Set theory

Set :-

Well defined collection of objects together is called as a set.

thos objects may be numbers, alphabets.

Eg :- $A = \{1, 4, 7, 8\}$, $B = \{a, b, c\}$

Types of sets :-

1. Null set :-

An empty set contains no elements and the set is denoted by ϕ or $\{\ \}$

2. Finite set :-

A set which contains countable numbers of elements is called a finite set.

Eg :- $B = \{1, 2, 3, 4\}$

3. Infinite set :-

A set which contains uncountable no. of elements is called a infinite set.

Eg :- $N = \{1, 2, 3, \ldots\}$

4. Subset :-

If A and B are two sets such that every element of A is also the element of B. then A is said to be a subset of B. and it is denoted by $A \subset B$

Eg :- $A = \{1, 2, 3\}$

$B = \{1, 2, 3, 4, 5\}$

$\therefore A \subset B$

5 Superset:-

If A is subset of B then, B is called superset of A and it is denoted by $B \supset A$

Eg:- $A = \{1, 2, 3\}$

$B = \{1, 2, 3, 4, 5\}$

$\therefore B \supset A$

proper subset:-

Any subset A is said to be proper subset of another set B. If A is subset of B, But there is atleast one element of B does not belongs to A. i.e $A \subset B$, $A \neq B$

Eg:- $A = \{1, 2, 3\}$, $B = \{1, 2, 3, 4, 5\}$

$A \subset B$, $A \neq B$.

Equal set:-

Two sets A & B are said to be equal if and only if every elements of A is in B and every element in B is in A.

Eg:- $A = \{a, b, c\}$, $B = \{b, c, a\}$

$A \subset B$, $B \subset A$

$A = B$

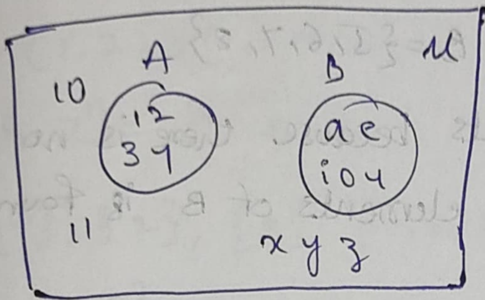
Note:-

* Every set is subset of itself.
* Null set is a subset of any set.

Universal set :-

All ~~the~~ sets under investigats are likely to be considered as a subset of a particular set. this set is called universal set and it is represented as μ or U.

Eg :-



$A \subset \mu$

$B \subset \mu$

Union of sets :-

The union of sets A and B denoted by "$A \cup B$" it is read as A union B. is a set of all elements which belongs to set A & set B.

Eg :- (1) $A = \{1, 2, 3\}$. $B = \{1, 2, 3, 4, 5\}$

$A \cup B = \{1, 2, 3, 4, 5\}$

(2) $A = \{1, 3, 5\}$, $B = \{2, 4, 6\}$

$A \cup B = \{1, 2, 3, 4, 5, 6\}$

Intersection of sets :-

The intersection of 2 sets A & B is denoted by "$A \cap B$" ~~and~~ it is read as A intersection B. It is the set of ~~all elements~~ which belongs to A & B.
common elements

Eg :- (1) $A = \{1, 2, 3\}$

$B = \{1, 2, 3, 4, 5\}$

$A \cap B = \{1, 2, 3\}$

(2) $A = \{1, 3, 5\}$

$B = \{2, 4, 6\}$

$A \cap B = \{\ \} = \phi$

Disjoint sets :-

Two sets are called disjoint sets, if they donot have any common element between them it implies that the elements of one set are totally different from other set.

Eg :- $A = \{1, 2, 3, 4\}$; $B = \{5, 6, 7, 8\}$

A, B are disjoint sets because there is no elements of A in set B and no elements of B is found in set A

Equivalent sets :-

If A & B are 2 sets and if total no. of elements of A and B are same they are called equivalent sets.

Eg :- $A = \{1, 2, 3, 4\}$, $B = \{5, 6, 7, 8\}$

A & B are equivalent sets and $A \neq B$.

Comparable & non-comparable sets :-

If A & B are two sets and if one of A & B is subset of another set A & B are comparable

Sets.

If none of two sets are subset of another set then they are non comparable sets.

Power set :-

If A is a set then the group of all possible subsets of A is called powerset of A. It is denoted by P(S).

If a set has n elements then the power set has 2^n element where small n denotes the no. of elements in the set.

