Chapter 1

Number System, Simplification and Approximation

This chapter forms a basis of many other topic in mathematics. Let us begin understanding Various types of Numbers.

(1) **Natural Numbers:-** All the Counting numbers are Called natural number.

Example:— 1, 2, 3, 4, 5 ———

(a) **Even Numbers,** The numbers which are exactly divisble by 2 are called even numbers.

Example:- 2, 4, 6, 8 ———

(b) **Odd Numbers:-** The numbers which leave a remainder 1 when divided by 2 are Called odd numbers.

Example:- 1, 3, 5, 7 ———

(c) **Prime numbers:-** If a number is not divisble by any other no. except 1 and itself, it is called prime no.

Example:— 2, 3, 5, 7, 11 ———

Co-Primes→ Two Numbers which have no common factor between except 1 are Said to be Co-prime to each other. The two numbers individually may be prime or composite.

Example - 13 and 29 are Co-Primes.

(d) **Composite Numbers**:— Numbers which are divisible by other number along with 1 and itself are called composite numbers.

Example:— 4, 6, 8, 10, 9 ...

(2) **Whole Numbers**:— Natural Numbers along with '0' form the set of whole no.

Example:— 0, 1, 2, 3 ...

(3) **Integers**:— All counting numbers and their negatives along with zero are called Integers.

Example:— ... −4, −3, −2, −1, 0, 1, 2, 3, 4 ...

(4) **Rational ~~No~~ and Irrational Numbers**:— Any Number which can be expressed in the form of $\frac{p}{q}$, where P and q are integers and $q=0$ is a rational no.

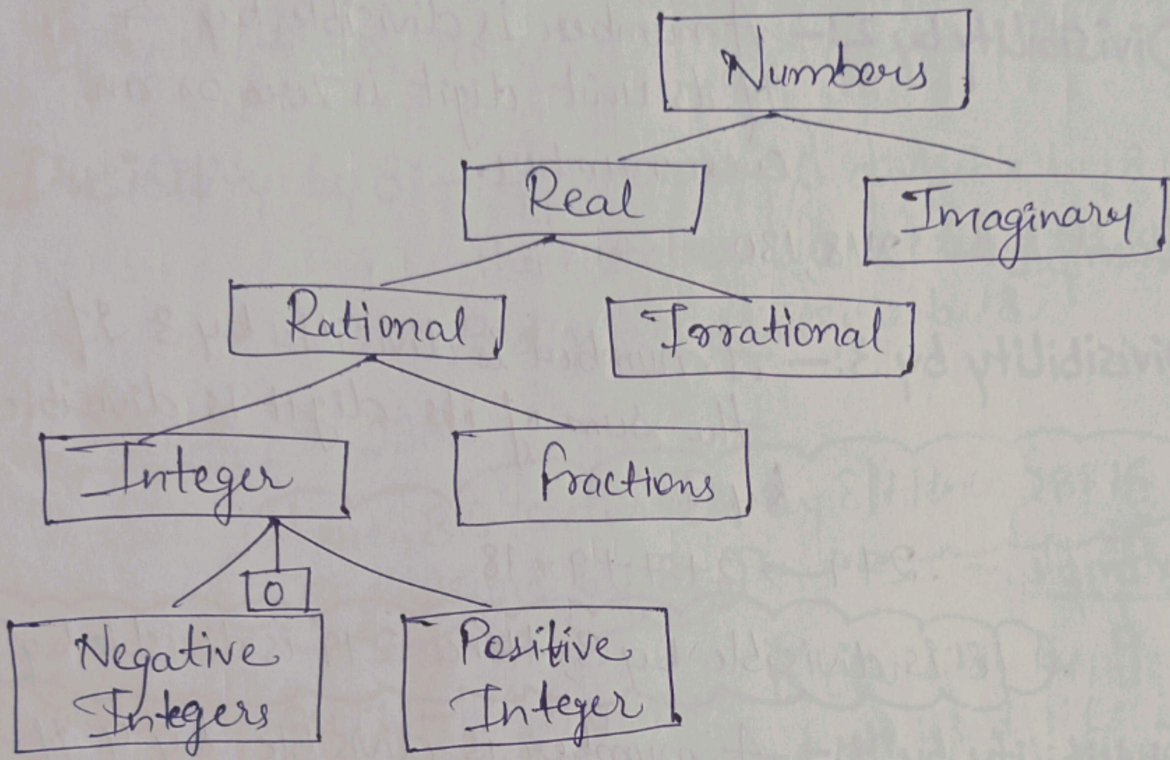
Example:— $\frac{3}{4}$, 4, −6, etc.

