Sets:

Sets is defined as well-defined collection of objects. These objects are referred to as elements of the sets.

OR

A collection of distinct elements of the same type. For example a basket of ranges, set of whole numbers etc.

* Set is denoted by capital letters.
→ Elements of sets are denoted by small letters.
→ {} used to denote the limit

Example: (i) Set of natural numbers.
(ii) Set of whole numbers.
(iii) Set of even numbers.

Symbols:

$\in$ → Belongs to
$\notin$ → does not belongs to
ϕ → null or empty set
$\cup$ → Union of sets
$\cap$ → Intersection of sets
$\cup$ → Universal set.
$\mathbb{Z}$ → Set of integers
N → set of natural numbers
R → set of real numbers
Q → set of rational numbers.

* Representation of set:

There are three types of representation of a set:

(i) Statement form / Descriptive.

In this form a well defined statement of a set is written and enclosed in curly braces. e.g

The set of even numbers less than 15.

$E = \{$ even numbers less than 15 $\}$.

(ii) Roster form:

In Roster form all elements of a set are listed. separated by commas with braces. e.g

$W = \{0, 1, 2, 3, \ldots\}$ → whole numbers

$P = \{2, 3, 5, 7, \ldots\}$ → set of prime numbers.

(iii) Set builder form:

A mathematical notation for describing a set by enumerating its elements or stating a property that its elements must satisfy.

e.g

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

$A = \{x \mid x \in N, \ 1 \leq x \leq 5\}$.

$S = \{x \mid \text{criteria}\}$

S: name of set; x: element of a set

$B = \{0, 2, 4, 6, 8, 10\}$.

$B = \{x \mid x \in \text{EE}, \ 0 \leq x \leq 10\}$.

Types of sets:

① **Empty Set:** A set that has no element is called an empty or null set. It is represented by ϕ or $\{\}$. e.g

$A = \{\}$.

B = Set of prime numbers less than 2.

$B = \phi$.

(ii) **Finite Set:**

A set that has a finite number of elements e.g.

$$N = \{1, 2, 3, 4, 5, 6\}.$$

(iii) **Infinite Set:**

A set that has uncountable elements is called infinite set.

e.g

$$P = \{2, 3, 5, 7, 11, \cdots\}.$$

(iv) **Equal Set:**

Two sets can be equal if they have the same elements even though they could be out of order. e.g

$$A = \{a, b, c, d, e\}.$$
$$B = \{b, c, a, e, d\}.$$
$$A = B$$

$$A = \{1, 2, 3\}.$$
$$B = \{0, 1, 2, 3\}.$$
$$A \neq B.$$

⇒ **Universal Set:** The set containing all elements under discussion is called a Universal set.

(v) Equivalent Set:

Two sets can be said Equivalent if they have different elements but same in number. e.g

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

$B = \{$ Jan, Feb, March, April, May $\}$.

It can be represented as $\leftrightarrow$

e.g

$A \leftrightarrow B$.

* Operation on Sets:

(i) Union of sets:

Union of two given sets is a set which the combination of both the sets. e.g

$A = \{0, 2, 4, 6, 8, 10\}$.

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

$A \cup B = \{0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$.

(ii) Intersection of sets:

Intersection of two sets is a single set is the combination of elements that are common to both sets. e.g

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

$B = \{0, 2, 4, 6, 8, 10\}$. $\{2, 4, 6, 8, 1$

$A \cap B = \{$

(iii) ~~Universal Set:~~

Compliment of a Set:

Let U be a Universal Set.

Then Compliment of set A' is, U − A.

$U = \{1, 2, 3, \ldots\ldots 20\}$.

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

$A' = U - A = \{6, 7, 8, \ldots 20\}$.

(iv) **Subset:**

A Subset is where the entire elements of one set are contained in the other set. e.g ~~(Article 92: Federal ministers & ministers of state → Resignation → Removal → Addition)~~

$A = \{a, b, c\}$.