Eg:- ① $A = \{1, 2\}$

$P(A) = 2^2 = 4$

$P(A) = \{1\}, \{2\}, \{1, 2\}, \{\}$

② $A = \{1, 2, 3\}$

$P(A) = 2^n = 2^3 = 8$

$P(A) = \{1\}, \{2\}, \{3\}, \{1, 2, 3\}, \{\}, \{1, 2\}, \{1, 3\},$
$\{2, 3\}.$

Compliment of a set:-

If set A is a subset of universal set μ. set A Contains elements of μ, if some elements of μ are not found in set A. then a set of those elements is called a compliment of set A.

It is denoted by A' or A^c.

$$\boxed{A' = \mu - A}$$

Eg:- $\mu = \{1, 2, 3, 4, 5, 6\}$, $A = \{2, 4, 6\}$

$A' = \mu - A = \{1, 3, 5\}.$

Presentation of sets:-

A set is an collection of element structured with in brackets. there are two ways of presentation of sets.

① Roaster method.

② Set builder method.

① Roaster form:-

Under the roaster form all the elements of a set are written in a continuous row. Each element is seperated by comma and total elements are enclosed in brackets.

Eg:- A set of even numbers below ten as.

$A = \{2, 4, 6, 8\}$

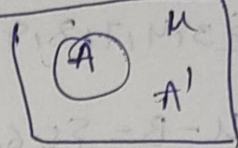
② Set Builder form:-

Under this method a set may be specified by stating its properties. In this form of presentation, instead of writing the elements directly. All the elements of a set should satisfy the properties and is within this common rule. This method is when the elements in the set are large & infinite.

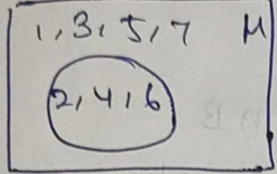
Roaster form	Set builder form
$V = \{a, e, i, o, u\}$	$V = \{x : x$ is an vowel in english alphabets$\}$
$A = \{-2, -1, 0, 1, 2\}$	$A = \{x : -2 \leq x \leq 2, x \in Z\}$
$B = \{\frac{1}{1}, \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \frac{1}{5}\}$	$B = \{x : x = \frac{1}{n}, n \leq 5; n \in N\}$

Venn diagram:-

In Venn Diagram, universal set is presented in the form of a rectangle and set is shown in circle. the remaining part is compliment of set.



Ex:-



$\mu = \{1, 2, 3, 4, 5, 6, 7\}$ $\quad (A')' = \{2, 4, 6\}$

$A = \{2, 4, 6\}$ $\quad \boxed{(A')' = A}$

$A' = \{1, 3, 5, 7\}$

Ex:- If $\mu = \{1, 2, 3, 4, 5, 6, 7\}$ and $A = \{1, 3, 5, 6\}$ then prove that $A' \cup A = \mu$ and $A' \cap A$

A) $\mu = \{1, 2, 3, 4, 5, 6, 7\}$

$A = \{1, 3, 5, 6\}$

$A' = \mu - A = \{2, 4, 7\}$

$A' \cup A = \{2, 4, 7\} \cup \{1, 3, 5, 6\} = \{1, 2, 3, 4, 5, 6, 7\}$

$A' \cup A = \mu$

$A' \cap A = \{2, 4, 7\} \cap \{1, 3, 5, 6\} = \{\} = \phi$

2 Ex:-

If μ is universal set, A and B are subsets

$\mu = \{3, 4, 5, 6, 7, 8, 9, 10, 11\}$, $A = \{4, 7, 9\}$, $B = \{3, 4, 7, 8, 9\}$

then prove that $A \subset B$ and $B' \subset A'$.

A) $\mu = \{3, 4, 5, 6, 7, 8, 9, 10, 11\}$

$A = \{4, 7, 9\}$

$A' = \mu - A = \{3, 5, 6, 8, 10, 11\}$

$B = \{3, 4, 7, 8, 9\}$

$B' = \mu - B = \{5, 6, 10, 11\}$

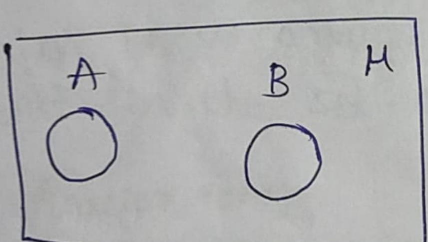
$A \subset B$, since all ~~of~~ elements of A are in B

$B' \subset A'$, since all the elements of B' are in A'

Note:-

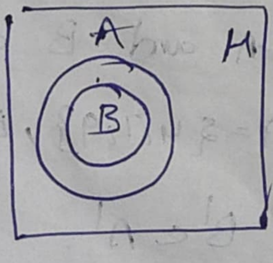
→ If A & B are two subsets of μ and both sets are disjoint sets.