Numbers which are represented by non-terminating and non-recurring decimals are called irrational numbers.

Example:— $\sqrt{2} = 1.414...$, $\sqrt{3} = 1.732...$

(5) **Real Numbers**:— Rational and Irrational ~~nu~~ number taken together are called real numbers.

We can summarise is the above discussion as follow:-



Some Important formula's :-

1. $a^2 - b^2 = (a+b)(a-b)$
2. $(a+b)^2 = a^2 + b^2 + 2ab$
3. $(a-b)^2 = a^2 + b^2 - 2ab$
4. $(a+b+c)^2 = a^2 + b^2 + c^2 + 2ab + 2bc + 2ac$
5. $(a+b)^3 = a^3 + b^3 + 3ab(a+b)$
6. $(a-b)^3 = a^3 - b^3 - 3ab(a-b)$
7. $a^3 + b^3 = (a+b)(a^2 + b^2 - ab)$
8. $a^3 \cancel{a} - b^3 = (a-b)(a^2 + b^2 + ab)$
9. $a^3 + b^3 + c^3 - 3abc = (a+b+c)(a^2 + b^2 + c^2 - ab - bc - ac)$

Tests of divisibility:—

Divisibility by 2:— A number is divisible by 2 If its unit digit is zero, or an even number.

Example:— 248, 130

Divisibility by 3:— A number is divisible by 3 If the sum of its digit is divisible by 3.

Example:— 279 → 2+7+9 = 18

18 is divisible by 3, Hence 279 is divisble by 3.

Divisibility by 4:— A number is divisible by 4 If the number formed by its last two digits is divisible by 4.

Example:— 236784

Here 84 is divisible by 4, Hence 236784 is divisible by 4.

Divisible by 5:— A number is divisible by 5 If the number or its unit digit is either 5 or 0.

Example:— 115, 240 etc.

Divide by 6:– A number is divisible by 6 If it is divisible by both 2 and 3.

Example:– 318, 396 etc.

Divisibility by 8:– A number is divisible by 8 if the number formed by its last 3 digit is divisible by 8.

Example:– 23816

Here, 816 is divisible by 8, Hence 23816 is divisible by 8.

Divisibility by 9:– A number is divisible by 9 if the sum of all its digits is divisible by 9.

Example:– 72936 → 7+2+9+3+6 = 27

27 is divisible by 9, Hence 72936 is divisible by 9.

Divisibility by 11:– A Number is divisible by 11 if the difference of the Sum of the alternate ~~digitat~~ digit and the sum of the alternate digit starting from the tens digit is either '0' or is a multiple of 11.

Example:– 1331

$(1+3)-(3+1)=0 \Rightarrow$ ~~1311~~ 1331 is divisible by 11.

Divisibility by 19:- A number is divisible by 19 if the Sum of the number formed by digits other than the unit digit and twice the unit digit is divisible by 19.

Example:- $76 \Rightarrow 7+(2\times6)=19$

Therefore 76 is divisible by 19.

Least Common Multiple (LCM)

LCM of two or more numbers is the least number which is divisible by each of these numbers.

<u>finding LCM</u>:- Write the numbers as product of Prime factors. Then multiply the Product of all the prime factors of the first Number by those Prime factors of the Second Number which are not Common to the prime factors of the first number.

The product is the multiplied by those Prime factors of the third number which are not Common to the prime factors of the ~~two~~ first two numbers.

<u>Example</u>:- find the LCM of 540 and 108?

