

Chap-1

Ratio & proportions, indices,
logarithms.

Unit-I

Ratio

1) Ans: a, 15:11

2) $\frac{3 \times 5}{4 \times 5} = \frac{15}{20}$

Ans: d, 20

3) Ratio = 5/7

Inverse = 7/5

Ans: c, 7

4) 2:3

9:4

5:6

8:10

720:720

Ans: a, 1

5) Ans: c, 9:16

6) Ans: d, 5:6

7) Ans: a, 8:27

8) Ans: c, 2:3

9) 4:9

9:16

36:144

Ans: a, 1:4

10) 4:9

9:16

8:27

9:7

2592:27,216

Ans: c, 2:21

11) 16:25

1:27

9:16

5:8

720:86,400

Ans: d, none of these

12) $\frac{a}{b} = \frac{3}{4}$

$\Rightarrow a = 3x$ &

$b = 4x$

$\Rightarrow \frac{2a+3b}{3a+4b} = \frac{2(3x)+3(4x)}{3(3x)+4(4x)}$

$= \frac{6x+12x}{9x+16x}$

$= \frac{18x}{25x}$

Ans: d, 18:25

13) 16,24 \rightarrow 12,20
(2:3) (3:5)

Ans: a, 16,24

14) Ans: c, 18°, 63°, 99°

$$15) \frac{324 \times \frac{11}{18}}{18} = 198$$

$$\frac{324 \times \frac{7}{18}}{18} = 126$$

Ans: d, none of these

$$16) \frac{80 \times 12}{90 \times 7} = \frac{960}{630}$$

$$= \frac{32}{21}$$

Ans: a, 32:21

$$17) 200, 305 = 105 = 40:61$$

$$185, 290 = 105 = 37:58$$

$$245, 350 = 105 = 7:10$$

Ans: c, 245, 350

$$18) \frac{P}{Q} = \frac{11}{12} = \frac{99}{108}$$

$$\frac{P}{R} = \frac{9}{8} = \frac{99}{88}$$

$$\Rightarrow \frac{Q}{R} = \frac{108}{88} = \frac{27}{22}$$

Ans: b, 27:22

$$19) \frac{x}{y} = \frac{3}{4}$$

$$\Rightarrow x = 3k \text{ \& } y = 4k$$

$$\frac{x^2y + xy^2}{x^3 + y^3} = \frac{(3k)^2(4k) + (3k)(4k)^2}{(3k)^3 + (4k)^3}$$