A & B

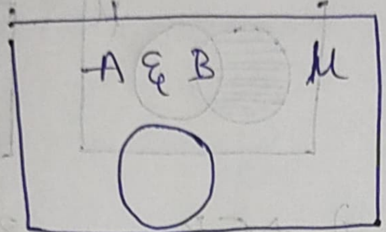


→ If A & B are subset of μ and B is a subset of A then the circle representing B is inside the circle A.

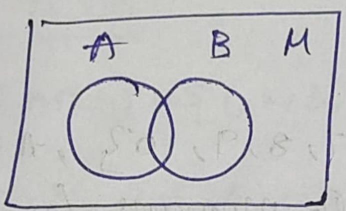
$B \subset A$



→ If A & B are subsets of μ and the two sets are equal sets then the same circle representing both A & B



→ If A & B are not disjoint sets, they will have common elements, the circles are drawn in the rectangle in such a way that both A & B have some common area.



operation on sets :-

There are Four operations on sets.

1. Union of sets
2. Intersection of sets
3. Differences of sets
4. Compliment of sets.

If $A = \{5,6,7\}$ and $B = \{6,8,10,12\}$ then find $A \cup B$ and $A \cap B$

A) $A \cup B = \{5,6,7\} \cup \{6,8,10,12\} = \{5,6,7,8,10,12\}$

$A \cap B = \{5,6,7\} \cap \{6,8,10,12\} = \{6\}$

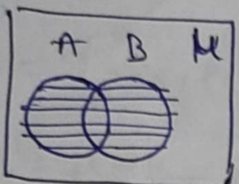
If $\mu = \{1,2,3,4,5,6,7,8,9,10\}$, $A = \{1,2,3\}$ then find A' or A^c.

A) $A' = \mu - A = \{1,2,3,4,5,6,7,8,9,10\} - \{1,2,3\}$

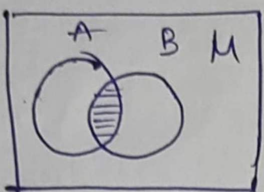
$A' = \{4,5,6,7,8,9,10\}$

Draw the Venn Diagrams of

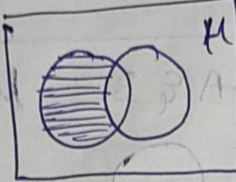
1) $A \cup B$



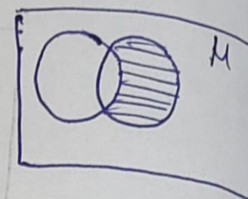
2) $A \cap B$



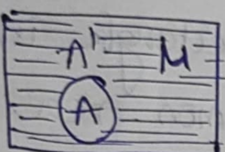
3) $A - B$



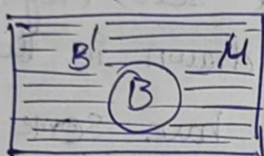
4) $B - A$



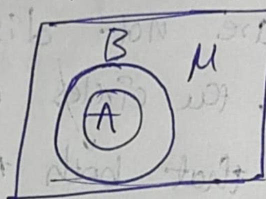
5) $A' = \mu - A$



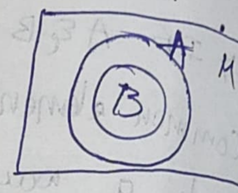
6) $B' = \mu - B$



7) $A \subset B$



8) $B \subset A$



De. morgan's law:-

r. If $\mu = \{1,2,3,4,5,6,7,8,9,10\}$, $A = \{2,4,6,8\}$, $B = \{1,3,5,7\}$ then verify De. morgans law.

A) w.k.T De. morgans law $(A \cup B)' = A' \cap B'$

$(A \cap B)' = A' \cup B'$

given that:

$\mu = \{1,2,3,4,5,6,7,8,9,10\}$, $A = \{2,4,6,8\}$,

$B = \{1,3,5,7\}$

$A' = \mu - A = \{1,2,3,4,5,6,7,8,9,10\} - \{2,4,6,8\}$

$= \{1,3,5,7,9,10\}$

$B' = \mu - B = \{1,2,3,4,5,6,7,8,9,10\} - \{1,3,5,7\}$

$= \{2,4,6,8,9,10\}$

$A \cup B = \{2,4,6,8\} \cup \{1,3,5,7\} = \{1,2,3,4,5,6,7,8\}$

$A \cap B = \{2,4,5,8\} \cap \{1,3,5,7\} = \{\}$

i) $(A \cup B)' = A' \cap B'$

$(A \cup B)' = \mu - (A \cup B) = \{1,2,3,4,5,6,7,8,9,10\} - \{1,2,3,4,5,6,7,8\}$