$540 = 2\times27\times10 = 2^3\times3^3\times5$

$108 = 2^2\times3^3$

$LCM = 2^2 \times 3^3 \times 5 = 4 \times 27 \times 5 = 540$

finding LCM by division!—

Choose one prime factor common to least two of the given numbers. write the given numbers in a row and divide them by the above Prime number. write the quotient for each number under the number itself. If a number ~~wor~~ is not divisible by the prime factor selected, write the numbe as it is Repeat this Process untill you get quotients which have no common factor.
The Product of all the divisors and the numbers in the ~~last~~ last line will be the LCM.

Example!— find the LCM of 36, 84 and 90

$$
\begin{array}{c|l}
3 & 36, 84, 90 \\ \hline
3 & 12, 28, 30 \\ \hline
2 & 4, 28, 10 \\ \hline
2 & 2, 14, 5 \\ \hline
 & 1, 7, 5
\end{array}
$$

$$\boxed{LCM = 3 \times 3 \times 2 \times 2 \times 7 \times 5 = 1260}$$

Highest Common Factor (HCF)

- HCF is the largest factor of two or more given numbers.
- HCF is also Called Greatest Common Divisor (GCD)

finding HCF by factorisation method.

Express each given number ~~is~~ as a product of Primes factors. The product of the prime ~~number~~ factors common to all the number will be the HCF.

Example1- find the HCF of 144, 336 and 2016 ?

$144 = 12 \times 12 = 3 \times 2^2 \times 3 \times 2^2 = 3^2 \times 2^4$

$336 = 2^4 \times 3 \times 7$

$2016 = 2^5 \times 7 \times 3^2$

$HCF = \cancel{3 \times 2^4 \times}\ 3 \times 2^4 = 48$

finding HCF by Division Method:-

Divide the greater number by the Small number. Then divide the Divisor by the remainder. Now, divide the Second divisor by the Second remainder. we repeat this process till no remainder is left.

- The last divisor is the HCF.
- Then using the Same method, find the HCF of this HCF and the third number. This will be the HCF of the three numbers.

Example- HCF of 144, 336

~~144) 96~~

$$\begin{array}{r|l|l} 144 & 336 & 2 \\ & 288 & \\ \hline 48 & 144 & 3 \\ & 144 & \\ \hline & 0 & \end{array}$$

$\boxed{HCF = 48}$

LCM and HCF of fraction :

* LCM of fractions :- $\dfrac{\text{LCM of Numerators}}{\text{LCM of Denominators}}$

* HCF of fractions = $\dfrac{\cancel{\text{LCM}}\ \text{HCF of Numerators}}{\text{LCM of Denominators}}$

Simplification

BODMAS Rule This Rule depicts the Correct Sequence in which the operations are to be executed, so as to find out the value of given expression.

B → Bracket
O → of
D → Division
M → Multiplication
A → Addition
S → subtraction.

Thus in simplifying an expression, first of all the brackets must be removed, strictly in the order (), {}, [].

After removing the brackets we must use the following operations strictly in the order.

(i) of (ii) Division (iii) Multiplication (iv) Addition (v) subtraction.

Approximation:– One needs to solve the questions of approximation by taking the nearest approximate values and marks the answer accordingly.

Example:– If the given value is 3.009 then the approximate value is ~~450~~. 3.

* If the given value is 4.45 then the approximate value is 4.50.

Example 1: $2959.85 \div 16.001 - 34.99 = ?$

(a) 160 (b) 150 (c) 140 (d) 180 (e) 170

Sol.n (b) $2959.85 \div 16.001 - 34.99 \cong 2960 \div 16 - 35 = 185 - 35$
$= 150$

Example 2. $(1702 \div 68) \times 136.05 = ?$

(a) 3500 (b) 3550 (c) 3450 (d) 3400 (e) 3525

Sol:– (d) $(1702 \div 68) \times 136.08 \cong (1700 - 68) \times 136 \approx 3400$

Some Shortcuts and tricks for calculations

Multiplication by 5 or ~~provision~~