$$= \frac{36k^3 + 48k^3}{27k^3 + 64k^3}$$

$$= \frac{84k^3}{91k^3}$$

$$= \frac{12}{13}$$

Ans: b, 12:13

$$20) \frac{\sqrt{p-x^2}}{\sqrt{q-x^2}} = \frac{p}{q}$$

$$\frac{p-x^2}{q-x^2} = \frac{p^2}{q^2}$$

$$pq^2 - x^2q^2 = qp^2 - x^2p^2$$

$$pq^2 - qp^2 = x^2q^2 - x^2p^2$$

$$pq(q-p) = x^2(q^2-p^2)$$

$$x^2 = \frac{pq(q-p)}{(q^2-p^2)}$$

$$x^2 = \frac{pq(q/p)}{(q+p)(q/p)}$$

$$x^2 = \frac{pq}{p+q}$$

Ans: c, $\frac{pq}{p+q}$

$$21) \frac{(2s-p)^2}{(3t-p)^2} = \frac{2s}{3t}$$

$$\frac{4s^2 + p^2 - 4sp}{9t^2 + p^2 - 6tp} = \frac{2s}{3t}$$

$$12ts^2 + 3p^2t - 12spt$$

$$= 18t^2s + 2p^2s - 12tps$$

$$\Rightarrow 12ts^2 + 3p^2t = 18t^2s + 2p^2s$$

$$12ts^2 - 18t^2s = 2p^2s - 3p^2t$$

$$6ts(2s - 3t) = p^2(2s - 3t)$$

$$\Rightarrow p^2 = 6ts$$

$$\text{Ans: a, } p^2 = 6st$$

$$22) \quad \frac{p}{q} = \frac{2}{3} \quad \& \quad \frac{x}{y} = \frac{4}{5}$$

$$\Rightarrow p = 2k \quad \& \quad q = 3k$$

$$x = 4k \quad \& \quad y = 5k$$

$$\frac{5px + 3qy}{10px + 4qy} = \frac{5(2)(4) + 3(3)(5)}{10(2)(4) + 4(3)(5)}$$

$$= \frac{40 + 45}{80 + 60}$$

$$= \frac{85}{140}$$

$$= \frac{17}{28}$$

$$\text{Ans: c, } 17:28$$

$$23) \quad \frac{19-15}{31-15} = \frac{4}{16} = \frac{1}{4}$$

$$\text{Ans: a, } 15$$

$$24) \quad \frac{4k-50}{5k-50} = \frac{7}{9}$$

$$36k - 450 = 35k - 350$$

$$k = 100$$

$$\text{Ans: c, } 400, 500$$

$$25) \quad d = 400$$

$$t = 5 \text{ hr}$$

$$S = 400/5 = 80 \text{ km/hr}$$

$$\frac{7}{8} = \frac{70}{80}$$

$$\text{Ans: c, } 70 \text{ km/hr}$$

Unit - II

Proportions

$$1) \quad \frac{4}{6} = \frac{8}{12}$$

$$\text{Ans: a, } 12$$

$$2) \quad \frac{12}{18} = \frac{18}{27}$$

$$\text{Ans: b, } 27$$

$$3) \quad \frac{25}{x} = \frac{x}{81}$$

$$2025 = x^2$$

$$x = 45$$

$$\text{Ans: c, } 45$$

$$4) \quad \frac{x}{26} = \frac{6}{13}$$

$$x = 12$$

$$\text{Ans: d, none of these}$$

$$5) \frac{2a}{a^2} = \frac{c}{x}$$

$$2x = ca$$

$$x = ac/2$$

Ans: a, ac/2

$$6) \frac{1}{2} \times \frac{3}{1} = \frac{1}{5} \times x$$

$$\frac{3}{2} = \frac{x}{5}$$

$$x = 15/2$$

Ans: c, 15/2

$$7) \frac{12x^2}{k} = \frac{k}{27y^2}$$

$$k^2 = 324x^2y^2$$

$$k = 18xy$$

Ans: a, 18xy

$$8) A = \frac{B}{2} = \frac{C}{5}$$

$$\frac{A}{B} = \frac{1}{2}$$

$$\frac{B}{C} = \frac{2}{5}$$

Ans: c, 1:2:5

$$9) \frac{a}{3} = \frac{b}{4} = \frac{c}{7}$$

$$\frac{a}{b} = \frac{3}{4} \quad \& \quad \frac{b}{c} = \frac{4}{7}$$

$$a = 3k \quad \&$$

$$b = 4k \quad \&$$

$$c = 7k$$

$$\frac{a+b+c}{c} = \frac{3k+4k+7k}{7k}$$

$$= \frac{14k}{7k}$$

$$= 2$$

Ans: c, 2

$$10) \frac{p}{q} = \frac{r}{s} = \frac{2.5}{1.5}$$

$$p = 2.5x \quad \& \quad r = 2.5y$$

$$q = 1.5x \quad \& \quad s = 1.5y$$