$= \{9,10\}$

$A' \cap B' = \{1,3,5,7,9,10\} \cap \{2,4,6,8,9,10\} = \{9,10\}$

$\therefore (A \cup B)' = A' \cap B'$

ii) $(A \cap B)' = A' \cup B'$

$(A \cap B)' = \mu - (A \cap B) = \{1,2,3,4,5,6,7,8,9,10\} - \{\}$

$= \{1,2,3,4,5,6,7,8,9,10\}$

$A' \cup B' = \{1,3,5,7,9,10\} \cup \{2,4,6,8,9,10\}$

$= \{1,2,3,4,5,6,7,8,9,10\}$

$\therefore (A \cap B)' = A' \cup B'$

$$\boxed{\begin{array}{l}(A \cup B)' = A' \cap B' \\ (A \cap B)' = A' \cup B'\end{array}}$$

De. morgans laws are proved

② If $\mu = \{1,3,5,7,9,11\}$, $A = \{3,5\}$, $B = \{5,7,9\}$
Then prove that Demorgan's theorem.

③ If $\mu = \{1,2,3,4,5,6,7,8\}$ $A = \{3,4,5\}$, $B = \{4,5,6\}$
Then prove that De morgans theorem.

A) W.K.T Demorgans law $(A \cup B)' = A' \cap B'$

$(A \cap B)' = A' \cup B'$

Given that.

$\mu = \{1,3,5,7,9,11\}$, $A = \{3,5\}$, $B = \{5,7,9\}$

$A' = \mu - A = \{1,3,5,7,9,11\} - \{3,5\} = \{1,7,9,11\}$

$B' = \mu - B = \{1,3,5,7,9,11\} - \{5,7,9\} = \{1,3,11\}$

$A \cup B = \{3,5\} \cup \{5,7,9\} = \{3,5,7,9\}$

$A \cap B = \{3,5\} \cap \{5,7,9\} = \{5\}$.

① $\underline{(A\cup B)' = A' \cap B'}$

$\{1,11\}$.

$(A\cup B)' = \mu - (A\cup B) = \{1,3,5,7,9,11\} - \{3,5,7,9\} = \cancel{\{1,3,5,7,9,11\}}$

$A' \cap B' = \{1,7,9,11\} \cap \{1,3,11\} = \{1,11\}$

$\therefore (A\cup B)' = A' \cap B'$

② $\underline{(A\cap B)' = A' \cup B'}$

$(A\cap B)' = \mu - (A\cap B) = \{1,3,5,7,9,11\} - \{5\} = \{1,3,7,9,11\}$

$A' \cup B' = \{1,7,9,11\} \cup \{1,3,11\} = \{1,3,7,9,11\}$

$\therefore (A\cap B)' = A' \cup B'$

$\therefore$ Demorgans law prooved.

(3A) Given that

$\mu = \{1,2,3,4,5,6,7,8\}$, $A = \{3,4,5\}$, $B = \{4,5,6\}$

w.T.T Demorgans law $(A\cup B)' = A' \cap B'$

$(A\cap B)' = A' \cup B'$

$A' = \mu - A = \{1,2,3,4,5,6,7,8\} - \{3,4,5\}$

$= \{1,2,6,7,8\}$

$B' = \mu - B = \{1,2,3,4,5,6,7,8\} - \{4,5,6\} = \{1,2,3,7,8\}$

$A \cup B = \{3,4,5\} \cup \{4,5,6\} = \{3,4,5,6\}$

$A \cap B = \{3,4,5\} \cap \{4,5,6\} = \{4,5\}$

① $(A \cup B)' = A' \cap B'$

$(A \cup B)' = \mu - (A \cup B) = \{1,2,3,4,5,6,7,8\} - \{3,4,5,6\} = \{1,2,7,8\}$

$A' \cap B' = \cancel{\{3,4,5,6\}}\ \{1,2,\cancel{3},6,7,8\} \cap \{1,2,3,7,8\}$

$= \{1,2,7,8\}$

$\therefore (A \cup B)' = A' \cap B'$

$(A \cup B)' = A' \cap B'$

$(A \cap B)' = A' \cup B'$

② $(A \cap B)' = A' \cup B'$

$(A \cap B)' = \mu - (A \cap B) = \{1,2,3,4,5,6,7,8\} - \{4,5\} = \{1,2,3,6,7,8\}$

