be the correlation coefficient between u and v ?
(a) 0.58 (b) -0.58
(c) -0.84 (d) 0.84
7. If the relation between x and u is $3x + 4u + 7 = 0$ and the correlation coefficient between x and y is -0.6, then what is the correlation coefficient between u and y ?
(a) -0.6 (b) 0.8
(c) 0.6 (d) -0.8
8. From the following data
- | | | | | | |
|-------|---|---|---|---|----|
| $x :$ | 2 | 3 | 5 | 4 | 7 |
| $y :$ | 4 | 6 | 7 | 8 | 10 |
- Two coefficient of correlation was found to be 0.93. What is the correlation between u and v as given below?
- | | | | | | |
|-------|----|----|----|----|---|
| $u :$ | -3 | -2 | 0 | -1 | 2 |
| $v :$ | -4 | -2 | -1 | 0 | 2 |
- (a) -0.93 (b) 0.93
(c) 0.57 (d) -0.57
9. Referring to the data presented in Q. No. 8, what would be the correlation between u and v ?
- | | | | | | |
|-------|-----|-----|-----|-----|-----|
| $u :$ | 10 | 15 | 25 | 20 | 35 |
| $v :$ | -24 | -36 | -42 | -48 | -60 |
- (a) -0.6 (b) 0.6
(c) -0.93 (d) 0.93
10. If the sum of squares of difference of ranks, given by two judges A and B, of 8 students in 21, what is the value of rank correlation coefficient?
(a) 0.7 (b) 0.65
(c) 0.75 (d) 0.8
11. If the rank correlation coefficient between marks in management and mathematics for a group of student in 0.6 and the sum of squares of the differences in ranks in 66, what is the number of students in the group?

(a) 10 (b) 9

(c) 8 (d) 11

12. While computing rank correlation coefficient between profit and investment for the last 6 years of a company the difference in rank for a year was taken 3 instead of 4. What is the rectified rank correlation coefficient if it is known that the original value of rank correlation coefficient was 0.4?

(a) 0.3 (b) 0.2

(c) 0.25 (d) 0.28

13. For 10 pairs of observations, No. of concurrent deviations was found to be 4. What is the value of the coefficient of concurrent deviation?

(a) $\sqrt{0.2}$ (b) $-\sqrt{0.2}$

(c) $1/3$ (d) $-1/3$

14. The coefficient of concurrent deviation for p pairs of observations was found to be $1/\sqrt{3}$. If the number of concurrent deviations was found to be 6, then the value of p is.

(a) 10 (b) 9

(c) 8 (d) none of these

15. What is the value of correlation coefficient due to Pearson on the basis of the following data:

x:	-5	-4	-3	-2	-1	0	1	2	3	4	5
y:	27	18	11	6	3	2	3	6	11	18	27

(a) 1 (b) -1

(c) 0 (d) -0.5

16. Following are the two normal equations obtained for deriving the regression line of y and x:

$$5a + 10b = 40$$

$$10a + 25b = 95$$

The regression line of y on x is given by

(a) $2x + 3y = 5$ (b) $2y + 3x = 5$

(c) $y = 2 + 3x$ (d) $y = 3 + 5x$

17. If the regression line of y on x and of x on y are given by $2x + 3y = -1$ and $5x + 6y = -1$ then the arithmetic means of x and y are given by

(a) (1, -1) (b) (-1, 1)

(c) (-1, -1) (d) (2, 3)

18. Given the regression equations as $3x + y = 13$ and $2x + 5y = 20$, which one is the regression equation of y on x ?
- (a) 1st equation (b) 2nd equation
(c) both (a) and (b) (d) none of these.
19. Given the following equations: $2x - 3y = 10$ and $3x + 4y = 15$, which one is the regression equation of x on y ?
- (a) 1st equation (b) 2nd equation
(c) both the equations (d) none of these
20. If $u = 2x + 5$ and $v = -3y - 6$ and regression coefficient of y on x is 2.4, what is the regression coefficient of v on u ?
- (a) 3.6 (b) -3.6
(c) 2.4 (d) -2.4
21. If $4y - 5x = 15$ is the regression line of y on x and the coefficient of correlation between x and y is 0.75, what is the value of the regression coefficient of x on y ?
- (a) 0.45 (b) 0.9375 (c) 0.6 (d) none of these
22. If the regression line of y on x and that of x on y are given by $y = -2x + 3$ and $8x = -y + 3$ respectively, what is the coefficient of correlation between x and y ?
- (a) 0.5 (b) $-1/\sqrt{2}$
(c) -0.5 (d) none of these
23. If the regression coefficient of y on x , the coefficient of correlation between x and y and variance of y are $-3/4$, $\frac{\sqrt{3}}{2}$ and 4 respectively, what is the variance of x ?
- (a) $2/\sqrt{3/2}$ (b) $16/3$ (c) $4/3$ (d) 4
24. If $y = 3x + 4$ is the regression line of y on x and the arithmetic mean of x is -1, what is the arithmetic mean of y ?
- (a) 1 (b) -1
(c) 7 (d) none of these

ANSWERS

Set A

1. (c) 2. (d) 3. (b) 4. (d) 5. (b) 6. (d)
7. (d) 8. (c) 9. (d) 10. (c) 11. (a) 12. (d)

13. (a) 14. (a) 15. (a) 16. (b) 17. (c) 18. (a)
 19. (a) 20. (c) 21. (d) 22. (c) 23. (d) 24. (b)
 25. (c) 26. (c) 27. (b) 28. (c) 29. (c) 30. (b)
 31. (d) 32. (b) 33. (a) 34. (a) 35. (d) 36. (d)
 37. (a) 38. (d) 39. (d) 40. (a) 41. (b) 42. (c)

Set B

1. (b) 2. (b) 3. (a) 4. (c) 5. (d) 6. (b)
 7. (c) 8. (b) 9. (c) 10. (c) 11. (a) 12. (b)
 13. (d) 14. (a) 15. (c) 16. (c) 17. (a) 18. (b)
 19. (d) 20. (b) 21. (a) 22. (c) 23. (b) 24. (a)

ADDITIONAL QUESTION BANK

1. is concerned with the measurement of the "strength of association" between variables.
 (a) correlation (b) regression
 (c) both (d) none
2. gives the mathematical relationship of the variables.
 (a) correlation (b) regression
 (c) both (d) none
3. When high values of one variable are associated with high values of the other & low values of one variable are associated with low values of another, then they are said to be
 (a) positively correlated (b) directly correlated
 (c) both (d) none
4. If high values of one tend to low values of the other, they are said to be
 (a) negatively correlated (b) inversely correlated

- (c) both (d) none
5. Correlation coefficient between two variables is a measure of their linear relationship .
(a) true (b) false
(c) both (d) none
6. Correlation coefficient is dependent of the choice of both origin & the scale of observations.
(a) True (b) false
(c) both (d) none
7. Correlation coefficient is a pure number.
(a) true (b) false
(c) both (d) none
8. Correlation coefficient is of the units of measurement.
(a) dependent (b) independent
(c) both (d) none
9. The value of correlation coefficient lies between
(a) -1 and +1 (b) -1 and 0
(c) 0 and 1 Inclusive of these two values (d) none.
10. Correlation coefficient can be found out by
(a) Scatter Diagram (b) Rank Method (c) both (d) none.
11. Covariance measures variations of two variables.
(a) joint (b) single
(c) both (d) none

12. In calculating the Karl Pearson's coefficient of correlation it is necessary that the data should be of numerical measurements. The statement is
- (a) valid (b) not valid
(c) both (d) none
13. Rank correlation coefficient lies between
- (a) 0 to 1 (b) -1 to + 1 inclusive of these value
(c) -1 to 0 (d) both
14. A coefficient near + 1 indicates tendency for the larger values of one variable to be associated with the larger values of the other.
- (a) true (b) false
(c) both (d) none
15. In rank correlation coefficient the association need not be linear.
- (a) true (b) false
(c) both (d) none
16. In rank correlation coefficient only an increasing/decreasing relationship is required.
- (a) false (b) true
(c) both (d) none
17. Great advantage of is that it can be used to rank attributes which can not be expressed by way of numerical value .
- (a) concurrent correlation (b) regression
(c) rank correlation (d) none
18. The sum of the difference of rank is
- (a) 1 (b) -1
(c) 0 (d) none.
19. Karl Pearson's coefficient is defined from
- (a) ungrouped data (b) grouped data (c) both (d) none.
20. Correlation methods are used to study the relationship between two time series of data which are recorded annually, monthly, weekly, daily and so on.
- (a) True (b) false
(c) both (d) none
21. Age of Applicants for life insurance and the premium of insurance – correlation is
- (a) positive (b) negative

- (c) zero (d) none
22. "Unemployment index and the purchasing power of the common man" Correlation is
(a) positive (b) negative
(c) zero (d) none
23. Production of pig iron and soot content in Durgapur – Correlations are
(a) positive (b) negative
(c) zero (d) none
24. "Demand for goods and their prices under normal times" Correlation is
(a) positive (b) negative
(c) zero (d) none
25. is a relative measure of association between two or more variables.
(a) Coefficient of correlation (b) Coefficient of regression
(c) both (d) none
26. The lines of regression passes through the points, bearing no. of points on both sides
(a) equal (b) unequal
(c) zero (d) none
27. Under Algebraic Method we get linear equations .
(a) one (b) two
(c) three (d) none
28. In linear equations $Y = a + bX$ and $X = a + bY$ 'a' is the
(a) intercept of the line (b) slope
(c) both (d) none
29. In linear equations $Y = a + bX$ and $X = a + bY$ 'b' is the
(a) intercept of the line (b) slope of the line
(c) both (d) none
30. The regression equations $Y = a + bX$ and $X = a + bY$ are based on the method of
(a) greatest squares (b) least squares (c) both (d) none
31. The line $Y = a + bX$ represents the regression equation of
(a) Y on X (b) X on Y
(c) both (d) none

32. The line $X = a + bY$ represents the regression equation of
 (a) Y on X (b) X on Y
 (c) both (d) none
33. Two regression lines always intersect at the means.
 (a) true (b) false
 (c) both (d) none
34. r , b_{xy} , b_{yx} all have sign.
 (a) different (b) same
 (c) both (d) none
35. The regression coefficients are zero if r is equal to
 (a) 2 (b) -1
 (c) 1 (d) 0
36. The regression lines are identical if r is equal to
 (a) +1 (b) ± 1
 (c) +1 (d) 0
37. The regression lines are perpendicular to each other if r is equal to
 (a) 0 (b) +1
 (c) -1 (d) +1
38. Feature of Least Square regression lines are The sum of the deviations at the Y's or the X's from their regression lines are zero.
 (a) true (b) false
 (c) both (d) none
39. The coefficient of determination is defined by the formula
 (a) $r^2 = 1 - \frac{\text{unexplained variance}}{\text{total variance}}$ (b) $r^2 = \frac{\text{explained variance}}{\text{total variance}}$
 (c) both (d) none
40. If the line $Y = 13 - 3X/2$ is the regression equation of y on x then by x is
 (a) $\frac{2}{3}$ (b) $\frac{-2}{3}$

(c) $\frac{3}{2}$ (d) $\frac{-3}{2}$

41. In the line $Y = 19 - 5X/2$ is the regression equation x on y then bxy is,
 (a) $19/2$ (b) $5/2$
 (c) $-5/2$ (d) $-2/5$
42. The line $X = 31/6 - Y/6$ is the regression equation of
 (a) Y on X (b) X on Y
 (c) both (d) we can not say
43. In the regression equation x on y, $X = 35/8 - 2Y/5$, bxy is equal to
 (a) $-2/5$ (b) $35/8$
 (c) $2/5$ (d) $5/2$
44. The square of coefficient of correlation 'r' is called the coefficient of
 (a) determination (b) regression
 (c) both (d) none
45. A relationship $r^2 = 1 - \frac{500}{300}$ is not possible
 (a) true (b) false
 (c) both (d) none
46. Whatever may be the value of r, positive or negative, its square will be
 (a) negative only (b) positive only
 (c) zero only (d) none only
47. Simple correlation is called
 (a) linear correlation (b) nonlinear correlation
 (c) both (d) none
48. A scatter diagram indicates the type of correlation between two variables.
 (a) true (b) false
 (c) both (d) none
49. If the pattern of points (or dots) on the scatter diagram shows a linear path diagonally across the graph paper from the bottom left- hand corner to the top right, correlation will be
 (a) negative (b) zero

- (c) positive (d) none
50. The correlation coefficient being + 1 if the slope of the straight line in a scatter diagram is
(a) positive (b) negative
(c) zero (d) none
51. The correlation coefficient being -1 if the slope of the straight line in a scatter diagram is
(a) positive (b) negative
(c) zero (d) none
52. The more scattered the points are around a straight line in a scattered diagram the is the correlation coefficient.
(a) zero (b) more
(c) less (d) none
53. If the values of y are not affected by changes in the values of x, the variables are said to be
(a) correlated (b) uncorrelated
(c) both (d) zero
54. If the amount of change in one variable tends to bear a constant ratio to the amount of change in the other variable, then correlation is said to be
(a) non linear (b) linear
(c) both (d) none
55. Variance may be positive, negative or zero.
(a) true (b) false
(c) both (d) none
56. Covariance may be positive, negative or zero.
(a) true (b) false
(c) both (d) none
57. Correlation coefficient between x and y = correlation coefficient between u and v
(a) true (b) false
(c) both (d) none
58. In case 'The ages of husbands and wives' correlation is
(a) positive (b) negative
(c) zero (d) none
59. In case 'Shoe size and intelligence'
(a) positive correlation (b) negative correlation

- (c) no correlation (d) none
60. In case 'Insurance companies' profits and the no of claims they have to pay "
- (a) positive correlation (b) negative correlation
- (c) no correlation (d) none
61. In case 'Years of education and income'
- (a) positive correlation (b) negative correlation
- (c) no correlation (d) none
62. In case 'Amount of rainfall and yield of crop'
- (a) positive correlation (b) negative correlation
- (c) no correlation (d) none
63. For calculation of correlation coefficient, a change of origin is
- (a) not possible (b) possible
- (c) both (d) none
64. The relation $r_{xy} = \text{cov}(x,y) / \sigma_x \sigma_y$ is
- (a) true (b) false
- (c) both (d) none
65. A small value of r indicates only a.....linear type of relationship between the variables.
- (a) good (b) poor
- (c) maximum (d) highest
66. Two regression lines coincide when
- (a) $r = 0$ (b) $r = 2$
- (c) $r = \pm 1$ (d) none
67. Neither y nor x can be estimated by a linear function of the other variable when r is equal to
- (a) + 1 (b) - 1
- (c) 0 (d) none
68. When $r = 0$ then $\text{cov}(x,y)$ is equal to
- (a) + 1 (b) - 1
- (c) 0 (d) none
69. When the variables are not independent, the correlation coefficient may be zero

