SETS

Set : A set is well defined collections of objects.

(i) Objects, elements and members of set are synonyms terms.

(ii) Sets are usually denoted by capital letters A, B, C, X, Y, Z etc.

(iii) The elements of a set are represented by small letters a, b, c, x, y, z etc.

Roaster or tabular form : Elements are listed, separated by commas and enclosed within curly brackets { }

Example : {a, e, i, o, u} set of vowels.

Set builder form : All elements possess a single common property. Example : { x : x is a vowel in English alphabet}

Cardinal number : Number of elements of a set A is called cardinal number and denoted by n(A).

Empty set : A set which does not contain any element is called the empty set or the null set or the void set.

Finite Set : A set which is empty or consists of a definite number of elements is called finite set.

Infinite Set : A set which is not empty & consists of a indefinite number of elements is called infinite set.

Equal Set : Two sets A and B are said to be equal if they have exactly the same elements and we write $A = B$.

Otherwise, the sets are said to be unequal and we write $A \neq B$

Subset : A set A is said to be a subset of a set B if every element of A is also an element of B.

$\boxed{A \subset B \text{ if } a \in A \Rightarrow a \in B}$

Proper subset : If $A \subset B$ and $A \neq B$, then A is called a proper subset of B and B is called superset of A.

Singleton set : If a set A has only one element, we call it singleton set.

Note : Subsets of set of real numbers $\boxed{N \subset Z \subset Q,\ Q \subset R,\ N \not\subset T}$ T = Irrational number

Intervals as subsets of R : $(a, b) = \{x : a < x < b\}$ is an open interval, does not contain end points a & b.

$[a, b] = \{x : a \le x \le b\}$ is an closed interval, contain end points also.

$[a, b) = \{x : a \le x < b\}$ is an open interval from a to b, including a but excluding b.

$(a, b] = \{x : a < x \le b\}$ is an open interval from a to b, including b but excluding a.

Length of any interval : The number (b-a) is called the length of any of the intervals (a, b), [a, b], (a, b] or (a, b].

Power Set : The collection of all subsets of a set A is called the power set of A. denoted by P(A).

Universal Set : A set that contains all sets in a given context is called Universal Set denoted by U.

Union of Sets : The union of A and B is the set which consists of all the elements of B, the common elements being taken only once. The symbol 'U' is used to denote the union.

$\boxed{A \cup B = \{x : x \in A \text{ or } x \in B\}}$

Some Properties of the operation of union

(i) $\boxed{A \cup B = B \cup A}$ (Commutative law)

(ii) $\boxed{(A \cup B) \cup C = A \cup (B \cup C)}$ (Associative law)

(iii) $\boxed{A \cup \phi = A}$ (Law of identity element, ϕ is the identity of U)

(iv) $\boxed{A \cup A = A}$ (Idempotent law)

(v) $\boxed{U \cup A = U}$ (Law of U)

Intersection of Sets : The intersection of A and B is the set of all the elements which are common to both A and B. The symbol '$\cap$' is used to denote the intersection.

$$\boxed{A \cap B = \{x : x \in A \text{ and } x \in B\}}$$

Some Properties of the operation of intersection

(i) $\boxed{A \cap B = B \cap A}$ (Commutative law)

(ii) $\boxed{(A \cap B) \cap C = A \cap (B \cap C)}$ (Associative law)

(iii) $\boxed{\phi \cap A = \phi,\ U \cap A = A}$ (Law of ϕ and U)

(iv) $\boxed{A \cap A = A}$ (Idempotent law)

(v) $\boxed{A \cap (B \cup C) = (A \cap B) \cup (A \cap C)}$ (Distributive law) i.e. $\cap$ distributes over $\cup$.

Difference of Sets : The difference of the two sets A and B in this order is the set of elements which belong to A but not to B.

$$\boxed{A - B = \{x : x \in A \text{ and } x \notin B\}}$$

Note : $\boxed{A - B \neq B - A}$

Complement of a Set : Let U be the universal set and A a subset of U. Then the complement of A is the set of all elements of U which are not the elements of A. denoted by A'

$$\boxed{A' = \{x : x \in U \text{ and } x \notin A\} \text{ obviously } A' = U - A}$$

Some properties of Complement Sets

1. Complement laws : (i) $\boxed{A \cup A' = U}$ (ii) $\boxed{A \cap A' = \phi}$
2. De Morgan's law : (i) $\boxed{(A \cup B)' = A' \cap B'}$ (ii) $\boxed{(A \cap B)' = A' \cup B'}$
3. Law of double complementation : $\boxed{(A')' = A}$
4. Laws of empty set and universal set : $\boxed{\phi' = U}$ and $\boxed{U' = \phi}$