~~$A' \cup B' = \{3,4,5,6\} \cup \{4,5\}$~~

$A' \cup B' = \{1,2,3,6,7,8\} \cup \{1,2,3,7,8\} = \{1,2,3,6,7,8\}$

$\therefore (A \cap B)' = A' \cup B'$

$\therefore$ Demorgans law proved

3) If $\mu = \{1,2,3,4,5,6,7,8,9,10\}$, $A = \{2,4,6,8,10\}$

$B = \{1,3,5,7,9\}$

A) w.k.T Demorgans law $(A \cup B)' = A' \cap B'$

$(A \cap B)' = A' \cup B'$

$A' = \mu - A = \{1,2,3,4,5,6,7,8,9,10\} - \{2,4,6,8,10\}$

$= \{1,3,5,7,9\}$

$B' = \mu - B = \{1,2,3,4,5,6,7,8,9,10\} - \{1,3,5,7,9\} = \{2,4,6,8,10\}$

$A \cup B = \{2,4,6,8,10\} \cup \{1,3,5,7,9\} = \{1,2,3,4,5,6,7,8,9,10\}$

$A \cap B = \{2,4,6,8,10\} \cap \{1,3,5,7,9\} = \{\}$.

$(A \cup B)' = A' \cap B'$:-

$(A \cup B)' = U - (A \cup B) = \{1,2,3,4,5,6,7,8,9,10\} - \{1,2,3,4,5,6,7,8,9,10\}$

$= \{\}$

$A' \cap B' = \{1,3,5,7,9\} \cap \{2,4,6,8,10\} = \{\}$

$\therefore (A \cup B)' = A' \cap B'$

$(A \cap B)' = A' \cup B'$:-

$(A \cap B)' = U - A \cap B = \{1,2,3,4,5,6,7,8,9,10\} - \{\}$

$= \{1,2,3,4,5,6,7,8,9,10\}$

$A' \cup B' = \cancel{\{2,4,6,8,10\} \cup \{1,}$

$\{1,3,5,7,9\} \cup \{2,4,6,8,10\}$

$= \{1,2,3,4,5,6,7,8,9,10\}$

$\therefore (A \cap B)' = A' \cup B'$

Hence the Demorgans laws are ~~proved~~

Distributive Laws :-

$A \cup (B \cap C) = (A \cup B) \cap (\cancel{B}\ A \cup C)$

$A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$

① If $A = \{1,2,3,4,5\}$, $B = \{4,5,6,7\}$, $C = \{2,3\}$ then prove that distributive laws.

Ⓐ W.K.T the distributive laws.

$A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$

$A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$

$A \cup B = \{1,2,3,4,5\} \cup \{4,5,6,7\} = \{1,2,3,4,5,6,7\}$

$A \cup C = \{1,2,3,4,5\} \cup \{2,3\} = \{1,2,3,4,5\}$

$B \cup C = \{4,5,6,7\} \cup \{2,3\} = \{2,3,4,5,6,7\}$

$A \cap B = \{1,2,3,4,5\} \cap \{4,5,6,7\} = \{4,5\}$

$A \cap C = \{1,2,3,4,5\} \cap \{2,3\} = \{2,3\}$

$B \cap C = \{4,5,6,7\} \cap \{2,3\} = \{\}$

①

$A \cup (B \cap C) = \{1,2,3,4,5\} \cup \{\cancel{2,3,4,5,6,7}\} = \{1,2,3,4,5\}$

$(A \cup B) \cap (A \cup C) = \{1,2,3,4,5,6,7\} \cap \{1,2,3,4,5\} = \{1,2,3,4,5\}$

$\therefore A \cup (B \cap C) = (A \cup B) \cap \{A \cup C\}$

② $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$

$A \cap (B \cup C) = \{1,2,3,4,5\} \cap \{2,3,4,5,6,7\} = \{2,3,4,5\}$

$(A \cap B) \cup (A \cap C) = \{4,5\} \cup \{2,3\} = \{2,3,4,5\}$

$\therefore A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$

Hence the distributive laws are proved

② If $A = \{1,3,4,8,9,12\}$, $B = \{1,4,9\}$, $C = \{2,4,8,10\}$ then prove that distributive laws.

A) W.K.T the distributive laws.