$$\frac{ps}{qr} = \frac{2.5x \times 1.5y}{1.5x \times 2.5y} = 1$$

Ans: b, 1:1

$$11) \frac{x}{y} = \frac{z}{w} = \frac{2.5}{1.5}$$

$$x = 2.5m \quad \& \quad z = 2.5n$$

$$y = 1.5m \quad \& \quad w = 1.5n$$

$$\frac{(x+z)}{(y+w)} = \frac{2.5m+2.5n}{1.5m+1.5n}$$

$$= \frac{2.5(m+n)}{1.5(m+n)}$$

$$= \frac{2.5}{1.5} = \frac{5}{3}$$

Ans: c, 5/3

$$12) \frac{5x-3y}{5y-3x} = \frac{3}{4}$$

$$20x-12y = 15y-9x$$

$$29x = 27y$$

$$\frac{x}{y} = \frac{27}{29}$$

Ans: d, none of these

$$13) \frac{A}{B} = \frac{3}{2} = \frac{9}{6}$$

$$\frac{B}{C} = \frac{3}{5} = \frac{6}{10}$$

Ans, a, 9:6:10

$$14) \frac{x}{2} = \frac{y}{3} = \frac{z}{7}$$

$$\frac{x}{y} = \frac{2}{3} \quad \frac{y}{z} = \frac{3}{7}$$

$$x = 2k \quad y = 3k \quad z = 7k$$

$$\frac{2x-5y+4z}{2y} = \frac{4k-15k+28k}{6k} = \frac{17k}{6k}$$

Ans: d, 17/6

$$15) \frac{x}{y} = \frac{2}{3} = \frac{8}{12}$$

$$\frac{y}{z} = \frac{4}{3} = \frac{12}{9}$$

8:12:9

Ans: d, none of these

$$16) 750 \times \frac{4}{15} = 200$$

$$750 \times \frac{5}{15} = 250$$

$$750 \times \frac{6}{15} = 300$$

Ans: a, 200, 250, 300

$$17) 35:40:45 = 7:8:9$$

Ans: a, 7:8:9

$$18) \frac{14}{16} = \frac{35}{40}$$

Ans: b, 40

$$19) x : y = 2 : 3$$

$$y : z = 4 : 2$$

Ans: d, none of these

$$20) \frac{p}{a} = \frac{r}{b} = \frac{p-r}{a-b}$$

Ans: a, Subtrahendo

21) Ans: c, Componendo & dividendo

22) Ans: d, none of these

$$23) \frac{12}{16} = \frac{15}{20}$$

Ans: c, 15

$$24) \frac{4}{x} = \frac{9}{135}$$

$$x = \frac{4 \times 135}{9} = 6$$

Ans: a, 6

$$25) \frac{1.4}{x} = \frac{x}{5.6}$$

$$x^2 = 7.84$$

$$x = 2.8$$

Ans: b, 2.8gms.

$$26) \frac{a}{4} = \frac{b}{5} = \frac{c}{9}$$

$$\frac{a}{b} = \frac{4}{5}$$

$$a = 4k$$

$$b = 5k$$

$$\frac{b}{c} = \frac{5}{9}$$

$$c = 9k$$

$$\frac{a+b+c}{c} = \frac{4k+5k+9k}{9k} = 2$$

Ans: b, 2

27, Ans: c, 18 and 24

$$28, \text{Ans: } b; \frac{a+4}{a-4} = \frac{b+5}{b-5}$$

$$29) \frac{a}{b} = \frac{4}{1} \quad \& \quad \frac{b}{a} = \frac{1}{4}$$

$$\sqrt{\frac{4}{1}} + \sqrt{\frac{1}{4}} = 2 + \frac{1}{2} = 5/2$$

Ans: a, 5/2

$$30) \frac{x}{b+c-a} = \frac{y}{c+a-b} = \frac{z}{a+b-c}$$

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

$$= (b-c)(b+c-a) +$$

$$(c-a)(c+a-b) +$$

$$(a-b)(a+b-c)$$

$$= b^2 + cb - ab - bc - c^2 + ac +$$

$$c^2 + ac - bc - ac - a^2 + ab +$$

$$a^2 + ab - ac - ba - b^2 + bc$$

$$= 0$$

Ans: b, 0

Unit - III

Indices

$$1) 4x^{-1/4} = 4/x^{1/4}$$

Ans: c, $4/x^{1/4}$

2) Ans: c, 2

3) Ans: c, 4

4) Ans: b, 2

5) Ans: a, 2/3

6) Ans: a, 1

$$\begin{aligned}
 7) & 2^{1/2} \times 4^{3/4} \\
 & = 2^{1/2} \times (2^2)^{3/4} \\
 & = 2^{1/2} \times 2^{3/2} \\
 & = 2^2 \\
 & = 4.
 \end{aligned}$$

Ans: b, a positive integer.