- (a) true (b) false
(c) both (d) none
70. b_{xy} is called regression coefficient of
(a) x on y (b) y on x
(c) both (d) none
71. b_{yx} is called regression coefficient of
(a) x on y (b) y on x
(c) both (d) none
72. The slopes of the regression line of y on x is
(a) b_{yx} (b) b_{xy}
(c) b_{xx} (d) b_{yy}
73. The slopes of the regression line of x on y is
(a) b_{yx} (b) b_{xy}
(c) $1/b_{xy}$ (d) $1/b_{yx}$
74. The angle between the regression lines depends on
(a) correlation coefficient (b) regression coefficient
(c) both (d) none
75. If x and y satisfy the relationship $y = -5 + 7x$, the value of r is
(a) 0 (b) -1
(c) +1 (d) none
76. If b_{yx} and b_{xy} are negative, r is
(a) positive (b) negative
(c) zero (d) none
77. Correlation coefficient r lie between the regression coefficients b_{yx} and b_{xy}
(a) true (b) false
(c) both (d) none
78. Since the correlation coefficient r cannot be greater than 1 numerically, the product of the regression must
(a) not exceed 1 (b) exceed 1
(c) be zero (d) none
79. The correlation coefficient r is the.....of the two regression coefficients b_{yx} and b_{xy}

- (a) A.M (b) G.M
(c) H.M (d) none
80. Which is true?
- (a) $b_{yx} = r \frac{\sigma_x}{\sigma_y}$ (b) $b_{yx} = r \frac{\sigma_y}{\sigma_x}$
(c) $b_{yx} = r \frac{\sigma_{xy}}{\sigma_x}$ (d) $b_{yx} = r \frac{\sigma_{yy}}{\sigma_x}$
81. Maximum value of Rank Correlation coefficient is
(a) -1 (b) + 1
(c) 0 (d) none
82. The partial correlation coefficient lies between
(a) -1 and + 1 inclusive of these two value (b) 0 and + 1
(c) -1 and (d) none
83. r_{12} is the correlation coefficient between
(a) x_1 and x_2 (b) x_2 and x_1
(c) x_1 and x_3 (d) x_2 and x_3
84. r_{12} is the same as r_{21}
(a) true (b) false
(c) both (d) none
85. In case of employed persons 'Age and income' correlation is
(a) positive (b) negative
(c) zero (d) none
86. In case 'Speed of an automobile and the distance required to stop the car often applying brakes' – correlation is
(a) positive (b) negative
(c) zero (d) none
87. In case 'Sale of woolen garments and day temperature'..... correlation is
(a) positive (b) negative
(c) zero (d) none
88. In case 'Sale of cold drinks and day temperature' correlation is
(a) positive (b) negative

- (c) zero (d) none
89. In case of 'Production and price per unit' – correlation is
(a) positive (b) negative
(c) zero (d) none
90. If slopes at two regression lines are equal then r is equal to
(a) 1 (b) ± 1
(c) 0 (d) none
91. Co-variance measures the joint variations of two variables.
(a) true (b) false
(c) both (d) none
92. The minimum value of correlation coefficient is
(a) 0 (b) -2
(c) 1 (d) -1
93. The maximum value of correlation coefficient is
(a) 0 (b) 2
(c) 1 (d) -1
94. When $r = 0$, the regression coefficients are
(a) 0 (b) 1
(c) -1 (d) none
95. The regression equation of Y on X is, $2x + 3Y + 50 = 0$. The value of b_{yx} is
(a) $2/3$ (b) $-2/3$
(c) $-3/2$ (d) none
96. In Method of Concurrent Deviations, only the directions of change (Positive direction / Negative direction) in the variables are taken into account for calculation of
(a) coefficient of S.D (b) coefficient of regression.
(c) coefficient of correlation (d) none

ANSWERS

1.	(a)	2.	(b)	3.	(c)	4.	(c)	5.	(a)
6.	(b)	7.	(a)	8.	(b)	9.	(a)	10.	(b)
11.	(a)	12.	(a)	13.	(b)	14.	(a)	15.	(a)
16.	(b)	17.	(c)	18.	(c)	19.	(b)	20.	(a)

21. (a)	22. (b)	23. (a)	24. (b)	25. (a)
26. (d)	27. (b)	28. (a)	29. (b)	30. (b)
31. (a)	32. (b)	33. (a)	34. (b)	35. (d)
36. (c)	37. (a)	38. (a)	39. (c)	40. (d)
41. (d)	42. (b)	43. (a)	44. (a)	45. (a)
46. (b)	47. (a)	48. (a)	49. (c)	50. (a)
51. (b)	52. (c)	53. (b)	54. (b)	55. (b)
56. (a)	57. (a)	58. (a)	59. (c)	60. (b)
61. (a)	62. (a)	63. (b)	64. (a)	65. (b)
66. (c)	67. (c)	68. (c)	69. (a)	70. (a)
71. (b)	72. (a)	73. (b)	74. (a)	75. (c)
76. (b)	77. (a)	78. (a)	79. (b)	80. (b)
81. (b)	82. (a)	83. (a)	84. (a)	85. (a)
86. (a)	87. (b)	88. (a)	89. (b)	90. (b)
91. (a)	92. (d)	93. (c)	94. (a)	95. (b)
96. (c)				
-

PAST YEARS QUESTION

2014-JUNE

- Two regression lines for a bivariate data are: $2x - 5y + 6 = 0$ and $5x - 4y + 3 = 0$. Then the coefficient of correlation should be:
 (a) $\frac{-2\sqrt{5}}{5}$ (b) $\frac{2}{5}$
 (c) $\frac{+2\sqrt{5}}{5}$ (d) $\frac{\sqrt{2}}{5}$
- When each individual gets the exactly opposite rank by the two Judges, then the rank correlation will be _____.
 (a) 0 (b) -1

(c) +1 (d) $\frac{1}{2}$

3. If the mean of the two variables 'x' and 'y' are 3 and 1 respectively.

Then the equation of two regression lines are _____.

(a) $5x+7y-22=0$, $6x+2y-20=0$ (b) $5x+7y-22=0$, $6x+2y+20=0$

(c) $5x+7y+22=0$, $6x+2y-20=0$ (d) $5x+7y+22=0$, $6x+2y+20=0$

4. The equation of two lines of regression for 'x' and 'y' are $5x = 22 + y$ and $64x = 24 + 45y$ then the value of regression coefficient of 'y' on 'x' will be _____.

(a) 5 (b) $\frac{1}{5}$

(c) $\frac{64}{45}$ (d) $\frac{45}{64}$

2014 - DECEMBER

5. If the correlation coefficient between two variables is zero, then the lines of regression are:

(a) Parallel (b) **Perpendicular**

(c) Coincide (d) None of these

6. If the value of correlation coefficient between x & y is 1, then the value of correlation coefficient between $x - 2$ and $\frac{-y}{2} + 1$ is:

(a) 1 (b) **-1**

(c) -1/2 (d) 1/2

7. The equations of two regression lines are $x + y = 6$ and $x + 2y = 10$, then the value of correlation coefficient between x and y is:

(a) -1/2 (b) +1/2

(c) **$-1/\sqrt{2}$** (d) $+1/\sqrt{2}$

2015 - JUNE

8. Two regression lines are

$$16x - 20y + 132 = 0$$

$$80x - 36y - 428 = 0$$

The value of the correlation coefficient is

(a) **0.6** (b) -0.6

(c) 0.54 (d) 0.45

9. When the correlation coefficient r is equal to + 1, all the points in a scatter diagram would be

(a) On a straight line directed from upper left to lower right

(b) **On a straight line directed from lower left to upper right**

(c) On a straight line

(d) Both (a) and (b) (1 mark)

2015 - DECEMBER

10. Out of following which is correct?

(a) $b_{yx} = r \frac{\sigma_x}{\sigma_y}$ (b) $b_{yx} = r \frac{\sigma_y}{\sigma_x}$

(c) $b_{yx} = \frac{\pi \cdot \sum xy}{\sigma_x}$ (d) $b_{yx} = \frac{\pi \cdot \sum xy}{\sigma_y}$ (1 mark)

11. In case of "Insurance Companies" profits and the number of claims they have to pay there is _____ correlation.

(a) Positive (b) **Negative**

(c) No correlation (d) None of the above

2016-JUNE

12. Two regression equations are as follows:

Regression equation of x on y : $5x - y = 22$

Regression equation of y on x : $64x - 45y = 24$

What will be the mean of x and y?

(a) $\bar{x} = 8$, $\bar{y} = 6$ (b) $\bar{x} = 6$, $\bar{y} = 6$

(c) $\bar{x} = 6$, $\bar{y} = 8$ (d) $\bar{x} = 8$, $\bar{y} = 8$

13. If the coefficient of correlation between X and Y variables is +0.90 then what will be the coefficient of determination?

(a) 0.30 (b) **0.81**

(c) 0.94 (d) None of these

14. The two lines of regression become identical when

(a) $r=1$

(b) $r = -1$

(c) $r = 0$

(d) (a) or (b)

15. If $r = 0.6$, then the coefficient of determination is.

(a) 0.4 (b) -0.6

(c) **0.36** (d) 0.64

2016 - DECEMBER

16. The two regression lines passing through

(a) **Represent means**

(b) Represent S.Ds

(c) (a) and (b)

(d) None of these.

17. Out of the following the one which effects the regression coefficient is

(a) Change of origin only

- (b) Change of scale only
(c) Change of scale and origin both

(d) Neither change in origin nor change of scale

18. The regression equation of x on y is $3x + 2y = 100$. The value of b_{yx} is:

- (a) $-\frac{2}{3}$ (b) $\frac{100}{3}$
(c) $\frac{3}{2}$ (d) $\frac{2}{3}$

19. In a beauty contest there were 10 competitors. Rank of these candidates are assigned by two judges A and B. The sum of squares of differences of ranks is 44. The value of rank correlation is:

- (a) 0.70 **(b) 0.73**
(c) 0.80 (d) 0.60

2017 - JUNE

20. The coefficient of correlation between the temperature of environment and power consumption is always:

- (a) Positive** (b) Negative
(c) Zero (d) Equal to 1

21. If two regression lines are $x + y = 1$ and $x - y = 1$ then mean values of x and y will be:

- (a) 0 and 1 (b) 1 and 1
(c) 1 and 0 (d) -1 and -1

22. The coefficient of correlation between x and y is 0.8. If x and y values are multiplied by -1, then the coefficient of correlation will be:

- (a) 0.6** (b) -0.6
(c) $\frac{1}{0.6}$ (d) 1 - 0.6

2017 - DECEMBER

23. If two regression lines are $5y = 9x - 22$ and $20x = 9y + 350$, then the value of correlation coefficient (r) will be:

- (a) 0.10 (b) -0.10
(c) -0.90 **(d) 0.90**

24. The regression coefficient is independent of the change of:

- (a) Origin** (b) Scale
(c) Both (a) and (b) (d) Neither (a) nor (b). (1 mark)

25. If $r = 0.6$ then the coefficient of non-determination will be:

- (a) 0.40 (b) -0.60
(c) 0.36 **(d) 0.64**

26. The correlation coefficient (r) is the _____ of the two regression coefficients (b_{yx} and b_{xy})

- (a) AM **(b) GM**
(c) HM (d) Median

27. If there is a constant increase in a series, then the corresponding graph will be

- (a) Convex curve
(b) Concave curve
(c) Parabola

(d) Straight line from the left to the right

2018 -MAY

28. If the plotted points in a scatter diagram are evenly distributed, then the correlation is

- (a) Zero** (b) Negative
(c) Positive (d) (a) Or (b)

29. The covariance between two variables is

- (a) Strictly positive
(b) Strictly negative
(c) Always Zero

(d) Either positive or negative or zero

30. The coefficient of determination is defined by the formula

- (a) $r^2 = \frac{1 - \text{unexplained variance}}{\text{total variance}}$
(b) $r^2 = \frac{\text{explained variance}}{\text{total variance}}$

(c) both (a) and (b)

(d) none

31. In the method of Concurrent Deviations, only the directions of change (Positive direction/Negative direction) in the variables are taken into account for calculation of

- (a) Coefficient of SD.
(b) Coefficient of regression
(c) Coefficient of correlation
(d) none

32. Correlation coefficient is _____ of the units of measurement.

- (a) dependent **(b) independent**
(c) both (d) none

33. In case speed of an automobile and the distance required to stop the car after applying brakes correlation is (a) Positive (b) Negative (c) Zero (d) None **(1 mark)**

34. A relationship $r^2 = 1 - \frac{500}{300}$ is not possible

- (a) True** (b) False
(c) Both (d) None

35. Rank correlation coefficient lies between

- (a) 0 to 1
(b) - 1 to +1 inclusive of these value
(c) - 1 to 0
(d) both

2018 - NOVEMBER

36. The two line of regression intersect at the point

- (a) Mean (b) Mode
(c) Median (d) None of these

37. If the two lines of regression are $x + 2y - 5 = 0$ and $2x + 3y - 8 = 0$, then the regression line of y on x is:

- (a) $x + 2y - 5 = 0$ (b) $2x + 3y - 8 = 0$
(c) $x + 2y = 0$ (d) $2x + 3y = 0$

38. If the two regression lines are $3X = Y$ and $8Y = 6X$, then the value of correlation coefficient is

- (a) 0.5 (b) -0.5
(c) 0.75 (d) -0.80

39. The regression coefficient is independent of the change of:

- (a) Scale (b) Origin
(c) Scale and origin both (d) None of these

40. If the correlation coefficient between the variables X and Y is 0.5, then the correlation coefficient between the variables $2x - 4$ and $3 - 2y$ is

- (a) 1 (b) 0.5
(c) -0.5 (d) 0

2019 - JUNE

41. A.M. of regression coefficients is

- (a) Equal to r
(b) Greater than or equal to r
(c) Half of r
(d) None

Answer:

(b) A.M of Regression Coefficient is greater than or equal to r.