$B = \{a, b, c, d, e, f\}$.

$A \subseteq B$

⇒ **power set:** Collection of all Subsets of A. $P(A)$. Denote $\rightarrow 2^n$. (no formula $= 2^n$)

(v) **Proper Subset:**

B is a proper Subset of A, if B contains ~~two~~ elements of A. e.g

$A = \{1, 2, 3, 4\}$.

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

OR

Any Subset of the Set except the set itself.

$\rightarrow A \subset B$

⇒ **Improper Subset:** A Subset which Contains all the elements of the original set is called Improper Subset. e.g

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

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

$B \subseteq A$

Venn diagram:

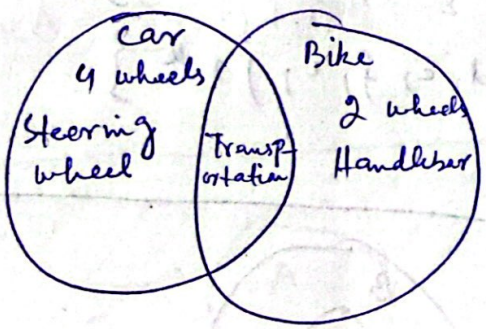
A Venn diagram is a diagram that shows all possible logical relations between a finite collection of different sets.

These diagrams depicts elements as points in the plane and sets as regions inside closed curves.

Example:

Car
→ 4 wheels
→ Steering wheel
→ Transportation

Bike
→ 2 wheels
→ Handle bar
→ Transportation.



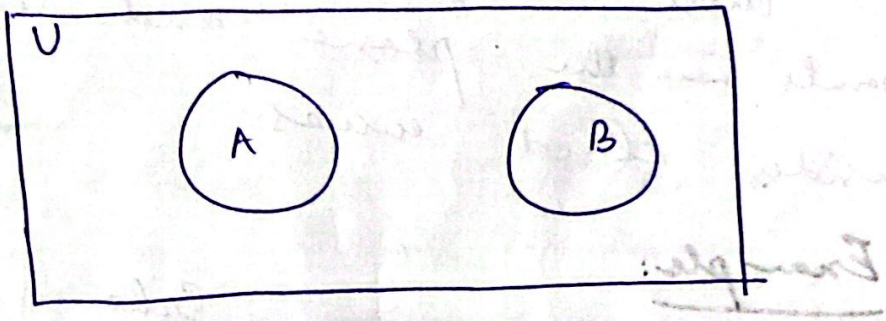
Types of Venn diagram

① Venn Disjoint Sets:

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

$B = \{4, 5, 6\}$.

$U = \{1, 2, 3, \ldots\}$.

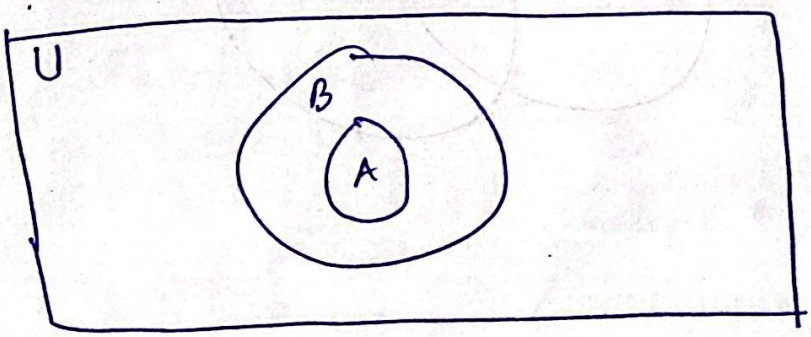


② Proper Subset:

$A = \{a, b\}$.

$B = \{a, b, c, d, e\}$.

$U = \{a, b, c, d, e, f, i, j, k\}$.