A

$A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$

$A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$

$(B \cap C) = \{1,4,9\} \cap \{2,4,8,10\} = \{4\}$

$(A \cup B) = \{1,3,4,8,9,12\} \cup \{1,4,9\} = \{1,3,4,8,9,12\}$

$(A \cup C) = \{1,3,4,8,9,12\} \cup \{2,4,8,10\} = \{1,2,3,4,8,9,10,12\}$

1. $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$

$A \cup (B \cap C) = \{1,3,4,8,9,12\} \cup \{4\} = \{1,3,4,8,9,12\}$

$(A \cup B) \cap \{A \cup C\} = \{1,3,4,8,9,12\} \cap \{1,2,3,4,8,9,10,12\}$

$= \{1,3,4,8,9,12\}$

$\therefore A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$

$(B \cup C) = \{1,4,9\} \cup \{2,4,8,10\} = \cancel{\{1,4,9\}}\ \{1,2,4,8,9,10\}$

$(A \cap B) = \{1,3,4,8,9,12\} \cap \{1,4,9\} = \{1,4,9\}$

$(A \cap C) = \{1,3,4,8,9,12\} \cap \{2,4,8,10\} = \{4,8\}$

2. $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$

$A \cap (B \cup C) = \{1,3,4,8,9,12\} \cap \{1,2,4,8,9,10\} = \{1,4,8,9\}$

$(A \cap B) \cup \{A \cap C\} = \{1,4,9\} \cup \{4,8\} = \{1,4,8,9\}$

$\therefore A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$

Hence the Distributive laws are prooved

If $A = \{1,2,3,4,5\}$, $B\{1,2,3,6,7\}$, $C = \{1,2,4,6,8\}$ wokoT then verify Distributive laws.

(A) wokoT the distributive laws $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$

$A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$

$A \cup B = \{1,2,3,4,5\} \cup \{1,2,3,6,7\} = \{1,2,3,4,5,6,7\}$

$A \cup C = \{1,2,3,4,5\} \cup \{1,2,4,6,8\} = \{1,2,3,4,5,6,8\}$

$B \cup C = \{1,2,3,6,7\} \cup \{1,2,4,6,8\} = \{1,2,3,4,6,7,8\}$

$A \cap B = \{1,2,3,4,5\} \cap \{1,2,3,6,7\} = \{1,2,3\}$

$A \cap C = \{1,2,3,4,5\} \cap \{1,2,4,6,8\} = \{1,2,4\}$

$B \cap C = \{1,2,3,6,7\} \cap \{1,2,4,6,8\} = \{1,2,6\}$

i) $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$

$A \cup (B \cap C) = \{1,2,3,4,5\} \cup \{1,2,6\} = \{1,2,3,4,5,6\}$

$(A \cup B) \cap (A \cup C) = \{1,2,3,4,5,6,7\} \cap \{1,2,3,4,5,6,8\} = \{1,2,3,4,5,6\}$

$\therefore A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$

(ii) $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$:-

$A \cap (B \cup C) = \{1,2,3,4,5\} \cap \{1,2,3,4,6,7,8\} = \{1,2,3,4\}$

$(A \cap B) \cup (A \cap C) = \{1,2,3\} \cup \{1,2,4\} = \{1,2,3,4\}$

$\therefore A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$

Hence Distributive laws are prooved.

If $A = \{1,2,3,4,5,6\}$ $B = \{1,2,3,4,5\}$, $C = \{1,9\}$ then prove the Distributive laws.
(i) $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$ (ii) $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$

$A \cup B = \{1,2,3,4,5,6\} \cup \{1,2,3,4,5\} = \{1,2,3,4,5,6\}$

$A \cup C = \{1,2,3,4,5,6\} \cup \{1,9\} = \{1,2,3,4,5,6,9\}$

$B \cup C = \{1,2,3,4,5\} \cup \{1,9\} = \{1,2,3,4,5,9\}$

$A \cap B = \{1,2,3,4,5,6\} \cap \{1,2,3,4,5\} = \{1,2,3,4,5\}$

$A \cap C = \{1,2,3,4,5,6\} \cap \{1,9\} = \{1\}$

$B \cap C = \{1,2,3,4,5\} \cap \{1,9\} = \{1\}$

i) $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$

$A \cup (B \cap C) = \{1,2,3,4,5,6\} \cup \{1\} = \{1,2,3,4,5,6\}$

$(A \cup B) \cap (A \cup C) = \{1,2,3,4,5,6\} \cap \{1,2,3,4,5,6,9\} =$

$\{1,2,3,4,5,6\}$

$\therefore A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$

ii) $\cancel{A \cap (B \cup C) = (A \cap B) \cap (A \cap C)}$

$\cancel{A \cap (B \cup C) = \{1,2,3,4,5,6\} \cap \{1,2,3,4,5,9\} = \{1,2,3,4,5,6,9\}}$