42. Given that

X	-3	-3/2	0	3/2	3
Y	9	9/4	0	9/4	9

Then Karipearson's coefficient of correlation is

- (a) Positive
(b) Zero
 (c) Negative
 (d) None

43. Find the probable error if $r = \frac{2}{\sqrt{10}}$ and $n = 36$

- (a) 0.6745
(b) 0.067
 (c) 0.5287
 (d) None

44. Given the following series:

X	10	13	12	15	8	15
Y	12	16	18	16	7	18

The rank correlation coefficient $r =$

- (a) $1 - \frac{6\sum d^2 + \sum_{i=1}^2 \frac{m_i(m_i^2-1)}{12}}{n(n^2-1)}$
(b) $1 - \frac{6\left[\sum d^2 + \sum_{i=1}^2 \frac{m_i(m_i^2-1)}{12}\right]}{n(n^2-1)}$
 (c) $1 - \frac{6\sum d^2 + \sum_{i=1}^2 \frac{m_i(m_i^2-1)}{12}}{n(n^2-1)}$
 (c) $1 - \frac{6\sum d^2 + \sum_{i=1}^3 \frac{m_i(m_i^2-1)}{12}}{n(n^2-1)}$

Answer:

45. Determine Spearman's rank correlation coefficient from the given data $\sum d^2 = 30$, $n = 10$:

- (a) $r = 0.82$**
 (b) $r = 0.32$
 (c) $r = 0.40$
 (d) None of the above

46. If the regression line of y on x is given by $y = x + 2$ and Karl Pearson's coefficient of correlation is 0.5 then $\frac{\sigma_y^2}{\sigma_x^2} =$ _____.

- (a) 3
 (b) 2
(c) 4
 (d) None

2019 - NOVEMBER

47. If two line of regression are $x + 2y - 5 = 0$ and $2x + 3y - 8 = 0$. So $x + 2y - 5 = 0$ is

(a) y on x

(b) x on y

(c) both

(d) None

48. Find the coefficient of correlation.

$$2x + 3y = 2$$

$$4x + 3y = 4$$

(a) -0.71

(b) 0.71

(c) -0.5

(d) 0.5

49. What is the coefficient of correlation from the following data?

x:	1	2	3	4	5
y:	5	4	3	2	6

(a) 0

(b) -0.75

(c) -0.85

(d) 0.82

50. If the plotted points in a scatter diagram lie from upper left to lower right, then correlation is

(a) Positive

(b) Negative

(c) Zero

(d) None of these (1 mark)

2020 - NOVEMBER

51. Which of the following is spurious correlation?

(a) Correlation between two variables having no casual relationship

(b) Negative correlation

(c) Bad relation between two variables

(d) Very low correlation between two variables. (1 mark)

52. Scatter diagram does not help us to?

(a) Find the type of correlation

(b) Identify whether variables correlated or not

(c) Determine the linear or non-linear correlation

(d) Find the numerical value of correlation coefficient

53. The covariance between two variables is

- (a) Strictly positive
- (b) Strictly negative
- (c) Always Zero
- (d) Either positive or negative or zero.**

2021 - JANUARY

54. For the set of observations $\{(1,2), (2, 5), (3,7), (4,8), (5,10)\}$ the value of kari-person's coefficient of correlation is approximately given by
- (a) 0.755
 - (b) 0.655
 - (c) 0.525
 - (d) 0.985**

55. The coefficient of correlation between x and y is 0.5 the covariance, is 16, and the standard deviation of y is
- (a) 4
 - (b) 8**
 - (c) 16
 - (d) 64 (1 mark)

56. . The interesting point of the two regression lines: y on x and x on y is
- (a) (0, 0)
 - (b) $(\bar{x}, \bar{y})$**
 - (c) (b_{yx}, b_{xy})
 - (d) (1,1)

57. Given that the variance of x is equal to the square of standard deviation by and the regression line of y on x is $y = 40 + 0.5 (x-30)$. Then regression line of x on y is
- (a) $y = 40 + 4 (x - 30)$
 - (b) $y = 40 + (x - 30)$
 - (c) $y = 40 + 2 (x-30)$
 - (d) $x = 30 + 2 (x - 40)$**

58. The regression coefficients remain unchanged due to
- (a) A shift of scale
 - (b) A shift of origin**
 - (c) Replacing x - values by $\frac{1}{x}$
 - (d) Replacing y values by $\frac{1}{y}$ (1 mark)

2021 - JULY

59. If $y = 9x$ and $x = 0.01 y$ then r is equal to:

(a) -0.1

(b) 0.1

(c) +0.3

(d) -0.3

60. The straight -line graph of the linear equation $y = a + b x$, slope is horizontal if:

(a) $b = 1$

(b) $b \neq 0$

(c) $b = 0$

(d) $a = b \neq 0$ (1 mark)

61. If $b_{yx} = -1.6$ and $b_{xy} = -0.4$, then r_{xy} will be:

(a) 0.4

(b) -0.8

(c) 0.64

(d) 0.8

62. If the sum of the product of the deviations of X and Y from their means is zero the correlation coefficient between X and Y is:

(a) Zero

(b) Positive

(c) Negative

(d) 10

63. If the slope of the regression line is calculated to be 5.5 and the intercept 15 then the value of Y and X is 6 is:

(a) 88

(b) 48

(c) 18

(d) 78

64. The sum of square of any real positive quantities and its reciprocal is never less than:

(a) 4

(b) 2

(c) 3

(d) 4.

2021 - DECEMBER

65. If the data points of (X,Y) series on a scatter diagram lie along a straight line that goes downwards as X-values move from left to right, then the data exhibit -----correlation.

(a) Direct

(b) Imperfect indirect

(c) Indirect

(d) Imperfect direct

66. For any two variables x and y the regression equations are given as $2x + 5y - 9 = 0$ and $3x - y - 5 = 0$. What are the A.M. of x and y ?

(a) 2, 1

(b) 1, 2

(c) 4, 2

(d) 2, 4

67. The intersecting point of two regression lines falls at X-axis. If the mean of X-values is 16, the standard deviations of X and Y are respectively, 3 and 4, then the mean of Y-values is

(a) $16/3$

(b) 4

(c) 0

(d) 1

68. The regression coefficients remain unchanged due to

(a) Shift of origin

(b) Shift of scale

(c) Always

(d) Never

JUNE 2022

69. if coefficient of correlation for $3X + 4Y - 6 = 0$ is 0.5 find the coefficient of correlation for $3u + 9v = 7$ for u and v

(a) $-(0.5)$

(b) (0.5)

(c) $+0.5$

(d) 0.25

70. Karl Pearson Coefficient Method is Used for

(a) any Data

(b) scattered data

(c) grouped data

(d) ungroup data

71. If the plotted point in a scatter diagram lie from lower left to upper right then correlation is

(a) positive

(b) negative

(c) perfectly negative

(d) zero

72. If the concurrent coefficient is $\frac{1}{\sqrt{3}}$. if Sum of deviation is 6 for n pairs of data?

- (a) 10
- (b) 9
- (c) 8
- (d) 11

DEC 2022

73. . The equations of the two lines of regression are $4x + 3y + 7 = 0$ and $3x + 4y + 8 = 0$. Find the correlation coefficient between x and y

- A -0.75 B. 0.25 C. -0.92 D. 1.25

74. If the regression equations are $2x + 3y + 1 = 0$ and $5x + 6y + 1 = 0$, then Mean of x and y respectively are

- A. -1, -1 B. -1, 1 C. 1, -1 D. 2, 3

75. . If $b_{yx} = 0.5$, $b_{xy} = 0.46$ then the value of correlation coefficient r is:

- A. 0.23 B. 0.25 C. 0.39 D. 0.48

76. The coefficient of rank correlation between the ranking of following 6 students in two subjects Mathematics and Statistics is:

Mathematics	3	5	8	4	7	10
Statistics	6	4	9	8	1	2

77. A. 0.25 B. 0.35 C. 0.38 D. 0.20 Peering's correlation coefficient between x and y is

- A. $\frac{\text{cov}(x,y)}{S_x S_y}$ B. $\frac{\text{cov}^2(x,y)}{S_x S_y}$ C. $\frac{(S_x S_y)^2}{\text{cov}(x,y)}$ D. $\frac{S_x S_y}{\text{cov}(x,y)}$

JUNE 23

78. If the regression equations are $x + 2y - 5 = 0$ and $2x + 3y - 8 = 0$, then Mean of x and y respectively are

- A. -3, 4 B. 2, 4 C. 1, 2 D. 2, 1

79. The spearmen correlation is given by

- (a) $1 - \frac{6\sum d^2}{n(n^2+1)}$
(b) $1 + \frac{6\sum d^2}{n(n^2-1)}$

(c) $1 + \frac{6\sum d^2}{n(n^2+1)}$
 (d) $1 - \frac{6\sum d^2}{n(n^2-1)}$

80. If $r = 0.4$ and $n = 81$ determine the population correlation limits

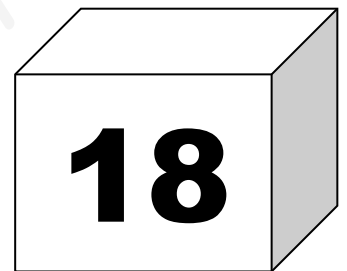
- A. 0.333, 0.4666 B. 0.367, 0.433 C. 0.337, 0.463 D. 0.373, 0.427

81. The regression line perpendicular to each others

- A. 1 B. -1 C. 1/2 D. 0

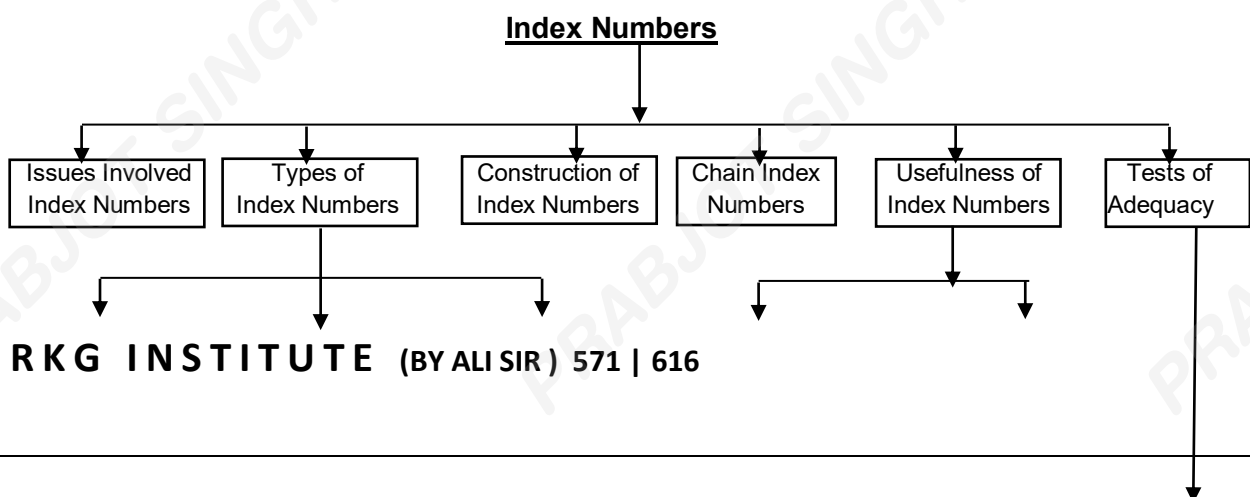
Four variables X and Y WE collected the four observation with $\sum X = 10$, $\sum Y = 14$, and $\sum X^2 = 65$ and $\sum Y^2 = 5$ $\sum XY = 3$ what is regression line Y On X

- A. $Y = -0.8X - 5.5$ B. $Y = 0.8X - 5.5$ C. $Y = -0.8X + 5.5$ D. $Y = -0.8X + 5.5$



INDEX NUMBER

UNIT OVERVIEW



Price Index
Numbers

Quantity Index
Numbers

Value Index
Numbers

Deflating Index
Numbers

Splicing of Index
Numbers

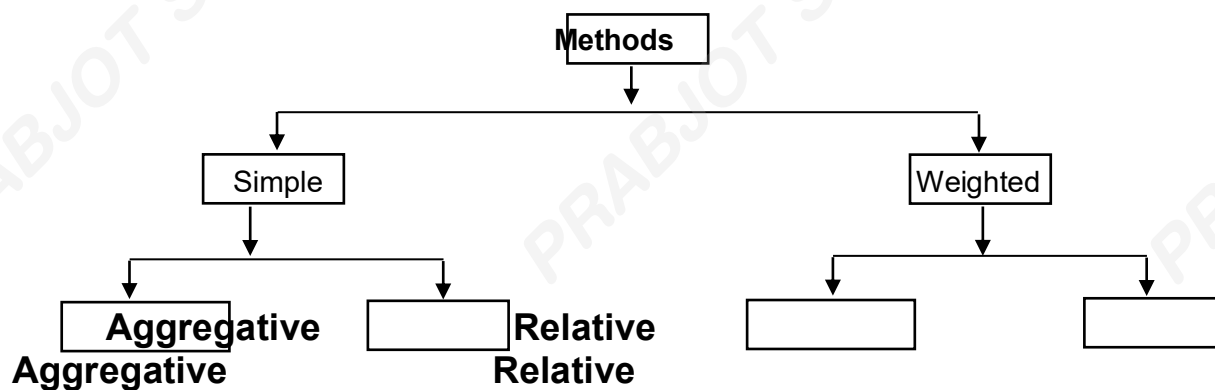
Unit
Test

Times
Reversal Text

Factor
Reversal Text

Circular
Test

Methods: We can state the broad heads as follows:



- ◆ An index number is a ratio or an average of ratios expressed as a percentage, Two or more time periods are involved, one of which is the base time period.
- ◆ Issues Involved in index numbers
 - (a) Selection of Data
 - (b) Base period
 - (c) Selection of Weights:
 - (d) Use of Averages:
 - (e) Choice of Variables
- ◆ Construction of Index Number Price Index numbers
 - (a) Simple aggregative price index = $\frac{\sum P_n}{\sum P_0} \times 100$
 - (b) Laspeyres' Index: In this Index base year quantities are used as weights:
 Laspeyres Index = $\frac{\sum P_n Q_0}{\sum P_0 Q_0} \times 100$
 - (c) Paasche's Index: In this Index current year quantities are used as weights:
 Passche's Index = $\frac{\sum P_n Q_n}{\sum P_0 Q_n} \times 100$
 - (d) The Marshall-Edgeworth index uses this method by taking the average of the base year and the current year
 Marshall-Edgeworth Index = $\frac{\sum P_n (Q_0 + Q_n)}{\sum P_0 (Q_0 + Q_n)} \times 100$
 - (e) Fisher's ideal Price Index: This index is the geometric mean of Laspeyres' and Paasche's.
 Fisher's Index = $\sqrt{\frac{\sum P_n Q_0}{\sum P_0 Q_0} \times \frac{\sum P_n Q_n}{\sum P_0 Q_n}} \times 100$
 - (g) Weighted Average of Relative Method : $\frac{\frac{\sum P_n}{P_0} \times (P_0 Q_0)}{\sum P_0 Q_0} \times 100 = \frac{\sum P_n Q_0}{\sum P_0 Q_0} \times 100$
 - (h) Cham index = $\frac{\text{Link relative of current year} \times \text{Chain Index of the previous year}}{100}$

Quantity Index Number

- ◆ Simple aggregate of quantities: $\frac{\sum Q_n}{\sum Q_0}$
- ◆ The simple average of quantity relatives: $\frac{\sum Q_n}{N}$
- ◆ Weighted aggregate quantity indices:

(i) With base year weight : $\frac{\sum Q_n P_0}{\sum Q_0 P_0}$ (Laspeyre's index)

(ii) With current year weight : $\frac{\sum Q_n P_n}{\sum Q_0 P_n}$ (Paasche's index)

(iii) Geometric mean of (i) and (ii) : $\sqrt{\frac{\sum Q_n P_0}{\sum Q_0 P_0} \times \frac{\sum Q_n P_n}{\sum Q_0 P_n}}$ (Fisher's Ideal)

◆ Base-year weighted average of quantity relatives. This has the formula $\frac{\sum \left(\frac{Q_n}{Q_0} Q_0 P_0 \right)}{\sum Q_0 P_0}$

◆ Value Indices

$$\frac{V_n}{V_0} = \frac{\sum P_n Q_n}{\sum Q_0 P_0}$$

◆ Deflated Value = $\frac{\text{Current Value}}{\text{Price Index of the current year}}$

or Current Value $\times \frac{\text{Base Price } (P_0)}{\text{Current Price } (P_n)} = \text{Base Price } (P_0)$

◆ Shifted Price Index = $\frac{\text{Original Price Index}}{\text{Price Index of the year on which it has to be shifted}} \times 100$

◆ Test of Adequacy

(1) Unit test

(2) Time reversal Test

(3) Factor reversal test

(4) Circular Test

EXERCISE

Choose the most appropriate option (a) (b) (c) or (d).

1. A series of numerical figures which show the relative position is called
 - a) index number
 - b) relative number
 - c) absolute number
 - d) none
2. Index number for the base period is always taken as
 - a) 200
 - b) 50
 - c) 1
 - d) 100
3. play a very important part in the construction of index numbers.
 - a) weights
 - b) classes
 - c) estimations
 - d) none
4. is particularly suitable for the construction of index numbers.
 - a) H.M.
 - b) A.M.
 - c) G.M.
 - d) none
5. Index numbers show changes rather than absolute amounts of change.
 - a) relative
 - b) percentage
 - c) both
 - d) none
6. The makes index numbers time-reversible.
 - a) A.M.
 - b) G.M.
 - c) H.M.
 - d) none
7. Price relative is equal to
 - a) $\frac{\text{Price in the given year} \times 100}{\text{Price in the base year}}$
 - b) $\frac{\text{Price in the year base year} \times 100}{\text{Price in the given year}}$
 - c) $\text{Price in the given year} \times 100$
 - d) $\text{Price in the base year} \times 100$
8. Index number is equal to
 - a) sum of price relatives
 - b) average of the price relatives
 - c) product of price relative
 - d) none
9. The of group indices given the General Index
 - a) H.M.
 - b) G.M.
 - c) A.M.
 - d) none
10. Circular Test is one of the tests of
 - a) index numbers
 - b) hypothesis
 - c) both
 - d) none
11. is an extension of time reversal test
 - a) Factor Reversal test
 - b) Circular test
 - c) both
 - d) none
12. Weighted G.M. of relative formula satisfy test
 - a) Time Reversal Test
 - b) Circular test
 - c) Factor Reversal Test
 - d) none

13. Factor Reversal test is satisfied by
 a) Fisher's Ideal Index b) Laspeyres Index
 c) Paasches Index d) none
14. Laspeyre's formula does not satisfy
 a) Factor Reversal Test b) Time Reversal Test
 c) Circular Test d) all the above
15. A ratio or an average of ratios expressed as a percentage is called
 a) a relative number b) an absolute number
 c) an index number d) none
16. The value at the base time period serves as the standard point of comparison
 a) false b) true
 c) both d) none
17. An index time series is a list of numbers for two or more periods of time
 a) index b) absolute
 c) relative d) none
18. Index numbers are often constructed from the
 a) frequency b) class
 c) sample d) none
19. is a point of reference in comparing various data describing individual behaviour.
 a) Sample b) Base period
 c) Estimation d) none
20. The ratio of price of single commodity in a given period to its price in the preceding year price is called the
 (a) base period (b) price ratio
 (c) relative price (d) none
21.
$$\frac{\text{Sum of all commodity prices in the current year} \times 100}{\text{Sum of all commodity prices in the base year}}$$
 is
 (a) Relative Price Index (b) Simple Aggregative Price Index
 (c) both (d) none
22. Chain index is equal to
 (a)
$$\frac{\text{link relative of current year} \times \text{chain index of the current year}}{100}$$

 (b)
$$\frac{\text{link relative of previous year} \times \text{chain index of the current year}}{100}$$

 (c)
$$\frac{\text{link relative of current year} \times \text{chain index of the previous year}}{100}$$

(d)
$$\frac{\text{link relative of previous year} \times \text{chain index of the previous year}}{100}$$

23. P_{01} is the index for time
 (a) 1 on 0 (b) 0 on 1
 (c) 1 on 1 (d) 0 on 0
24. P_{10} is the index for time
 (a) 1 on 0 (b) 0 on 1
 (c) 1 on 1 (d) 0 on 0
25. When the product of price index and the quantity index is equal to the corresponding value index then the test that holds is
 (a) Unit Test (b) Time Reversal Test
 (c) Factor Reversal Test (d) none holds
26. The formula should be independent of the unit in which or for which price and quantities are quoted in
 (a) Unit Test (b) Time Reversal Test
 (c) Factor Reversal Test (d) none
27. Laspeyre's method and Paasche's method do not satisfy
 (a) Unit Test (b) Time Reversal Test
 (c) Factor Reversal Test (d) b & c
28. The purpose determines the type of index number to use
 (a) yes (b) no
 (c) may be (d) may not be
29. The index number is a special type of average
 (a) false (b) true
 (c) both (d) none
30. The choice of suitable base period is at best temporary solution
 (a) true (b) false
 (c) both (d) none
31. Fisher's Ideal Formula for calculating index numbers satisfies the tests
 (a) Unit Test (b) Factor Reversal Test
 (c) both (d) none
32. Fisher's Ideal Formula dose not satisfy test
 (a) Unit Test (b) Circular Test
 (c) Time Reversal Test (d) none
33. satisfies circular test
 a) G.M. of price relatives or the weighted aggregate with fixed weights
 b) A.M. of price relatives or the weighted aggregate with fixed weights
 c) H.M. of price relatives or the weighted aggregate with fixed weights
 d) none

34. Laspeyre's and Paasche's method time reversal test
 (a) satisfy (b) do not satisfy
 (c) are (d) are not
35. There is no such thing as unweighted index numbers
 (a) false (b) true
 (c) both (d) none
36. Theoretically, G.M. is the best average in the construction of index numbers but in practice, mostly the A.M. is used
 (a) false (b) true
 (c) both (d) none
37. Laspeyre's or Paasche's or the Fisher's ideal index do not satisfy
 (a) Time Reversal Test (b) Unit Test
 (c) Circular Test (d) none
38. is concerned with the measurement of price changes over a period of years,
 when it is desirable to shift the base
 (a) Unit Test (b) Circular Test
 (c) Time Reversal Test (d) none
39. The test of shifting the base is called
 (a) Unit Test (b) Time Reversal Test
 (c) Circular Test (d) none
40. The formula for conversion to current value
 (a) Deflated value = $\frac{\text{Price Index of the current year}}{\text{previous value}}$
 (b) Deflated value = $\frac{\text{Price Index of the current year}}{\text{current value}}$
 (c) Deflated value = $\frac{\text{Price Index of the previous year}}{\text{previous value}}$
 (d) Deflated value = $\frac{\text{Price Index of the previous year}}{\text{previous value}}$
41. Shifted price Index = $\frac{\text{Original Price} \times 100}{\text{Price Index of the year on which it has to be shifted}}$
 (a) True (b) false
 (c) both (d) none
42. The number of test of Adequacy is
 (a) 2 (b) 5
 (c) 3 (d) 4
43. We use price index numbers
 (a) To measure and compare prices (b) to measure prices
 (c) to compare prices (d) none

44. Simple aggregate of quantities is a type of
(a) Quantity control (b) Quantity indices
(c) both (d) none

ANSWERS

Exercise

1. (a)	2. (d)	3. (a)	4. (c)	5. (b)	6. (b)	7. (a)	8. (b)
9. (c)	10. (a)	11. (b)	12. (a)	13. (a)	14. (d)	15. (c)	16. (b)
17. (a)	18. (c)	19. (b)	20. (c)	21. (b)	22. (c)	23. (a)	24. (b)
25. (c)	26. (a)	27. (d)	28. (a)	29. (b)	30. (a)	31. (c)	32. (b)
33. (a)	34. (b)	35. (a)	36. (b)	37. (c)	38. (b)	39. (c)	40. (b)
41. (a)	42. (d)	43. (a)	44. (b)				
-

ADDITIONAL QUESTION BANK

1. Each of the following statements is either True or False write your choice of the answer by writing T for True
 - (a) Index Numbers are the signs and guideposts along the business highway that indicate to the businessman how he should drive or manage.
 - (b) "For Construction index number, the best method on theoretical ground is not the best method from practical point of view".
 - (c) Weighting index numbers makes them less representative.
 - (d) Fisher's index number is not an ideal index number.
2. Each of the following statements is either True or False. Write your choice of the answer by writing F for false.
 - (a) Geometric mean is the most appropriate average to be used for constructing an index number.
 - (b) Weighted average of relatives and weighted aggregative methods render the same result.
 - (c) "Fisher's Ideal Index Number is a compromise between two well known indices - not a right compromise, economically speaking".
 - (d) "Like all statistical tools, index numbers must be used with great caution".
3. The best average for constructing an index numbers is
 - (a) Arithmetic Mean
 - (b) Harmonic Mean
 - (c) Geometric Mean
 - (d) None of these.
4. The time reversal test is satisfied by
 - (a) Fisher's index number.
 - (b) Paasche's index number.
 - (c) Laspeyre's index number.
 - (d) None of these.
5. The factor reversal test is satisfied by
 - (a) Simple aggregative index number.
 - (b) Paasche's index number.
 - (c) Laspeyre's index number.
 - (d) None of these.
6. The circular test is satisfied by
 - (a) Fisher's index number.
 - (b) Paasche's index number.
 - (c) Laspeyre's index number.
 - (d) None of these.
7. Fisher's index number is based on
 - (a) The Arithmetic mean of Laspeyre's and Paasche's index numbers.
 - (b) The Median of Laspeyre's and Paasche's index numbers.
 - (c) the Mode of Laspeyre's and Paasche's index numbers.
 - (d) None of these.
8. Paasche index is based on
 - (a) Base year quantities.
 - (b) Current year quantities.
 - (c) Average of current and base year.
 - (d) None of these.
9. Fisher's ideal index number is
 - (a) The Median of Laspeyre's and Paasche's index numbers

- (b) The Arithmetic Mean of Laspeyre's and Paasche's index numbers
 (c) The Geometric Mean of Laspeyre's and Paasche's index numbers
 (d) None of these.

10. Price-relative is expressed in term of

- (a) $P = \frac{P_n}{P_0}$ (b) $P = \frac{P_0}{P_n}$
 (c) $P = \frac{P_n}{P_0} \times 100$ (d) $P = \frac{P_0}{P_n} \times 100$

11. Paasehe's index number is expressed in terms of :

- (a) $\frac{\sum P_n q_n}{\sum P_0 q_n}$ (b) $\frac{\sum P_0 q_0}{\sum P_n q_n}$
 (c) $\frac{\sum P_n q_n}{\sum P_0 q_n} \times 100$ (d) $\frac{\sum P_n q_0}{\sum P_0 q_0} \times 100$

12. Time reversal Test is satisfied by following index number formula is

- (a) Laspeyre's Index number.
 (b) Simple Arithmetic Mean of price relative formula
 (c) Marshall-Edge worth formula.
 (d) None of these.

13. Cost of Living Index number (C. L. I.) is expressed in terms of :

- (a) $\frac{\sum P_n q_0}{\sum P_0 q_0} \times 100$ (b) $\frac{\sum P_0 q_n}{\sum P_n q_n} \times 100$
 (c) $\frac{\sum P_0 q_n}{\sum P_n q_n} \times 100$ s p q x 100 (d) None of these.

14. If the ratio between Laspeyre's index number and Paasche's Index number is 28 : 27. Then the missing figure in the following table p is :

Commodity	Base Year		Current Year	
	Price	Quantity	Price	Quantity
X	L	40	2	5
Y	L	5	P	2

- (a) 7 (b) 4
 (c) 3 (d) 9

15. If the prices of all commodities in a place have increased 1.25 times in comparison to the base period, the index number of prices of that place now is

- (a) 125 (b) 150
 (c) 225 (d) None of these.