Practical Problems on Union and intersection of two sets :

(i) $\boxed{n(A \cup B) = n(A) + n(B)}$

(ii) $\boxed{n(A \cup B) = n(A) + n(B) - n(A \cap B)}$

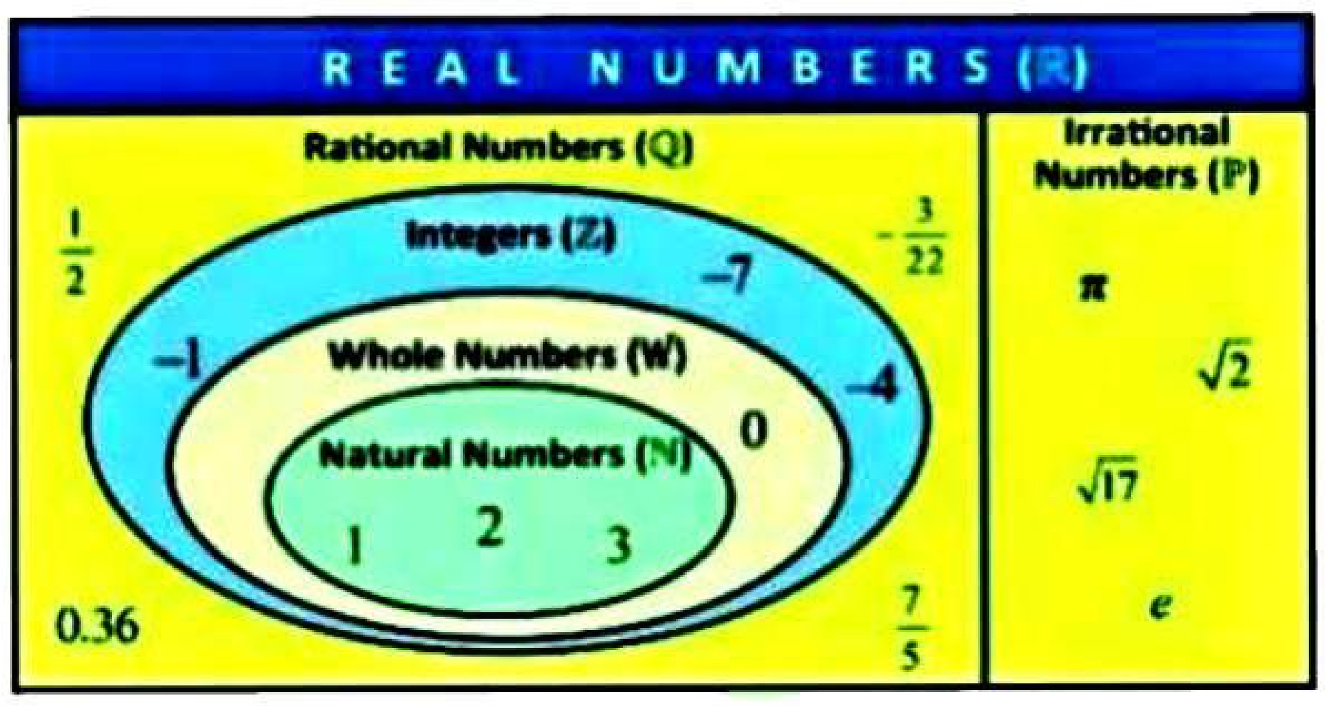
(iii) If A, B and C are finite sets, then

$$\boxed{n(A \cup B \cup C) = n(A) + n(B) + n(C) - n(A \cap B) - n(B \cap C) - n(A \cap C) + n(A \cap B \cap C)}$$

Note : If A is a subset of the universal set U, then its complement A' is also a subset of U.

Important Note :

$=$	equal to	$<$	less then
$\neq$	Not equal to	$\leq$	less then equal to
$\subset$	subset	$>$	greater than
$\not\subset$	not a subset	$\geq$	greater than equal to
$\Rightarrow$	implies	$\supset$	Superset
$\Leftrightarrow$	if and only if	$\not\supset$	Not superset
$\in$	belongs to OR contains in	$\cup$	Union
$\forall$	for all	$\cap$	Intersection
$:$	such that		



N : the set of the all natural numbers.

Z : the set of the all integers.

Q : the set of the all rational numbers.

R : the set of the all real numbers.

Z^+ : the set of the all positive integers.

Q^+ : the set of the all positive rational numbers.

R^+ : the set of the all positive real numbers.