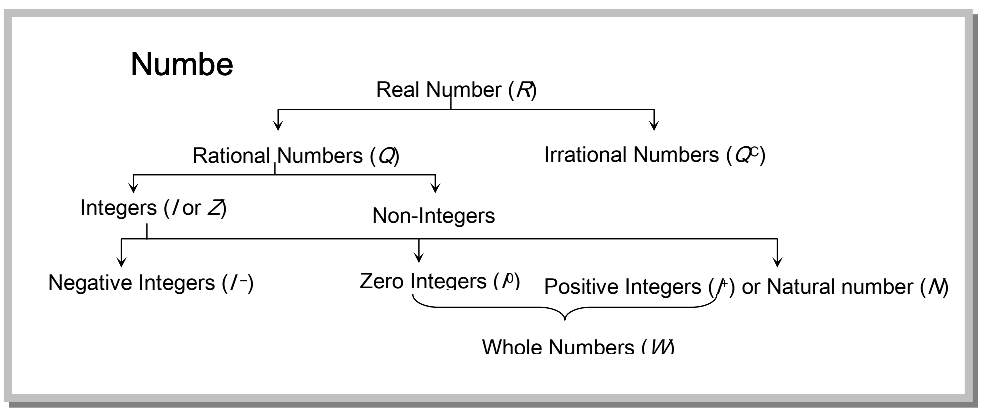
Some Important Definitions.

(1) **Real numbers:**Real numbers are those which are either rational or irrational. The set of real numbers is denoted by *R*.

(i)**Rational numbers:**All numbers of the form p/q where *p* and *q* are integers and $q \neq 0$, are called rational numbers and their set is denoted by *Q*. *e.g.* $\frac{2}{3}, -\frac{5}{2}\ 4\left(\text{as} \quad 4 = \frac{4}{1}\right)$ are rational numbers.

(ii)**Irrational numbers:**Those are numbers which cannot be expressed in form of p/q are called irrational numbers and their set is denoted by Q^c (*i.e.*, complementary set of *Q*) *e.g.* $\sqrt{2}, \quad 1-\sqrt{3}, \ \pi$ are irrational numbers.

(iii)**Integers:**The numbers ....– 3, – 2, – 1, 0, 1, 2, 3, ... are called integers. The set of integers is denoted by *I* or *Z*. Thus, *I* or *Z*= {.......,– 3, – 2, –1, 0, 1, 2, 3,......}



Note: Set of positive integers I^+ = {1, 2, 3, ...}

Set of negative integers I^- = {– 1, – 2, – 3, ...}.

Set of non-negative integers = {0, 1, 2, 3, ..}

Set of non-positive integers = {0, – 1, – 2, – 3,.....}

Positive real numbers: $R^+ = (0, \infty)$

❒ Negative real numbers: $R^- = (-\infty, 0)$

R_0 : All real numbers except 0 (Zero)

❒ Imaginary numbers: $C = \{i, \omega, ...\}$

Even numbers: $E = \{0, 2, 4, 6, ...\}$ ❐ Odd numbers:

$0 = \{1, 3, 5, 7, ...\}$

Prime numbers: The natural numbers greater than 1 which is divisible by 1 and itself only, called prime numbers.

In rational numbers the digits are repeated after decimal

0 (zero) is a rational number

In irrational numbers, digits are not repeated after decimal

π and *e* are called special irrational quantities

∞ is neither a rational number nor an irrational number

(2) **Related quantities:** When two quantities are such that the change in one is accompanied by the change in other, *i.e.,* if the value of one quantity depends upon the other, then they are called related quantities. *e.g.* The area of a circle $(A = \pi r^2)$ depends upon its radius (*r*) as soon as the radius of the circle increases (or decreases), its area also increases (or decreases). In the given example, *A* and *r* are related quantities.

(3) **Variable:** A variable is a symbol which can assume any value out of a given set of values. The quantities, like height, weight, time, temperature, profit, sales etc. are examples of variables. The variables are usually denoted by *x*, *y*, *z*, *u*, *v*, *w*, *t* etc. There are two types of variables mainly:

(i) **Independent variable:** A variable which can take any arbitrary value, is called independent variable.

(ii) **Dependent variable:** A variable whose value depends upon the independent variable is called dependent variable. *E.g.* $y = x^2$, if *x* = 2 then *y* = 4 $\Rightarrow$ so value of *y* depends on *x*. *y* is dependent and *x* is independent variable here.

(4) **Constant:** A constant is a symbol which does not change its value, *i.e.*, retains the same value throughout a set of mathematical operation. These are generally denoted by *a*, *b*, *c* etc. There are two types of constant.

(i) **Absolute constant:** A constant which remains the same throughout a set of mathematical operation is known as absolute constant. All numerical numbers are absolute constants, *i.e.* $2, \sqrt{3}, \pi$ etc. are absolute constants.

(ii) **Arbitrary constant:** A constant which remains same in a particular operation, but changes with the change of reference, is called arbitrary constant *e.g.* $y = mx + c$ represents a line. Here *m* and *c* are constants, but they are different for different lines. Therefore, *m* and *c* are arbitrary constants.

(5) **Absolute value:** The absolute value of a number x, denoted by $|x|$, is a number that satisfies the conditions

$|x| = \begin{cases} -x & \text{if } x < 0 \\ 0 & \text{if } x = 0 \\ x & \text{if } x > 0 \end{cases}$. We also define $|x|$ as follows, $|x|$ = maximum $\{x, -x\}$ or $|x| = \sqrt{x^2}$

The properties of absolute value are

(i) The inequality $|x| \le a$ means $-a \le x \le a$

(ii) The inequality $|x| \ge a$ means $x \ge a$ or $x \le -a$

(iii) $|x \pm y| \le |x| + |y|$ and $|x \pm y| \ge |x| - |y|$

(iv) $|xy| = |x||y|$

(v) $\left|\frac{x}{y}\right| = \frac{|x|}{|y|}, y \ne 0$

(6) **Greatest integer:** Let $x \in R$. Then $[x]$ denotes the greatest integer less than or equal to x, *e.g.* [1.34] =1, [– 4.57] = – 5, [0.69] = 0 etc.

(7) **Fractional part:** We know that $x \ge [x]$. the difference between the number 'x' and its integral value '$[x]$' is called the fractional part of x and is symbolically denoted as $\{x\}$. Thus, $\{x\} = x - [x]$

e.g., if x = 4.92 then $[x]$ = 4 and $\{x\}$ = 0.92.