16. If the index number of prices at a place in 1994 is 250 with 1984 as base year, then the prices have increased on average by

- (a) 250% (b) 150%

- (c) 350% (d) None of these.
17. If the prices of all commodities in a place have decreased 35% over the base period prices, then the index number of prices of that place is now
 (a) 35 (b) 135
 (c) 65 (d) None of these.
18. Link relative index number is expressed for period n is
 (a) $\frac{P_n}{P_{n+1}}$ (b) $\frac{P_0}{P_{n-1}}$
 (c) $\frac{P_n}{P_{n-1}} \times 100$ (d) None of these.
19. Fisher's Ideal Index number is expressed in terms of :
 (a) $(P_{on})^F = \sqrt{\text{Laspeyre's Index} \times (\text{Paasche's Index})}$
 (b) $(P_{on})^F = \text{Laspeyre's Index} \times \text{Paasche's Index}$
 (c) $(P_{on})^F = \sqrt{\text{Marshall Edge worth Index} \times \text{Paasche's}}$
 (d) None of these.
20. Factor Reversal Test According to Fisher is $P_{01} \times Q_{01} =$
 (a) $\frac{\sum P_0 q_0}{\sum P_n q_n}$ (b) $\frac{\sum P_n q_n}{\sum P_0 q_0}$
 (c) $\frac{\sum P_0 q_n}{\sum P_n q_n}$ (d) None of these.
21. Marshall-edge worth Index formula after interchange of p and q is expressed in terms of :
 (a) $\frac{\sum q_n (P_n + P_0)}{\sum q_n (P_0 + P_n)}$ (b) $\frac{\sum P_n (q_n + q_0)}{\sum q P_0 (q_0 + q_n)}$
 (c) $\frac{\sum P_0 (q_n + q_0)}{\sum P_0 (P_0 + P_n)}$ (d) None of these.
22. If $\sum P_n q_n = 249$, $\sum P_0 q_0 = 150$, Paasche's Index Number = 150 and Drobish and Bowley's Index number = 145, then the Fisher's Ideal Index Number is
 (a) 75 (b) 60
 (c) 145.97 (d) None of these.
23. Consumer Price index number for the year 1957 was 313 with 1940 as the base year 96 the Average Monthly wages in 1957 of the workers into factory be ` 160/- their real wages is
 (a) ` 48.40 (b) ` 51.12
 (c) 40.30 (d) None of these.
24. If $\sum P_0 q_0 = 3500$, $\sum P_n q_0 = 3850$, then the Cost of living Index (C.L.I.) for 1950 w.r. to base 1960 is
 (a) 110 (b) 90
 (c) 100 (d) None of these.
25. From the following table by the method of relatives using Arithmetic mean the price

Index number is

Commodity	Wheat	Milk	Fish	Sugar
Base Price	5	8	25	6
Current Price	7	10	32	12

- (a) 140.35 (b) 148.95
(c) 140.75 (d) None of these.

From the Q. No. 26 to 29 each of the following statements is either True or False with your choice of the answer by writing F for False.

26. (a) Base year quantities are taken as weights in Laspeyres's price Index number
(b) Fisher's ideal index is equal to the Arithmetic mean of Laspeyres's and Paasche's index numbers.
(c) Laspeyres's index number formula does not satisfy time reversal test.
(d) None of these.
27. (a) Current year quantities are taken as weights in Paasche's price index number.
(b) Edge worth Marshall's index number formula satisfies Time, Reversal Test.
(c) The Arithmetic mean of Laspeyres's and Paasche's index numbers is called Bowley's index numbers.
(d) None of these.
28. (a) Current year prices are taken as weights in Paasche's quantity index number.
(b) Fisher's Ideal Index formula satisfies factor Reversal Test.
(c) The sum of the quantities of the base period and current period is taken as weights in Laspeyres's index number.
(d) None of these.
29. (a) Simple Aggregative and simple Geometric mean of price relatives formula satisfy circular Test.
(b) Base year prices are taken as weights in Laspeyres's quantity index numbers.
(c) Fisher's Ideal Index formula obeys time reversal and factor reversal tests.
(d) None of these.
30. In 1980, the net monthly income of the employee was ₹ 800/- p. m. The consumer price index number was 160 in 1980. It rises to 200 in 1984. If he has to be rightly compensated. The additional D. A. to be paid to the employee is
(a) ₹ 175/- (b) ₹ 185/-
(c) ₹ 200/- (d) ₹ 125.
31. The simple Aggregative formula and weighted aggregative formula satisfy is
(a) Factor Reversal Test (b) Circular Test
(c) Unit Test (d) None of these.
32. "Fisher's Ideal Index is the only formula which satisfies"
(a) Time Reversal Test (b) Circular Test
(c) Factor Reversal Test (d) a & c.
33. "Neither Laspeyres's formula nor Paasche's formula obeys" :

- (a) Time Reversal and factor Reversal Tests of index numbers.
- (b) Unit Test and circular Tests of index number.
- (c) Time Reversal and Unit Test of index number.
- (d) None of these.

34. Bowley's index number is 150. Fisher's index number is 149.95. Paasche's index number is

- (a) 158
- (b) 154
- (c) 148
- (d) 156

35. With the base year 1960 the C. L. I. in 1972 stood at 250. x was getting a monthly Salary of ` 500 in 1960 and ` 750 in 1972. In 1972 to maintain his standard of living in 1960 x has to receive as extra allowances of

- (a) ` 600/-
- (b) ` 500/-
- (c) 300/-
- (d) none of these.

36. From the following data base year :-

Commodity	Base Year		Current Year	
	Price	Quantity	Price	Quantity
A	4	3	6	2
B	5	4	6	4
C	7	2	9	2
D	2	3	4	5

Fisher's Ideal Index is

- (a) 117.3
- (b) 115.43
- (c) 118.35
- (d) 116.48

37. Which statement is False?

- (a) The choice of suitable base period is at best a temporary solution.
- (b) The index number is a special type of average.
- (c) There is no such thing as unweighted index numbers.
- (d) Theoretically, geometric mean is the best average in the construction of index numbers but in practice, mostly the arithmetic mean is used.

38. Factor Reversal Test is expressed in terms of

- (a) $\frac{\sum P_1 Q_1}{\sum P_0 Q_0}$
- (b) $\frac{\sum P_1 Q_1}{\sum P_0 Q_0} \times \frac{\sum P_1 Q_1}{\sum P_0 Q_1}$
- (c) $\frac{\sum P_1 Q_1}{\sum Q_0 P_1}$
- (d) $\frac{\sum Q_1 P_0}{\sum Q_0 P_0} \times \frac{\sum P_1 Q_1}{\sum Q_0 P_1}$

39. Circular Test is satisfied by

- (a) Laspeyre's Index number.
- (b) Paasche's Index number

(c) The simple geometric mean of price relatives and the weighted aggregative with fixed weights.

(d) None of these.

40. From the following data for the 5 groups combined

Group	Weight	Index Number
Food	35	425
Cloth	15	235
Power & Fuel	20	215
Rent & Rates	8	115
Miscellaneous	22	150

The general Index number is

(a) 270

(b) 269.2

(c) 268.5

(d) 272.5

41. From the following data with 1966 as base year

Commodity	Quantity Units	Values (₹)
A	400	500
B	80	320
C	60	150
D	30	360

The price per unit of commodity A in 1966 is

(a) ₹ 5

(b) ₹ 6

(c) ₹ 4

(d) ₹ 12

42. The index number in whole sale prices is 152 for August 1999 compared to August 1998. During the year there is net increase in prices of whole sale commodities to the extent of

(a) 45%

(b) 35%

(c) 52%

(d) 48%

43. The value Index is expressed in terms of

(a) $\frac{\sum P_1 Q_1}{\sum P_0 Q_0} \times 100$

(b) $\frac{\sum P_1 Q_1}{\sum P_0 Q_0}$

(c) $\frac{\sum P_0 Q_0}{\sum P_1 Q_1} \times 100$

(d) $\frac{\sum P_0 Q_1 \times \sum P_1 Q_1}{\sum P_0 Q_0 \times \sum P_1 Q_0}$

44. Purchasing Power of Money is

(a) Reciprocal of price index number. (b) Equal to price index number.

(c) Unequal to price index number. (d) None of these.

45. The price level of a country in a certain year has increased 25% over the base period. The index number is

- (a) 25 (b) 125
(c) 225 (d) 2500
46. The index number of prices at a place in 1998 is 355 with 1991 as base. This means
(a) There has been on the average a 255% increase in prices.
(b) There has been on the average a 355% increase in price.
(c) There has been on the average a 250% increase in price.
(d) None of these.
47. If the price of all commodities in a place have increased 125 times in comparison to the base period prices, then the index number of prices for the place is now
(a) 100 (b) 125
(c) 225 (d) None of the above.
48. The wholesale price index number of agricultural commodities in a given region at a given date is 280. The percentage increase in prices of agricultural commodities over the base year is :
(a) 380 (b) 280
(c) 180 (d) 80
49. If now the prices of all the commodities in a place have been decreased by 85% over the base period prices, then the index number of prices for the place is now (index number of prices of base period = 100)
(a) 100 (b) 135
(c) 65 (d) None of these.
50. From the data given below

Commodity	Price Relative	Weight
A	125	5
B	67	2
C	250	3

- Then the suitable index number is
(a) 150.9 (b) 155.8
(c) 145.8 (d) None of these.
51. Bowley's Index number is expressed in the form of :
(a) $\frac{\text{Laspeyre's index} + \text{Paasche's index}}{2}$ (b) $\frac{\text{Laspeyre's index} \times \text{Paasche's index}}{2}$
(c) $\frac{\text{Laspeyre's index} - \text{Paasche's index}}{2}$ (d) None of these.
52. From the following data

Commodity	Base Price	Current Price
Rice	35	42
Wheat	30	35

Pulse	40	38
Fish	107	420

The simple Aggregative Index is

- (a) 115.8 (b) 110.8
(c) 112.5 (d) 113.4

53. With regard to Laspeyre's and Paasche's price index numbers, it is maintained that "If the prices of all the goods change in the same ratio, the two indices will be equal for them the weighting system is irrelevant; or if the quantities of all the goods change in the same ratio, they will be equal, for them the two weighting systems are the same relatively". Then the above statements satisfy.

- (a) Laspeyre's Price index $\neq$ Paasche's Price Index.
(b) Laspeyre's Price Index = Paasche's Price Index.
(c) Laspeyre's Price Index may be equal Paasche's Price Index.
(d) None of these.

54. The quantity Index number using Fisher's formula satisfies :

- (a) Unit Test (b) Factor Reversal Test.
(c) Circular Test. (d) Time Reversal Test.

55. For constructing consumer price Index is used :

- (a) Marshall Edge worth Method. (b) Paasche's Method.
(c) Dorbish and Bowley's Method. (d) Laspeyre's Method.

56. The cost of living Index (C.L.I.) is always :

- (a) Weighted index (b) Price Index.
(c) Quantity Index. (d) None of these.

57. The Time Reversal Test is not satisfied to :

- (a) Fisher's ideal Index. (b) Marshall Edge worth Method.
(c) Laspeyre's and Paasche Method. (d) None of these.

58. Given below are the data on prices of some consumer goods and the weights attached to the various items Compute price index number for the year 1985 (Base 1984 = 100)

Items	Unit	1984	1985	Weight
Wheat	Kg.	0.50	0.75	2
Milk	Litre	0.60	0.75	5
Egg	Dozen	2.00	2.40	4
Sugar	Kg.	1.80	2.40	8
Shoes	Pair	8.00	10.00	4

Then weighted average of price Relative Index is :

- (a) 125.43 (b) 123.3
(c) 124.53 (d) 124.52

59. The Factor Reversal Test is as represented symbolically is :

(a) $P_{01} \times Q_{01} = \frac{\sum P_1 Q_1}{\sum P_0 Q_0}$

(b) $I_{01} \times I_{10}$

(c) $\frac{\sum P_0 Q_0}{\sum P_1 Q_1}$

(d) $\sqrt{\frac{\sum P_1 Q_1}{\sum P_0 Q_0} \times \frac{\sum P_0 Q_1}{\sum Q_{10} P_0}}$

60. If the 1970 index with base 1965 is 200 and 1965 index with base 1960 is 150, the index 1970 on base 1960 will be :

(a) 700

(b) 300

(c) 500

(d) 600

61. Circular Test is not met by :

(a) The simple Geometric mean of price relatives.

(b) The weighted aggregative with fixed weights.

(c) Laspeyre's or Paasche's or the fisher's Ideal index.

(d) None of these.

62. From the following data

Commodity	Base Year		Current Year	
	Price	Quantity	Price	Quantity
A	4	3	6	2
B	5	4	6	4
C	7	2	9	2
D	2	3	4	5

Then the value ratio is:

(a) $\frac{59}{52}$

(b) $\frac{49}{47}$

(c) $\frac{41}{53}$

(d) $\frac{47}{53}$

63. The value index is equal to :

(a) The total sum of the values of a given year multiplied by the sum of the values of the base year.

(b) The total sum of the values of a given year Divided by the sum of the values of the base year.

(c) The total sum of the values of a given year plus by the sum of the values of the base year.

(d) None of these.

64. Time Reversal Test is represented symbolically by :

(a) $P_{01} \times P_{10}$

(b) $P_{01} \times P_{10} = 1$

(c) $P_{01} \times P_{10} \neq 1$

(d) None of these.

65. In 1996 the average price of a commodity was 20% more than in 1995 but 20% less

than in 1994; and more over it was 50% more than in 1997 to price relatives using 1995 as base (1995 price relative 100) Reduce the data is :

- (a) 150, 100, 120, 80 for (1994-97) (b) 135, 100, 125, 87 for (1994-97)
 (c) 140, 100, 120, 80 for (1994-97) (d) None of these.

66. From the following data

Commodities	Base Year 1922 Price (₹)	Current Year 1934 Price
A	6	40
B	2	2
C	4	6
D	11	12
E	8	12

The price index number for the year 1934 is :

- (a) 140 (b) 145
 (c) 147 (d) None of these.

67. From the following data

Commodities	Base Price 1964	Current Price 1968
Rice	36	54
Pulse	30	50
Fish	130	155
Potato	40	35
Oil	110	110

The index number by unweighted methods :

- (a) 116.8 (b) 117.25
 (c) 115.35 (d) 119.37

68. The Bowley's Price index number is represented in terms of :

- (a) A.M. of Laspeyre's and Paasche's Price index number.
 (b) G.M. of Laspeyre's and Paasche's Price index number.
 (c) A.M. of Laspeyre's and Walsh's price index number.
 (d) None of these.