$$\begin{aligned}
 8) & \left(\frac{81x^4}{y^8} \right)^{1/4} = (81x^4y^8)^{1/4} \\
 & = 3xy^2
 \end{aligned}$$

Ans: d, none of these

$$\begin{aligned}
 9) & x^{a-b} \times x^{b-c} \times x^{c-a} \\
 & = x^{a-b+b-c+c-a} \\
 & = x^0 = 1
 \end{aligned}$$

Ans: c, 1

10) Ans: c, 1

$$\frac{3^6 \times 4^6 \times 5^6}{3^6 \times 4^6 \times 5^6} = 1$$

Ans: d, 1

12) Ans: c, $2^0 = (1/2)^0$

$$13) x = y^{p/a}$$

$$z = y^{r/a}$$

$$xyz = 1$$

$$y^{p/a} \times y \times y^{r/a} = 1$$

$$y^{p/a+1+r/a} = 1$$

$$y^{\frac{p+q+r}{a}} = 1 = _{}^0$$

$$\Rightarrow p+q+r = 0.$$

Ans: b, 0

$$\begin{aligned}
 14) & y^{a-b} \times y^{b-c} \times y^{c-a} \times y^{-a-b} \\
 & = y^{-(a+b)} = \frac{1}{y^{a+b}}
 \end{aligned}$$

Ans: d, $1/y^{a+b}$

15) Ans: a, $x^{2/3} = \sqrt[3]{x^2}$

$$16) 16x^3y^2 \times 8^{-1}x^3y^{-2} = 2$$

Ans: c, 2

$$17) \left(\frac{8}{27} \right)^{-1/3} \times \left(\frac{32}{243} \right)^{-1/5}$$

$$= \left(\frac{27}{8} \right)^{1/3} \times \left(\frac{243}{32} \right)^{1/5}$$

$$= \frac{3}{2} \times \frac{3}{2} = 9/4$$

Ans: a, 9/4

$$18) \left[\frac{(x+y)^{2/3} (x-y)^{3/2}}{(x+y)^{1/2} ((x-y)^3)^{1/2}} \right]^6$$

$$= \left[(x+y)^{1/6} \right]^6 = x+y$$

Ans: c, $x+y$

$$= 19) (125)^{2/3} \times (25)^{1/2} \times 5 \times 5^{1/2}$$

$$= 3\sqrt{125^2} \times 5 \times 5 \times \sqrt{5}$$

$$= 25 \times 25 \times 5$$

$$= 625\sqrt{5}$$

2 Ans: d, none of these

$$20) \left[\left[(2)^{1/2} \times (2^2)^{3/4} \times (2^3)^{5/6} \times (2^4)^{7/8} \times (2^5)^{9/10} \right]^4 \right]^{3/25}$$

$$= \left[\left[2^{1/2} \times 2^{3/2} \times 2^{5/2} \times 2^{7/2} \times 2^{9/2} \right]^4 \right]^{3/25}$$

