Operation on Sets

There are some operations which when performed on two sets give rise to another set. Here we will define certain operations on set and examine their properties.

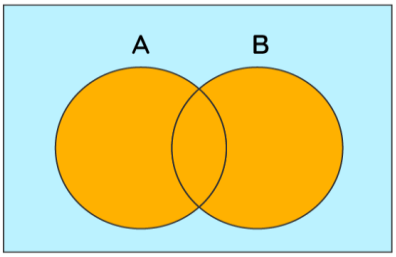
1) **Union of sets**

The union of **A** and **B** is the set of all those elements which belong to either in **A** or in **B** or in both. It is denoted by **A∪B** and read as **A union B**. The symbol 'U' is used to denote the union.

Example:

A = {1, 2, 3}, B = {3, 4, 5} therefore AUB = {1, 2, 3, 4, 5}

Ven diagram of AUB: -



Shaded Portion in Orange is A ∪ B

Some of properties of union of sets: -

a) AUB = BUA (**Commutative law**)
b) AU(BUC) = (AUB)UC (**Associative law**)
c) AU ϕ = A (**Identity law**)
d) AUA = A (**Idempotent law**)
e) AUU = U (**law of Universal set**)

Q1) Find the union of each of the following pairs of sets.

i. A = {a, e, i, o, u}, B = {a, c, d}

Ans: AUB = {a, e, i, o, u, c, d}

ii. A = {1, 3, 5}, B = {2, 4, 6}

Ans: AUB = {1, 2, 3, 4, 5, 6}

iii. A = {x : x is a natural number and $1<x\leq5$}
B = {x : x is a natural number and $5<x\leq10$}

Ans: A = {2, 3, 4, 5}, B = {6, 7, 8, 9, 10}, AUB= {2, 3, 4, 5, 6, 7, 8, 9, 10}

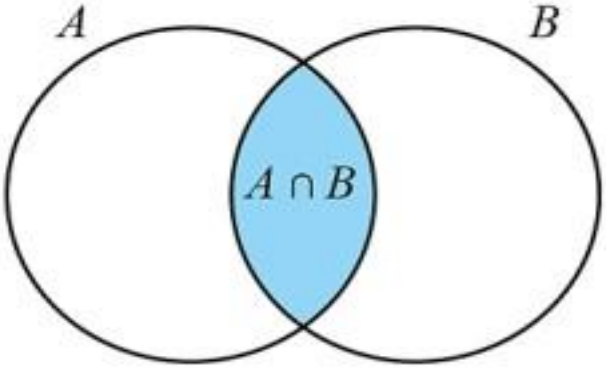
2) Intersection of sets

The intersection of **A** and **B** is the set of all those elements which are common in **A** and **B**. It is denoted by **A∩B** and read as **A intersection B**. The symbol '∩' is used to denote the intersection.

Example:

A = {1, 3, 5, 7}, B = {1, 5} therefore A∩B = {1, 5}

Ven diagram of A∩B: -



Some properties of Intersections of Sets: -

a) A∩B = B∩A (**Commutative law**)
b) A∩(B∩C) = (A∩B)∩C (**Associative law**)
c) ϕ ∩A = ϕ (**law of empty set**)
d) U∩A = A (**law of universal set**)
e) A∩A = A (**Idempotent law**)
f) A∩(B∪C) = (A∩B) ∪ (A∩C)
   A∪(B∩C) = (A∪B) ∩ (A∪C) (**Distributive law**)

Q2) Find the intersection of each of the following pairs of sets.

i. If A = {1, 3, 5, 7, 9} and B = {2, 3, 6, 8, 9} then find A∩B
   Ans: A∩B = {3, 9}
ii. If A = {e, f, g} and B = ϕ then find A∩B
   Ans: A∩B = ϕ
iii. If A = {x : x = 3n, n∈Z} and B = {x : x = 4n, n∈Z} then find A∩B
   Ans: A = {3, 6, 9, 12, 15} and B = {4, 8, 12, 16} therefore A∩B = {12}

3) Difference of sets

The difference of set **A** and **B** is represented as: -

A—**B** = {x : x∈A and x∉B}

Conversely, **B**—**A** = {x : x∈B and x∉A}

Ven diagram of A—B and B—A given are below: -