69. Fisher's price index number equal is :

- (a) G.M. of Kelly's price index number and Paasche's price index number.
 (b) G.M. of Laspeyre's and Paasche's Price index number.
 (c) G.M. of Bowley's price index number and Paasche's price index number.
 (d) None of these.

70. The price index number using simple G.M. of the n relatives is given by :

$$(a) \log I_{on} = 2 - \frac{1}{n} \sum \log \frac{P_n}{P_0}$$

$$(b) \log I_{on} = 2 + \frac{1}{n} \sum \log \frac{P_n}{P_0}$$

$$(c) \log I_{on} = \frac{1}{2n} \sum \log \frac{P_n}{P_0}$$

(d) None of these.

71. The price of a number of commodities are given below in the current year 1975 and base year 1970.

Commodities	A	B	C	D	E	F
Base Price	45	60	20	50	85	120
Current Price	55	70	30	75	90	130

For 1975 with base 1970 by the Method of price relatives using Geometrical mean, the price index is:

- (a) 125.3
(b) 124.3
(c) 128.8
(d) None of these.

72. From the following data

Group	A	B	C	D	E	F
Group Index	120	132	98	115	108	95
Weight	6	3	4	2	4	4

The general Index I is given by :

- (a) 111.3
(b) 113.45
(c) 117.25
(d) 114.75
73. The price of a commodity increases from ` 5 per unit in 1990 to ` 7.50 per unit in 1995 and the quantity consumed decreases from 120 units in 1990 to 90 units in 1995. The price and quantity in 1995 are 150% and 75% respectively of the corresponding price and quantity in 1990. Therefore, the product of the price ratio and quantity ratio is :
- (a) 1.8
(b) 1.125
(c) 1.75
(d) None of these.
74. Test whether the index number due to Walsh give by :

$$I = \frac{\sum P_1 \sqrt{Q_0 Q_1}}{\sum P_0 \sqrt{Q_0 Q_1}} \times 100 \text{ Satisfies is :-}$$

- (a) Time reversal Test.
(b) Factor reversal Test.
(c) Circular Test.
(d) None of these.

75. From the following data

Group	Weight	Index Number Base : 1952-53 = 100
Food	50	241
Clothing	2	21

Fuel and Light	3	204
Rent	16	256
Miscellaneous	29	179

The Cost of living index numbers is :

- (a) 224.5 (b) 223.91
(c) 225.32 (d) None of these.
76. Consumer price index number goes up from 110 to 200 and the Salary of a worker is also raised from ₹ 325 to ₹ 500. Therefore, in real terms, to maintain his previous standard of living he should get an additional amount of :
(a) ₹ 85 (b) ₹ 90.91
(c) ₹ 98.25 (d) None of these.
77. The prices of a commodity in the year 1975 and 1980 were 25 and 30 respectively taking 1980 as base year the price relative is :
(a) 109.78 (b) 110.25
(c) 113.25 (d) None of these.
78. The average price of certain commodities in 1980 was ₹ 60 and the average price of the same commodities in 1982 was ₹ 120. Therefore, the increase in 1982 on the basis of 1980 was 100%. 80. The decrease in 1980 with 1982 as base is: using 1982, comment on the above statement is :
(a) The price in 1980 decreases by 60% using 1982 as base.
(b) The price in 1980 decreases by 50% using 1982 as base.
(c) The price in 1980 decreases by 90% using 1982 as base.
(d) None of these.
79. Cost of Living Index (C.L.I.) numbers are also used to find real wages by the process of
(a) Deflating of Index number. (b) Splicing of Index number.
(c) Base shifting. (d) None of these.
80. From the following data

Commodities		A	B	C	D
1992 Base	Price	3	5	4	1
	Quantity	18	6	20	14
1993 Current Year	Price	4	5	6	3
	Quantity	15	9	26	15

The Passche price Index number is :

- (a) 146.41 (b) 148.25
(c) 144.25 (d) None of these.
81. From the following data

Commodity	Base Year		Current Year	
	Price	Quantity	Price	Quantity
A	7	17	13	25
B	6	23	7	25
C	11	14	13	15
D	4	10	8	8

The Marshall Edge Worth Index number is :

- (a) 148.25 (b) 144.19
(c) 147.25 (d) None of these.
82. The circular Test is an extension of
(a) The time reversal Test. (b) The factor reversal Test.
(c) The unit Test. (d) None of these.
83. Circular test, an index constructed for the year 'x' on the base year 'y' and for the year 'y' on the base year 'z' should yield the same result as an index constructed for 'x' on base year 'z' i.e. $I_{01} \times I_{12} \times I_{20}$ equal is :
(a) 3 (b) 2
(c) 1 (d) None of these.
84. In 1976 the average price of a commodity was 20% more than that in 1975 but 20% less than that in 1974 and more over it was 50% more than that in 1977. The price relatives using 1975 as base year (1975 price relative = 100) then the reduce date is :
(a) 8,.75 (b) 150,80
(c) 75,125 (d) None of these.
85. Time Reversal Test is represented by symbolically is :
(a) $P_{01} \times Q_{01} = 1$ (b) $I_{01} \times I_{10} = 1$
(b) $I_{01} \times I_{12} \times I_{23} \times \dots \times I_{(n-1)n} \times I_{n0} = 1$ (d) None of these.
86. The prices of a commodity in the years 1975 and 1980 were 25 and 30 respectively, taking 1975 as base year the price relative is :
(a) 120 (b) 135
(c) 122 (d) None of these.
87. From the following data

Year	1992	1993	1995	1996	1997
Link Index	100	103	105	112	108

(Base 1992 = 100) for the years 1993-97. The construction of chain index is :

- (a) 103, 100.94, 107, 118.72 (b) 103, 108.15, 121.3, 130.82
(c) 107, 100.25, 104, 118.72 (d) None of these.
88. During a certain period the cost of living index number goes up from 110 to 200 and the salary of a worker is also raised from ` 330 to ` 500. The worker does not get really gain. Then the real wages decreased by :

- (a) ` 45.45 (b) ` 43.25
(c) ` 100 (d) None of these.
89. Net monthly salary of an employee was ` 3000 in 1980. The consumer price index number in 1985 is 250 with 1980 as base year. If he has to be rightly compensated then, 7th dearness allowances to be paid to the employee is :
- (a) ` 4,800.00 (b) ` 4,700.00
(c) ` 4,500.0 (d) None of these.
90. Net Monthly income of an employee was ` 800 in 1980. The consumer price Index number was 160 in 1980. It rises to 200 in 1984. If he has to be rightly compensated. The additional dearness allowance to be paid to the employee is :
- (a) ` 240 (b) ` 275
(c) ` 250 (d) None of these.
91. When the cost of Tobacco was increased by 50%, a certain hardened smoker, who maintained his formal scale of consumption, said that the rise had increased his cost of living by 5%. Before the change in price, the percentage of his cost of living was due to buying Tobacco is
- (a) 15% (b) 8%
(c) 10% (d) None of these.
92. If the price index for the year, say 1960 be 110.3 and the price index for the year, say 1950 be 98.4, then the purchasing power of money (Rupees) of 1950 will in 1960 is
- (a) ` 1.12 (b) ` 1.25
(c) ` 1.37 (d) None of these.
93. If $\sum P_0 Q_0 = 1360$, $\sum P_n Q_0 = 1900$, $\sum P_0 Q_n = 1344$, $\sum P_n Q_n = 1880$ then the Laspeyre's Index number is
- (a) 0.71 (b) 1.39
(c) 1.75 (d) None of these.
94. The consumer price Index for April 1985 was 125. The food price index was 120 and other items index was 135. The percentage of the total weight of the index is
- (a) 66.67 (b) 68.28
(c) 90.25 (d) None of these.
95. The total value of retained imports into India in 1960 was ` 71.5 million per month. The corresponding total for 1967 was ` 87.6 million per month. The index of volume of retained imports in 1967 composed with 1960 (= 100) was 62.0. The price index for retained inputs for 1967 our 1960 as base is
- (a) 198.61 (b) 197.61
(c) 198.25 (d) None of these.
96. During the certain period the C.L.I. goes up from 110 to 200 and the Salary of a worker is also raised from 330 to 500, then the real terms is
- (a) Loss by ` 50 (b) Loss by 75
(c) Loss by ` 90 (d) None of these.
97. From the following data

Commodities	Q0	P0	Q1	P1

A	2	2	6	18
B	5	5	2	2
C	7	7	4	24

Then the fisher's quantity index number is

- (a) 87.34 (b) 85.24
(c) 87.25 (d) None of these.

98. From the following data

Commodities	Base year	Current year
A	25	55
B	30	45

Then index numbers from G. M. Method is :

- (a) 181.66 (b) 185.25
(c) 181.75 (d) None of these.

99. Using the following data

Commodity	Base Year		Current Year	
	Price	Quantity	Price	Quantity
X	4	10	6	15
Y	6	15	4	20
Z	8	5	10	4

The Paasche's formula for index is :

- (a) 125.38 (b) 147.25
(c) 129.8 (d) None of these.

100. Group index number is represented by

- (a) $\frac{\text{Price Relative for the year}}{\text{Price Relative for the previous year}} \times 100$ (b) $\frac{(\sum \text{Price Relative} \times w)}{\sum w}$
(c) $\frac{\sum (\text{Price Relative} \times w)}{\sum w} \times 100$ (d) None of these.

ANSWERS

1. (a) 2. (c) 3. (c) 4. (a) 5. (a)
6. (d) 7. (d) 8. (b) 9. (c) 10. (c)

- 11 (c) 12. (c) 13. (a) 14. (b) 15. (c)
- 16 (b) 17. (c) 18. (c) 19. (a) 20. (b)
- 21 (a) 22. (d) 23. (b) 24. (a) 25. (b)
- 26 (b) 27. (d) 28. (c) 29. (d) 30. (c)
- 31 (b) 32. (d) 33. (a) 34. (a) 35. (b)
- 36 (a) 37. (c) 38. (a) 39. (c) 40. (b)
- 41 (a) 42. (c) 43. (a) 44. (a) 45. (b)
- 46 (a) 47. (c) 48. (c) 49. (c) 50. (a)
- 51 (a) 52. (b) 53. (b) 54. (d) 55. (d)
- 56 (a) 57. (c) 58. (b) 59. (a) 60. (b)
- 61 (c) 62. (a) 63. (b) 64. (b) 65. (a)
- 66 (d) 67. (a) 68. (a) 69. (b) 70. (b)
- 71 (b) 72. (a) 73. (b) 74. (a) 75. (d)
- 76 (b) 77. (d) 78. (b) 79. (a) 80. (a)
- 81 (b) 82. (a) 83. (c) 84. (b) 85. (b)
- 86 (a) 87. (b) 88. (c) 89. (c) 90. (a)
- 91 (c) 92. (a) 93. (b) 94. (a) 95. (b)
- 96 (a) 97. (a) 98. (a) 99. (d) 100. (b)

PAST YEARS QUESTION

2014 - DECEMBER

1. If $\sum P_1 Q_0 = 1180$, $\sum P_0 Q_0 = 1170$, $\sum P_1 Q_1 = 1064$, $\sum P_0 Q_1 = 1100$. The Fisher's ideal Index is:
(a) 96.73 (h) 38.795
(c) **98.77** (d) 100.86
2. If the price of a commodity in a place has decreased by 30% over the base period prices, then the index number of the place is:
(a) 30 (b) 60
(c) **70** (d) 80

2015 – JUNE

3. If with an increase of 10% in prices, the rise in wages is 20% then the real wage has increased by
(a) **20%** (b) 10%
(c) Less than 10% (d) More than 10% .
4. _____ play a very important role in the construction of index numbers.

(a) Weights

- (b) Classes
(c) Estimations
(d) None)

2015 - DECEMBER

5. Consumer price index number for the year 1977, was 313, with 1960 as the base year, and was 100 for the year 1960. The average monthly wages in 1977 of the workers into factory be Rs. 160, their real wages is:
(a) Rs. 48.40 (b) **Rs. 51.12**
(c) Rs. 40.30 (d) None of the above

2016 - JUNE

6. Purchasing power of money is
(a) **Reciprocal of price index number**
(b) Equal to price index number
(c) Unequal to price index number
(d) None of these. (1 mark)
7. If $\sum P_0 Q_0 = 1360$, $\sum P_n Q_0 = 1900$, $\sum P_0 Q_n = 1344$, $\sum P_n Q_n = 1880$, then the Laspeyre's Index Number is

- (a) 0.71 **(b) 1.39**
- (c) 1.76 (d) none.
8. In the year 2010 the monthly salary of a clerk was Rs. 24,000. The consumer price Index was 140 in the year 2010, which rises to 224 in the year 2016. If he has to be rightly compensated, what additional monthly salary should be paid to him?
- (a) Rs. 14,400** (b) Rs. 38,400
- (c) Rs. 7,200 (d) None of these
9. The suitable index number for the comparison of changes in price level of every year is _____.
- (a) Fixed Base Index Number
- (b) Fisher's Ideal Index Number
- (c) Chain Base index Number**
- (d) Both (a) and (c)

2016- DECEMBER

10. Following is the data concerning to commodities A, B, C and D in the base period 1992 and current period 1993.

Commodities	Base Year 1992		Current Year 1993	
	Price	Quantity	Price	Quantity
A	3	18	4	15
B	5	6	5	9
C	4	20	6	26
D	1	14	3	15

The Paasche's price index number is:

- (a) 148.25 **(b) 146.41**
- (c) 144.25 (d) None of these
11. Which method satisfy time reversal test?
- (a) Laspeyres's method (b) Paasche's method
- (c) Fishers method** (d) None of these.
12. Index number are the _____.
- (a) Economic (b) Statistics
- (c) (a) and (b)** (d) None of these.

2017-JUNE

13. The monthly income of an employee was Rs. 8,000 in 2014. The consumer price index number was 160 in 2014, which rose to 200 in 2017. If he has to be rightly compensated, the additional dearness allowance to be paid to him in 2017 would be:

- (a) Rs. 2,400 (b) Rs. 2,750
(c) Rs. 2,500 **(d) None of these.**

14. If Laspeyre's index number (L) and Paasche's index number (P) are known, then one can compute Fisher's index number (F) by:

- (a) $F = LP$ (b) $\sqrt{F} = LP$
(c) $F = \frac{1}{LP}$ **(d) $F^2 = LP$**

15. Fisher's index number does not satisfy:

- (a) Unit Test **(b) Circular Test**
(c) Time reversal test (d) Factor reversal test.