$$= \left(2^{25/2} \right)^4 \Big)^{3/25}$$

$$= \left(2^{50} \right)^{3/25}$$

$$= 26$$

$$= 64$$

Ans: b, an integer

$$21) \left[1 - \left\{ 1 - (1-x^2)^{-1} \right\}^{-1} \right]^{-1/2}$$

$$= \left[1 - \left\{ 1 - \frac{1}{1-x^2} \right\}^{-1} \right]^{-1/2}$$

$$= \left[1 - \left\{ \frac{1-x^2-1}{1-x^2} \right\}^{-1} \right]^{-1/2}$$

$$= \left[1 - \frac{1-x^2}{1-x^2-1} \right]^{-1/2}$$

$$= \left[\frac{x-x^2-x-1+x^2}{x-x^2-x} \right]^{-1/2}$$

$$= \left[\frac{-1}{-x^2} \right]^{-1/2}$$

$$= (x^2)^{1/2}$$

$$= x$$

Ans: a, x

$$22) \left[(x^n)^{n-1/n} \right]^{1/n+1}$$

$$= (x^{n^2-1})^{1/n+1}$$

$$= \left[x^{(n+1)(n-1)} \right]^{1/n+1}$$

$$= x^{n-1}$$

Ans: c, x^{n-1}

$$23) x^{(l-m)(l^2+lm+m^2)}$$

$$x^{(m-n)(m^2+mn+n^2)}$$

$$x^{(n-l)(l^2+ln+n^2)}$$

$$= x^{l^3-m^3} \times x^{m^3-n^3} \times x^{n^3-l^3}$$

$$= x^0 = 1$$

Ans: b, 1

$$24) x^3 = \left(p^{1/3} - \frac{1}{p^{1/3}} \right)^3$$

$$x^3 = p - \frac{1}{p} - 3x$$

$$x^3 + 3x = p - \frac{1}{p}$$

Ans: b, $x^3 + 3x = p - 1/p$

$$25) \frac{1}{1+a^{m-n}+a^{m-p}} + \frac{1}{1+a^{n-m}+a^{n-p}} + \frac{1}{1+a^{p-m}+a^{p-n}}$$

$$= \frac{a^{-m}}{a^{-m}+a^{-n}+a^{-p}} + \frac{a^{-n}}{a^{-n}+a^{-m}+a^{-p}} + \frac{a^{-p}}{a^{-p}+a^{-m}+a^{-n}}$$

$$= \frac{a^{-m}+a^{-n}+a^{-p}}{a^{-p}+a^{-m}+a^{-n}} = 1$$

Ans: c, 1

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

$$= x^{(a-b)(a+b)} \times x^{(b-c)(b+c)} \times x^{(c-a)(c+a)}$$

$$= x^{a^2-b^2+b^2-c^2+c^2-a^2} = x^0 = 1$$

Ans: a, 1

$$27) x = \sqrt[3]{3} + \frac{1}{\sqrt[3]{3}}$$

$$3x^3 - 9x = 3\left(\sqrt[3]{3} + \frac{1}{\sqrt[3]{3}}\right)^3 - 9\left(\sqrt[3]{3} + \frac{1}{\sqrt[3]{3}}\right)$$

$$= 3\left(3 + \frac{1}{3} + 3\left(\sqrt[3]{3} + \frac{1}{\sqrt[3]{3}}\right)\right) -$$

$$9\sqrt[3]{3} - 9/\sqrt[3]{3}$$

$$= 3\left(\frac{10}{3} + 3\sqrt[3]{3} + \frac{3}{\sqrt[3]{3}}\right) - 9\sqrt[3]{3} - \frac{9}{\sqrt[3]{3}}$$

$$= 10 + 9\sqrt[3]{3} + \frac{9}{\sqrt[3]{3}} - 9\sqrt[3]{3} - \frac{9}{\sqrt[3]{3}}$$

$$= 10$$

Ans: b, 10

$$28) a^x = b$$

$$b^y = c$$

$$c^z = a = 1$$

$$(b^y)^z = a$$

$$b^{yz} = a$$

$$(a^x)^{yz} = a$$

$$a^{xyz} = a$$

$$\Rightarrow xyz = 1$$

Ans: a, 1

$$29) x^{a^3-b^3} \times x^{b^3-c^3} \times x^{c^3-a^3}$$

$$= x^0 = 1$$

Ans: a, 1

$$30) 2^x = 3^y = 6^{-z} = k$$

$$k^{1/x} = 2$$

$$k^{1/y} = 3$$

$$k^{-1/z} = 6$$

$$k^{-1/2} = k^{1/2} \times k^{1/2}$$

$$k^{-1/2} = k^{1/2 + 1/2}$$

$$\Rightarrow -1/2 = 1/2 + 1/2$$

$$\Rightarrow 1/2 + 1/2 + 1/2 = 0$$

Ans: b, 0.

Unit - IV

Logarithms.

1) Ans: b, $\log 30$.

2) Ans: c, 3

3) Ans: b, $\log 32 - \log 4$

4) Ans: a, $\log 1 + \log 2 + \log 3$

5) Ans: b, 4

6) $2 \log x = 4 \log 3$

$$x^2 = 3^4 = 81$$

$$x = 9$$

Ans: b, 9.

7) Ans: a, 12

8) Ans: c, 6

9) Ans: c, -2

10) Ans: d, none of these

11) Ans: c, 0.7781

12) Ans: c, 1

13) Ans: a, $-1/2$.