$\cancel{(A \cap B) \cup (A \cap C) = \{1,2,3,4,5\} \cap \{1\} = \{1,2,3,4,5\}}$

$\therefore A \cap$

ii) $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$

$A \cap (B \cup C) = \{1,2,3,4,5,6\} \cap \{1,2,3,4,5,9\}$

$= \{1,2,3,4,5\}$

$(A \cap B) \cup (A \cap C) = \{1,2,3,4,5\} \cup \{1\}$

$= \{1,2,3,4,5\}$

$\therefore$ Hence the Distributed laws is prooved

If $A=\{1,2,3\}$, $B=\{2,3,4\}$, $C=\{3,4,5\}$ the prooved Distributive laws.

A) $A \cup B = \{1,2,3\} \cup \{2,3,4\} = \{1,2,3,4\}$

$A \cup C = \{1,2,3\} \cup \{3,4,5\} = \{1,2,3,4,5\}$

$B \cup C = \{2,3,4\} \cup \{3,4,5\} = \{2,3,4,5\}$

$A\cap B = \{1,2,3\} \cap \{2,3,4\} = \{2,3\}$

$A\cap C = \{1,2,3\} \cap \{3,4,5\} = \{3\}$

$B\cap C = \{2,3,4\} \cap \{3,4,5\} = \{3,4\}$

i) $\underline{A\cup(B\cap C) = (A\cup B)\cap(A\cup C)}$

$A\cup(B\cap C) = \{1,2,3\} \cup \{3,4\} = \{1,2,3,4\}$

$(A\cup B)\cap(A\cup C) = \{1,2,3,4\} \cap \{1,2,3,4,5\} = \{1,2,3,4\}$

$\therefore A\cup(B\cap C) = (A\cup B)\cap(A\cup C)$

ii) $\underline{A\cap(B\cup C) = (A\cap B)\cup(A\cap C)}$

$A\cap(B\cup C) = \{1,2,3\} \cap \{2,3,4,5\} = \{2,3\}$

$(A\cap B)\cup(A\cap C) = \{2,3\} \cup \{3\} = \{2,3\}$

$\therefore A\cap(B\cup C) = (A\cap B)\cup(A\cap C)$

$\therefore$ Hence distributive laws are proved.

i) $A\cap(B\cup C) = (A\cap B)\cup(A\cap C)$

ii) $A\cup(B\cap C) = (A\cup B)\cap(A\cup C)$

Properties of union of sets :—

$$\boxed{\begin{array}{l} \text{i) } A\cup A = A \\ A\cup B = B\cup A \\ A\cup\phi = A \\ A\cup U = U \\ (A\cup B)\cup C = A\cup(B\cup C) \end{array}}$$

1. $A\cup A = A$

Ex:- $A = \{1,2,3,4,5\}$

$A\cup A = \{1,2,3,4,5\} \cup \{1,2,3,4,5\} = \{1,2,3,4,5\}$

$\therefore A\cup A = A$

2. $A\cup B = B\cup A$

Eg:- $A = \{1,2,3\}$, $B = \{4,5,6\}$

$A\cup B = \{1,2,3\} \cup \{4,5,6\} = \{1,2,3,4,5,6\}$

$B\cup A = \{4,5,6\} \cup \{1,2,3\} = \{1,2,3,4,5,6\}$

$\therefore A\cup B = B\cup A$

3. $A\cup\phi = A$

Eg:- $A = \{1,2,-1,0\} \cup \{\} = \{1,2,-1,0\}$

4. $A \cup \mu = \mu$

Eg:- $\mu = \{1, 2, 3, 4, 5\}$, $A = \{1, 2.\}$

$A \cup \mu = \{1, 2\} \cup \{1, 2, 3, 4, 5\} = \{1, 2, 3, 4, 5\}$

$\therefore A \cup \mu = \mu$

5. $A \cup (B \cup C) = (A \cup B) \cup C$ assosiative

Eg:- $A = \{1, 2, 3\}$, $B = \{4, 5, 6\}$, $C = \{7, 8, 9\}$

$B \cup C = \{4, 5, 6\} \cup \{7, 8, 9\} = \{4, 5, 6, 7, 8, 9\}$

$A \cup (B \cup C) = \{1, 2, 3\} \cup \{4, 5, 6, 7, 8, 9\} = \{1, 2, 3, 4, 5, 6, 7, 8, 9.\}$

$A \cup B = \{1, 2, 3\} \cup \{4, 5, 6\} = \{1, 2, 3, 4, 5, 6\}$

$(A \cup B) \cup C = \{1, 2, 3, 4, 5, 6\} \cup \{7, 8, 9\} = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$