2017 - December

16. Circular Test is an extension of _____.

- (a) Factor reversal test **(b) Time reversal test**
(c) Neither (a) nor (b) (d) Both (a) and (b).

17. Fishers index number is based on:

- (a) The arithmetic mean of Laspeyre's and Paasche's index numbers
(b) The meciari of Laspeyre's and Paasche's index numbers
(c) The mode of Laspeyre's and Paasche's index numbers
(d) None of the above.

18. Price relative is equal to:

- (a) $\frac{\text{Price in the given year}}{\text{Price in the base year}} \times 100$**
(b) $\frac{\text{Price in tine base year}}{\text{Price in the given year}} \times 100$
(c) Price in the given year $\times 100$
(d) Price in the base year $\times 100$.

19. For consumer price index, prices are collected from:

- (a) Retail traders** (b) Wholesale traders
(c) Fair price shops (d) Government Depots.

2018 - May

20. Time reversal & factor reversal are:

- (a) Quantity Index (b) ideal Index
(c) Price Index **(d) Test of consistency**

21. A series of numerical figures which show the relative position is called,

- (a) **Index number** (b) Relative number
(c) Absolute number (d) None

22. The number of test of Adequacy is:

- (a) 2 (b) 5
(c) 3 (d) **4**

Answer:

(d) The Number of test of Adequacy is 4.

23. P_{01} is the index for time

- (a) **1 on 0** (b) 0 on 1
(c) 1 on 1 (d) 0 on 0

24. The circular test is an extension of

- (a) **The time is reversal test** (b) The factor reversal test
(c) The unit test (d) None of these.

Answer:

(a) The circular test is the extension of Time Reversal Test.

25. If $\sum P_0 Q_0 = 1360$, $\sum P_n Q_0 = 1900$, $\sum P_0 Q_n = 1344$, $\sum P_n Q_n = 1880$ then the Laspeyre's. Index number is

- (a) 0.71 (b) **1.39**
(c) 1.75 (d) None of these

26. Price -relative is expressed in term of

(a) $P = \frac{P_n}{P_0}$ (b) $P = \frac{P_0}{P_n}$

(c) $P = \frac{P_n}{P_0} \times 100$ (d) $P = \frac{P_0}{P_n} \times 100$

27. Circular test is satisfied by

- (a) Lespeyre's Index Number
(b) Paasche's index Number
(c) **The simple geometric mean of price relatives and the weighted aggregative with fixed weights.**
(d) None of these

Answer:

(c) Circular test is satisfied by the simple geometric mean of price relatives and weighted aggregative with fixed weights.

28. If the 1970 index with base 1965 is 200 and 1965 index with base 1960 is 150, what will be the index of 1970 on base 1960?

- (a) 700 (b) **300**
(c) 500 (d) 600

2018 - November

29. Which of the following statement is true?

- (a) Paache's Index Number is based on the base year quantity
- (b) Fisher's Index Number is the Arithmetic Mean of Laspeyre's Index Number and Paache's Index number
- (c) Arithmetic Mean is the most appropriate average for constructing the index number
- (d) Fisher's Index Number is an Ideal Index Number**

Answer:

(d) Fisher's Index Number is an Ideal Index No.

30. If Laspeyre's Index Number is 250 and Paache's Index Number is 160, then Fisher's Index Number is

- (a) 40,000 (b) $\frac{25}{16}$
- (c) 200** (d) $\frac{16}{25}$

31. If $\sum p_0 q_0 = 240$, $\sum p_1 q_1 = 480$, $\sum p_1 q_0 = 600$ and $\sum p_0 q_1 = 192$, then Laspeyre's Index Number is

- (a) 250** (b) 300
- (c) 350 (d) 200

2019 - June

32. Which is called an ideal index numbers

- (a) Laspeyre's index number
- (b) Pasche's index number
- (c) Fisher's index number**
- (d) Marshall Edgeworth index number

33. Which is not satisfied by Fisher's ideal index number?

- (a) Factor Reversal Test
- (b) Time Reversal Test
- (c) Circular Test**
- (d) None of the above

Answer:

(c) Circular test is not satisfied by Fisher's Ideal Index No.

34. The prices and quantities of 3 commodities in base and current years are as follows:

p_0	p_1	q_0	q_1
12	14	10	20
10	8	20	30
8	10	30	10

The Laspeyre price index is

(a) 118.13

(b) 107.14

(c) 120.10

(d) None

Answer:

35. The cost of living index numbers in years 2015 and 2018 were 97.5 and 115 respectively. The salary of a worker in 2015 was Rs. 19500. How much additional salary was required for him in 2018 to maintain the same standard of living as in 2015?

(a) 3000

(b) 4000

(c) 3500

(d) 4500

2019 - NOVEMBER

36. Fisher's index number does not satisfy:

(a) Circular test

(b) Time reversal test

(c) Factor reversal test

(d) Unit test

37. The index number of prices at place in the year 2008 is 225 with 2004 as the base then there is:

(a) 125% increase

(b) 225% increase

(c) 100% increase

(d) 25% decrease

2020 - NOVEMBER

38. Fisher's ideal Index Number does not satisfy _____ test

(a) Circular

(b) Time reversal

(c) Factor Reversal

(d) Unit

39. Index Numbers are expressed as

(a) Squares

(b) Ratio

(c) Percentages

(d) Combinations

40. In Laspeyre's index number is 110 and Fisher's ideal index number is 109. Then Paasche's index number is

- (a) 118
- (b) 110
- (c) 109
- (d) **108**

2021 - JANUARY

41. The cost of living index is always

- (a) Price index number
- (b) Quantity index number
- (c) **Weighted index number**
- (d) Value index number

Answer:

- (c) The cost of living Index is always **weighted Index Number**.

42. Fisher's index number does not satisfy

- (a) Unit test
- (b) Circular test
- (c) Time reversal test
- (d) Factor reversal test

43. When the prices for quantities consumed of all commodities are changing in the same ratio, then the index numbers due to Laspeyre's and Paasche's will be.

- (a) **Equal**
- (b) Unequal
- (c) Reciprocal of Marshall Edge worth Index Number
- (d) Reciprocal of Fisher Index Number

2021 - JULY

44. The weighted aggregative price index turnover for 2001 with 2000 as the base year using Fisher's Index Number is :

Commodity	Price (In Rs.)		Quantities	
	2000	2001	2000	2001
A	10	12	20	22
B	8	8	16	18
C	5	6	10	11
D	4	4	7	8

- (a) 12.26
- (b) 112.20
- (c) 112.32

(d) **126.01**

45. The weighted aggregative price index numbers for 2001 with 2000 as the base year using Paasche's index number is :

Commodity	Price (In Rs.)		Quantities	
	2000	2001	2000	2001
A	10	12	20	22
B	8	8	16	18
C	5	6	10	11
D	4	4	7	8

(a) 112.32

(b) 112.38

(c) 112.26

(d) **112.20**

46. The weighted aggregative price index numbers for 2001 with 2000 as the base year using Marshall Edgeworth index number is:

Commodity	Price in (Rs.)		Quantities	
	2000	2001	2000	2001
A	10	12	20	22
B	8	8	16	18
C	5	6	10	11
D	4	4	7	8

(a) 112.26 (b) 112.20

(c) 112.32 (d) 112.38

47. The consumer price index goes up from 120 to 180 when salary goes up from 240 to 540, what is the increase in real terms?

(a) 80 (b) 150

(c) **360** (d) 240

2021 - DECEMBER

48. If P_{10} and P_{01} are index for 1 on 0 and 0 on 1 respectively then formula $P_{01} \times P_{10} = 1$ is used for

(a) Unit Test **(b) Time Reversal Test**

(c) Factor Reversal Test (d) Circular Test

49. The weighted averaged of price relatives of commodities, when the weights are equal to the value of commodities in the current year, yields _____ index number.

(a) Fisher's ideal (b) Laspeyres's

(c) Paasches' (d) Marshall-Edgeworth

50. From the following data base year:

Commodity		Base year		Current year
	Price	Quantity	Price	Quantity
A	4	3	6	2
B	5	4	6	4
C	7	2	9	2
D	2	3	1	5

Fisher's Ideal Index is

(a) 117.30 (b) 115.43

(c) 118.35 (d) 116.48

51. Index numbers are not helpful in

(a) Framing economics policies

(b) Revealing trend

(c) Forecasting

(d) Identifying errors

Answer:

(d) Index numbers are not helpful in Identifying Errors.

52. The three index numbers, namely, Laspeyre, Paasche and Fisher donot satisfy _____ test.

(a) Time reversal (b) Factor reversal

(c) Unit **(d) Circular**

JUNE 2022

53. Which of the Following Index measures the change from the Month in the Cost of a representative basket of goods and services of the type which are bought by a typical household?

(a) **Retail Price Index**

(b) Laspeyres index

(c) Fishers index

(d) Paasche index

DEC 2022

54. Fisher's index number is called as ideal index number because it is satisfying?

- A. Factor reversal test B. Time reversal test
C Both factor and time reversal test. D. Circular test

55. If Lapeyre's Index is 119 and Paasche's Index is 112, then Fisher's Index number will be:

- A. 113.99 B. 115.45 C. 115.89 D. 151.98

56. In price index, when a new commodity is required to be added, which of the following index is used?

- A. Shifted price index B. Splicing price index
C. Deflating price index D. Value price index

JUNE 2023

57. If Fisher index is 160 and Paasche Index is 140 and Laspeyres is

- A. 147.77 B. 182.85 C. 183.35 D. 146.25

58. The index of prices for a country at a given data 250, in comparison to base period price, the price of all commodities in the country has increases by _____ times.

- A. 1.25 **B. 1.5** C. 2 D. 2.5

59. From the following data

Commodity				Current year
Base year				
	Price	Quantity	Price	Quantity
A	10	5	20	2
B	15	4	25	8
C	40	2	60	6
D	25	3	40	4

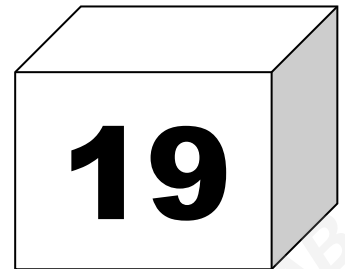
Laspeyres Index is

- (a) **166.04** (b) 166.40
(c) 164.04 (d) 164.40

60. Which of the following index is computed by taking the average of base year and current

year is ?

- (a) Laspeyre's index number
- (c) Fisher's index number
- (b) Pasche's index number
- (d) Marshall Edgeworth index number**



SAMPLING THEORY

INTRODUCTION

There are situations when we would like to know about a vast, infinite universe or population. But some important factors like time, cost, efficiency, vastness of the population make it almost impossible to go for a complete enumeration of all the units constituting the population. Instead, we take recourse to selecting a representative part of the population and infer about the unknown universe on the basis of our knowledge from the known sample. A somewhat clear picture would emerge out if we consider the following cases.

In the first example let us share the problem faced by Mr. Basu. Mr. Basu would like to put a big order for electrical lamps produced by Mr. Ahuja's company "General Electricals". But before putting the order, he must know whether the claim made by Mr. Ahuja that the lamps of General Electricals last for at least 1500 hours is justified.

Miss Manju Bedi is a well-known social activist. Of late, she has noticed that the incidence of a particular disease in her area is on the rise. She claims that twenty per cent of the people in her town have been suffering from the disease.

In both the situations, we are faced with three different types of problems. The first problem is how to draw a representative sample from the population of electrical lamps in the first case and from the population of human beings in her town in the second case. The second problem is to estimate the population parameters i.e., the average life of all the bulbs produced by General Electricals and the proportion of people suffering from the disease in the first and second examples respectively on the basis of sample observations. The third problem relates to decision making i.e., is there enough evidence, once again on the basis of sample observations, to suggest that the claims made by Mr. Ahuja or Miss Bedi are justifiable so that Mr. Basu can take a decision about buying the lamps from General Electricals in the first case and some effective steps can be taken in the second example with

a view to reducing the outbreak of the disease. We consider tests of significance or tests of hypothesis before decision making.

BASIC PRINCIPLES OF SAMPLE SURVEY

Sample Survey is the study of the unknown population on the basis of a proper representative sample drawn from it. How can a part of the universe reveal the characteristics of the unknown universe? The answer to this question lies in the basic principles of sample survey comprising the following components:

- (a) Law of Statistical regularity
- (b) Principle of Inertia
- (c) Principle of Optimization
- (d) Principle of Validity

According to the law of statistical regularity, if a sample of fairly large size is drawn from the population under discussion at random, then on an average the sample would possess the characteristics of that population.

Thus the sample, to be taken from the population, should be moderately large. In fact larger the sample size, the better in revealing the identity of the population. The reliability of a statistic in estimating a population characteristic varies as the square root of the sample size. However, it is not always possible to increase the sample size as it would put an extra burden on the available resource. We make a compromise on the sample size in accordance with some factors like cost, time, efficiency etc.

Apart from the sample size, the sample should be drawn at random from the population which means that each and every unit of the population should have a pre-assigned probability to belong to the sample.

The results derived from a sample, according to the principle of inertia of large numbers, are likely to be more reliable, accurate and precise as the sample size increases, provided other factors are kept constant. This is a direct consequence of the first principle.

The principle of optimization ensures that an optimum level of efficiency at a minimum cost or the maximum efficiency at a given level of cost can be achieved with the selection of an appropriate sampling design.

The principle of validity states that a sampling design is valid only if it is possible to obtain valid estimates and valid tests about population parameters. Only a probability sampling ensures this validity.

COMPARISON BETWEEN SAMPLE SURVEY AND COMPLETE ENUMERATION

When complete information is collected for all the units belonging to a population, it is defined as complete enumeration or census. In most cases, we prefer sample survey to complete enumeration due to the following factors:

Speed: As compared to census, a sample survey could be conducted, usually, much more quickly simply because in sample survey, only a part of the vast population is enumerated.

Cost: The cost of collection of data on each unit in case of sample survey is likely to be more as compared to census because better trained personnel are employed for conducting a sample survey. But when it comes to total cost, sample survey is likely to be less expensive as only some selected units are considered in a sample survey.

Reliability: The data collected in a sample survey are likely to be more reliable than that in a complete enumeration because of trained enumerators better supervision and application of modern technique.