14) $\log x + \log y = \log xy$

$$\log(x+y) = \log xy.$$

$$x+y = xy$$

$$x = xy - y$$

$$x = y(x-1)$$

$$y = x/x-1$$

Ans: c, $x/x-1$.

15) Ans: c, 0.

$$16) \frac{1}{\log x^2} + \frac{1}{\log x^{2^2}} + \frac{1}{\log x^{2^4}} = \frac{21}{4}$$

$$\frac{1}{\log x^2} + \frac{1}{2 \log x^2} + \frac{1}{4 \log x^2} = \frac{21}{4}$$

$$\frac{1}{\log x^2} \left(1 + \frac{1}{2} + \frac{1}{4} \right) = \frac{21}{4}$$

$$\frac{7}{4 \log x^2} = \frac{21}{4}$$

$$\log_2 x = 3$$

$$x = 8$$

Ans: a, 8.

$$17) \log_{10} 60 = \log_{10} 2 + \log_{10} 3 + \log_{10} 10$$
$$= x + y + 1$$

Ans: b, $x + y + 1$

$$18) \log_{10} 1.2 = \log 2 + \log 3 + \log 2 - \log 10$$

$$= x + y + x - 1$$

$$= 2x + y - 1$$

Ans: c, $2x + y - 1$

$$19) \log_{10} x - \log y^2$$

$$= \log 10 + \log x - 2 \log y$$

$$= 1 + m + n - 2(m - n)$$

$$= 1 + m + n - 2m + 2n$$

$$= 1 - m + 3n$$

Ans: a, $1 - m + 3n$

$$20) \frac{\log 5^2 \times 8}{4^{1/2}} = \log \frac{25 \times 8^4}{2}$$

$$= \log_{10} 100$$

$$= 2$$

Ans: c, 2

$$21) \log \left[1 - \left\{ 1 - (1 - x^2)^{-1} \right\}^{-1} \right]^{-1/2}$$

$$= \log \left[1 - \left\{ 1 - \frac{1}{1 - x^2} \right\}^{-1} \right]^{-1/2}$$

$$= \log \left[1 - \left\{ \frac{1 + x^2}{1 - x^2} \right\}^{-1} \right]^{-1/2}$$

$$= \log \left[1 - \left\{ \frac{1 + x^2}{1 - x^2} \right\}^{-1} \right]^{-1/2}$$

$$= \log \left[1 - \left\{ \frac{1 - x^2}{1 + x^2} \right\} \right]^{-1/2}$$

$$= \log \left[1 - \frac{1 - x^2}{1 + x^2} \right]^{-1/2}$$

$$= \log \left[\frac{x^2 - x + 1}{x^2} \right]^{-1/2}$$

$$= \log \left[\frac{1}{x^2} \right]^{-1/2}$$

$$= \log (+x^2)^{1/2}$$

$$= \log x$$

Ans: b, $\log x$

$$22) 4 \sqrt{729 \times 3 \sqrt{9^{-1} \times 27^{-4/3}}}$$

$$= 4 \sqrt{729 \times 9^{-1/3} \times 27^{-4/9}}$$

$$= 729^{1/4} \times 9^{-1/12} \times 27^{-1/9}$$

$$= 3^{3/2} \times 3^{-1/6} \times 3^{-1/3}$$

$$= 3^{3/2 - 1/6 - 1/3}$$

$$= 3^{9/6 - 1/6 - 2/6}$$

$$= 3^1$$

$$= 3$$

Ans: a, $\log 3$

$$23) (\log_b a \times \log_e b \times \log_a e)^3$$

$$= 1$$

Ans: c, 1

24) Ans: d, none of these

$$25) \log_8 25 = \frac{\log 25}{\log 8}$$

$$= \frac{\log 100}{2 \times 2}$$

$$= \frac{\log 100 - \log 2 - \log 2}{3 \log 2}$$

$$= \frac{2(1) - 0.3010 - 0.3010}{3(0.3010)}$$

$$= \frac{1.398}{0.903}$$

$$= 1.548$$

Ans: c, 1.548