Properties of Intersection :-

1. $A \cap A = A$

Eg:- $A = \{1, 2, 3, 4, 5\}$

$A \cap A = \{1, 2, 3, 4, 5\} \cap \{1, 2, 3, 4, 5\} = \{1, 2, 3, 4, 5\} = A$

2. $A \cap B = B \cap A$

eg:- $A = \{1, 2, 3\}$, $B = \{3, 4, 5\}$

$A \cap B = \{1, 2, 3\} \cap \{3, 4, 5\} = \{3\}$

$B \cap A = \{3, 4, 5\} \cap \{1, 2, 3\} = \{3\}$

3. $A \cap \phi = \phi$

eg:- $A = \{1, 2, -1, 0\}$

$A \cap \phi = \{1, 2, -1, 0\} \cap \{\} = \{\}$

$\therefore A \cap \phi = \phi$

i) $A \cap A = A$
ii) $A \cap B = B \cap A$
iii) $A \cap \phi = \phi$
iv) $A \cap \mu = A$
v) $A \cap (B \cap C) = (A \cap B) \cap C$

4. $A \cap \mu = A$

Eg:- $\mu = \{1, 2, 3, 4, 5\}$, $A = \{1, 2\}$

$A \cap \mu = \{1, 2\} \cap \{1, 2, 3, 4, 5\} = \{1, 2\} = A$

5. $A \cap (B \cap C) = (A \cap B) \cap C$

$A = \{1, 2, 3, 4\}$, $B = \{4, 5, 6\}$, $C = \{4, 5, 6, 7\}$

$B \cap C = \{4, 5, 6\} \cap \{4, 5, 6, 7\} = \{4, 5, 6\}$

$A \cap (B \cap C) = \{1, 2, 3, 4\} \cap \{4, 5, 6\} = \{4\}$

$A \cap B = \{1, 2, 3, 4\} \cap \{4, 5, 6\} = \{4\}$

$(A \cap B) \cap C = \{4\} \cap \{4, 5, 6, 7\} = \{4\}$.

Differences of two sets :-

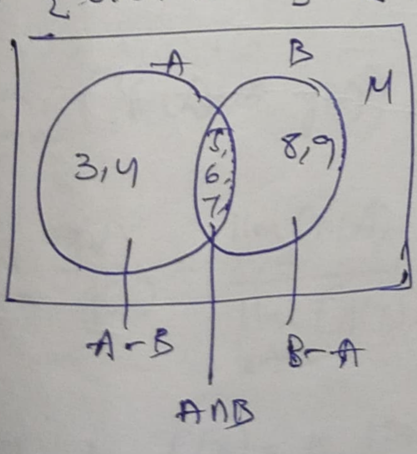
If A & B are two sets, the set of elements of ~~capital~~ A which are not contained in B. is difference of set A & B. it is denoted by A−B.

Eg:- If $A = \{3, 4, 5, 6, 7\}$, $B = \{5, 6, 7, 8, 9\}$ then find A − B. and B − A

Eg:- $A = \{3, 4, 5, 6, 7\}$, $B = \{5, 6, 7, 8, 9\}$

$A - B = \{3, 4, 5, 6, 7\} - \{5, 6, 7, 8, 9\} = \{3, 4\}$

$B - A = \{5, 6, 7, 8, 9\} - \{3, 4, 5, 6, 7\} = \{8, 9\}$



Properties of Differences of sets :-

① $A - B = A \cap B'$

$A = \{3, 4, 5, 6\}$, $B = \{5, 6, 7\}$

$A - B = \{3, 4, 5, 6\} - \{5, 6, 7\} = \{3, 4\}$

$A \cap B' = \{3, 4, 5, 6\} \cap \{3, 4\} = \{3, 4\}$.

$U = \{3, 4, 5, 6, 7\}$

$B' = U - B\{3, 4, 5, 6, 7\} - \{5, 6, 7\}$

$= \{3, 4\}$

② If $A = \{1, 2, 3, 4, 5\}$, $B = \{3, 4, 5, 6\}$ then find $(A-B) \cup (B-A)$

A) $A - B = \{1, 2, 3, 4, 5\} - \{3, 4, 5, 6\} = \{1, 2\}$

$B - A = \{3, 4, 5, 6\} - \{1, 2, 3, 4, 5\} = \{6\}$

$(A - B) \cup (B - A) = \{1, 2\} \cup \{6\} = \{1, 2, 6\}$

Chandu
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