Accuracy: Every sampling is subjected to what is known as sampling fluctuation which is termed as sampling error. It is obvious that complete enumeration is totally free from this sampling error. However, errors due to recording observations, biases on the part of the enumerators, wrong and faulty interpretation of data etc. are prevalent in both sampling and census and this type of error is termed as non-sampling errors. It may be noted that in sample survey, the sampling error can be reduced to a great extent by taking several steps like increasing the sample size, adhering to a probability sampling design strictly and so on. The non-sampling errors also can be contained to a desirable degree by a proper planning which is not possible or feasible in case of complete enumeration.

Necessity: Sometimes, sampling becomes necessity. When it comes to destructive sampling where the items get exhausted like testing the length of life of electrical bulbs or sampling from a hypothetical population like coin tossing, there is no alternative to sample survey.

However, when it is necessary to get detailed information about each and every item constituting the population, we go for complete enumeration. If the population size is not large, there is hardly any merit to take recourse to sampling. If the occurrence of just one defect may lead to a complete destruction of the process as in an aircraft, we must go for complete enumeration.

ERRORS IN SAMPLE SURVEY

Errors or biases in a survey may be defined as the deviation between the value of population parameter as obtained from a sample and its observed value. Errors are of two types.

Sampling Errors

Non-Sampling Errors

Sampling Errors : Since only a part of the population is investigated in a sampling, every sampling design is subjected to this type of errors. The factors contributing to sampling errors are listed below:

Errors arising out due to defective sampling design: Selection of a proper sampling design plays a crucial role in sampling. If a non-probabilistic sampling design is followed, the bias or prejudice of the sampler affects the sampling technique thereby resulting some kind of error.

Errors arising out due to substitution: A very common practice among the enumerators is to replace a sampling unit by a suitable unit in accordance with their convenience when difficulty arises

in getting information from the originally selected unit. Since the sampling design is not strictly adhered to, this results in some type of bias.

Errors owing to faulty demarcation of units: It has its origin in faulty demarcation of sampling units. In case of an agricultural survey, the sampler has, usually, a tendency to underestimate or overestimate the character under consideration.

Errors owing to wrong choice of statistic: One must be careful in selecting the proper statistic while estimating a population characteristic.

Variability in the population: Errors may occur due to variability among population units beyond a degree. This could be reduced by following somewhat complicated sampling design like stratified sampling, Multistage sampling etc.

Non-sampling Errors

As discussed earlier, this type of errors happen both in sampling and complete enumeration. Some factors responsible for this particular kind of biases are lapse of memory, preference for certain digits, ignorance, psychological factors like vanity, non-responses on the part of the interviewees, wrong measurements of the sampling units, communication gap between the interviewers and the interviewees, incomplete coverage etc. on the part of the enumerators also lead to non-sampling errors.

SOME IMPORTANT TERMS ASSOCIATED WITH SAMPLING

Population or Universe

It may be defined as the aggregate of all the units under consideration. All the lamps produced by "General Electricals" in our first example in the past, present and future constitute the population. In the second example, all the people living in the town of Miss Manju form the population. The number of units belonging to a population is known as population size. If there are one lakh people in her town then the population size, to be denoted by N , is 1 lakh.

A population may be finite or infinite. If a population comprises only a finite number of units, then it is known as a finite population. The population in the second example is obviously, finite. If the population contains an infinite or uncountable number of units, then it is known as an infinite population. The population of electrical lamps of General Electricals is infinite. Similarly, the population of stars, the population of mosquitoes in Kolkata, the population of owners in Mumbai, the population of insects in Delhi etc. are infinite population.

Population may also be regarded as existent or hypothetical. A population consisting of real objects is known as an existent population. The population of the lamps produced by General Electricals and the population of Miss Manju's town are example of existent populations. A population that exists just hypothetically like the population of heads when a coin is tossed infinitely is known as a hypothetical or an imaginary population.

Sample

A sample may be defined as a part of a population so selected with a view to representing the population in all its characteristics. Selection of a proper representative sample is pretty important.

because statistical inferences about the population are drawn only on the basis of the sample observations. If a sample contains n units, then n is known as sample size. If a sample of 500 electrical lamps is taken from the production process of General Electricals, then $n = 500$. The units forming the sample are known as "Sampling Units". In the first example, the sampling unit is electrical lamp and in the second example, it is a human. A detailed and complete list of all the sampling units is known as a "Sampling Frame". Before drawing sample, it is a must to have a updated sampling frame complete in all respects before the samples are actually drawn.

TYPES OF SAMPLING

There are three different types of sampling which are

Probability Sampling

Non – Probability Sampling

Mixed Sampling

In the first type of sampling there is always a fixed, pre assigned probability for each member of the population to be a part of the sample taken from that population . When each member of the population has an equal chance to belong to the sample, the sampling scheme is known as Simple Random Sampling. Some important probability sampling other than simple random sampling are stratified sampling, Multi Stage sampling, Multi Phase Sampling, Cluster Sampling and so on. In non-probability sampling , no probability attached to the member of the population and as such it is based entirely on the judgement of the sampler. Non-probability sampling is also known as Purposive or Judgement Sampling. Mixed sampling is based partly on some probabilistic law and partly on some pre decided rule. Systematic sampling belongs to this category. Some important and commonly used sampling process are described now.

Simple Random Sampling (SRS)

When the units are selected independent of each other in such a way that each unit belonging to the population has an equal chance of being a part of the sample, the sampling is known as Simple random sampling or just random sampling. If the units are drawn one by one and each unit after selection is returned to the population before the next unit is being drawn so that the composition of the original population remains unchanged at any stage of the sampling then the sampling procedure is known as Simple Random Sampling with replacement. If, however, once the units selected from the population one by one are never returned to the population before the next drawing is made, then the sampling is known as sampling without replacement. The two sampling methods become almost identical if the population is infinite i.e. very large or a very large sample is taken from the population. The best method of drawing simple random sample is to use random sampling numbers.

Simple random sampling is a very simple and effective method of drawing samples provided

(i) the population is not very large (ii) the sample size is not very small and (iii) the population under consideration is not heterogeneous i.e. there is not much variability among the members forming the population. Simple random sampling is completely free from Sampler's biases. All the tests of significance are based on the concept of simple random sampling.

Stratified Sampling

If the population is large and heterogeneous, then we consider a somewhat, complicated sampling design known as stratified sampling which comprises dividing the population into a number of strata or sub-populations in such a way that there should be very little variations among the units comprising a stratum and maximum variation should occur among the different strata. The stratified sample consists of a number of sub samples, one from each stratum. Different sampling scheme may be applied to different strata and, in particular, if simple random sampling

is applied for drawing units from all the strata, the sampling procedure is known as stratified random sampling. The purpose of stratified sampling are (i) to make representation of all the sub populations (ii) to provide an estimate of parameter not only for all the strata but also and overall estimate (iii) reduction of variability and thereby an increase in precision.

There are two types of allocation of sample size. When there is prior information that there is not much variation between the strata variances. We consider "Proportional allocation" or "Bowley's allocation where the sample sizes for different strata are taken as proportional to the population sizes. When the strata-variances differ significantly among themselves, we take recourse to "Neyman's allocation" where sample size vary jointly with population size and population standard deviation i.e. $n_i \propto N_i S_i$. Here n_i denotes the sample size for the i^{th} stratum, N_i and S_i being the corresponding population size and population standard deviation. In case of Bowley's allocation, we have $n_i \propto N_i$.

Stratified sampling is not advisable if (i) the population is not large (ii) some prior information is not available and (iii) there is not much heterogeneity among the units of population.

Multi Stage Sampling

In this type of complicated sampling, the population is supposed to compose of first stage sampling units, each of which in its turn is supposed to compose of second stage sampling units, each of which again in its turn is supposed to compose of third stage sampling units and so on till we reach the ultimate sampling unit.

Sampling also, in this type of sampling design, is carried out through stages. Firstly, only a number of first stage units is selected. For each of the selected first stage sampling units, a number of second stage sampling units is selected. The process is carried out until we select the ultimate sampling units. As an example of multi stage sampling, in order to find the extent of unemployment in India, we may take state, district, police station and household as the first stage, second stage, third stage and ultimate sampling units respectively.

The coverage in case of multistage sampling is quite large. It also saves computational labour and is cost-effective. It adds flexibility into the sampling process which is lacking in other sampling schemes. However, compared to stratified sampling, multistage sampling is likely to be less accurate.

Systematic Sampling

It refers to a sampling scheme where the units constituting the sample are selected at regular interval after selecting the very first unit at random i.e., with equal probability. Systematic sampling is partly probability sampling in the sense that the first unit of the systematic sample is selected probabilistically and partly non-probability sampling in the sense that the remaining units of the sample are selected according to a fixed rule which is non-probabilistic in nature.

If the population size N is a multiple of the sample size n i.e. $N = nk$, for a positive integer k which must be less than n , then the systematic sampling comprises selecting one of the first k units at random,

usually by using random sampling number and thereby selecting every kth unit till the complete, adequate and updated sampling frame comprising all the members of the population is exhausted. This type of systematic sampling is known as “linear systematic sampling”. K is known as “sample interval”.

EXERCISE

Set A

Answer the following questions. Each question carries one mark.

1. Sampling can be described as a statistical procedure
 - (a) To infer about the unknown universe from a knowledge of any sample
 - (b) To infer about the known universe from a knowledge of a sample drawn from it
 - (c) To infer about the unknown universe from a knowledge of a random sample drawn from it
 - (d) Both (a) and (b).
2. The Law of Statistical Regularity says that
 - (a) Sample drawn from the population under discussion possesses the characteristics of the population
 - (b) A large sample drawn at random from the population would possess the characteristics of the population
 - (c) A large sample drawn at random from the population would possess the characteristics of the population on an average
 - (d) An optimum level of efficiency can be attained at a minimum cost.
3. A sample survey is prone to
 - (a) Sampling errors
 - (b) Non-sampling errors
 - (c) Either a and b
 - (d) Both (a) and (b)**
4. The population of roses in Salt Lake City is an example of
 - (a) A finite population
 - (b) An infinite population
 - (c) A hypothetical population**
 - (d) An imaginary population.**
5. Statistical decision about an unknown universe is taken on the basis of
 - (a) Sample observations
 - (b) A sampling frame
 - (c) Sample survey**
 - (d) Complete enumeration**
6. Random sampling implies
 - (a) Haphazard sampling
 - (b) Probability sampling
 - (c) Systematic sampling**
 - (d) Sampling with the same probability for each unit.**
7. A parameter is a characteristic of
 - (a) Population
 - (b) Sample
 - (c) Both (a) and (b)**
 - (d) (a) or (b)**

8. A statistic is
(a) A function of sample observations (b) A function of population units
(c) A characteristic of a population (d) A part of a population.

9. Sampling Fluctuations may be described as

- (a) The variation in the values of a statistic
(b) The variation in the values of a sample
(c) The differences in the values of a parameter
(d) The variation in the values of observations.

10. The sampling distribution is

- (a) The distribution of sample observations
(b) The distribution of random samples
(c) The distribution of a parameter
(d) The probability distribution of a statistic.

11. Standard error can be described as

- (a) The error committed in sampling
(b) The error committed in sample survey
(c) The error committed in estimating a parameter
(d) Standard deviation of a statistic.

12. A measure of precision obtained by sampling is given by

- (a) Standard error (b) Sampling fluctuation
(c) Sampling distribution (d) Expectation.

13. As the sample size increases, standard error

- (a) Increases (b) Decreases
(c) Remains constant (d) Decreases proportionately.

14. If from a population with 25 members, a random sample without replacement of 2 members is taken, the number of all such samples is

- (a) 300 (b) 625**
(c) 50 (d) 600

15. A population comprises 5 members. The number of all possible samples of size 2 that can be drawn from it with replacement is

- (a) 100 (b) 15**
(c) 125 (d) 25

16. Simple random sampling is very effective if

- (a) The population is not very large
(b) The population is not much heterogeneous
(c) The population is partitioned into several sections.

- (d) Both (a) and (b)
17. Simple random sampling is
- (a) A probabilistic sampling (b) A non- probabilistic sampling
- (c) A mixed sampling (d) Both (b) and (c).**
18. According to Neyman's allocation, in stratified sampling
- (a) Sample size is proportional to the population size
- (b) Sample size is proportional to the sample SD
- (c) Sample size is proportional to the sample variance
- (d) Population size is proportional to the sample variance.
19. Which sampling provides separate estimates for population means for different segments and also an over all estimate?
- (a) Multistage sampling (b) Stratified sampling
- (c) Simple random sampling (d) Systematic sampling**
20. Which sampling adds exibility to the sampling process?
- (a) Simple random sampling (b) Multistage sampling
- (c) Stratified sampling (d) Systematic sampling**
21. Which sampling is affected most if the sampling frame contains an undetected periodicity?
- (a) Simple random sampling (b) Stratified sampling**
- (c) Multistage sampling (d) Systematic sampling**
22. Which sampling is subjected to the discretion of the sampler?
- (a) Systematic sampling (b) Simple random sampling
- (c) Purposive sampling (d) Quota sampling.**
23. If a random sample of size 2 with replacement is taken from the population containing the units 3, 6 and 1, then the samples would be
- (a) (3,6),(3,1),(6,1)**
- (b) (3,3),(6,6),(1,1)**
- (c) (3,3),(3,6),(3,1),(6,6),(6,3),(6,1),(1,1),(1,3),(1,6)**
- (d) (1,1),(1,3),(1,6),(6,1),(6,2),(6,3),(6,6),(1,6),(1,1)**
24. If a random sample of size two is taken without replacement from a population containing the units a, b, c and d then the possible samples are
- (a) (a, b),(a, c),(a, d)** **(b) (a, b),(b, c), (c, d)**
- (c) (a, b), (b, a), (a, c),(c,a), (a, d), (d, a)** **(d) (a, b), (a, c), (a, d), (b, c), (b, d), (c,d)**

ANSWERS

Set A

1. (c)	2. (c)	3. (d)	4. (b)	5. (a)	6. (d)
7. (a)	8. (a)	9. (a)	10. (d)	11. (d)	12. (a)
13. (b)	14. (a)	15. (d)	16. (b)	17. (a)	18. (a)
19. (b)	20. (d)	21. (d)	22. (c)	23. (c)	24. (d)