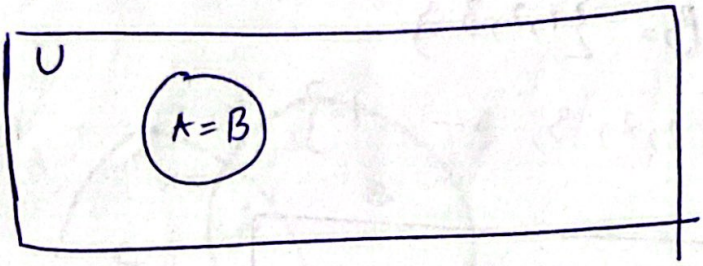


(iii) Equal Sets

$A = \{1, 2, 3\}$.

$B = \{2, 1, 3\}$.

$U = \{1, 2, 3, \dots\}$.

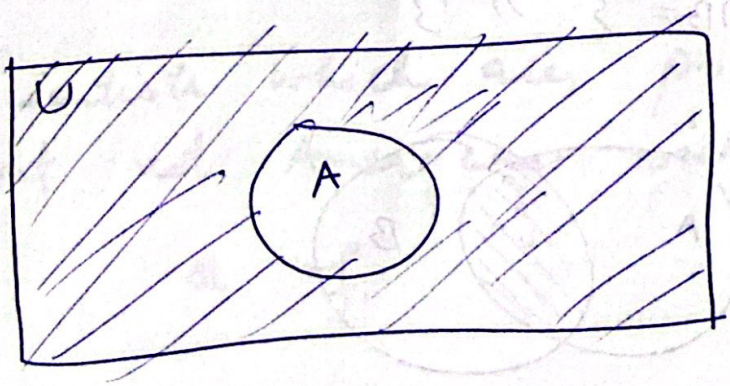


(iv) Compliment of a Set:

$U = \{1, 2, 3, \dots 20\}$.

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

$A' = U - A = \{6, 7, 8, 9, \dots 20\}$.



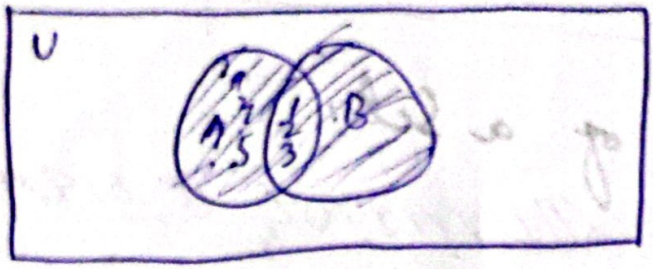
(v) Union of Sets:

The set of all elements which lie in both Set A and Set B.

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

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

$U = \{1, 2, 3, \ldots 10\}$.

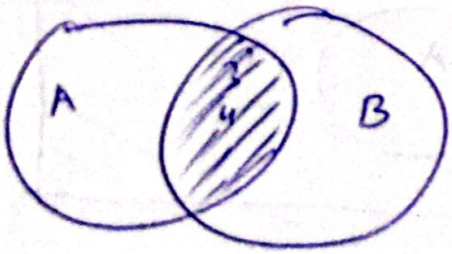


(vi) Intersection of Sets:

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

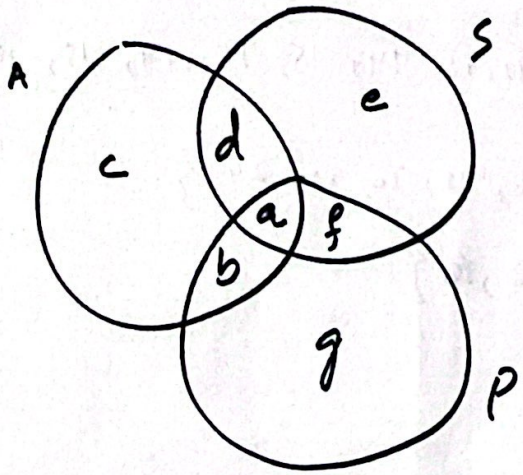
$B = \{3, 4\}$.

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



CSS 2079

Q: In the following diagram A represents American, S represents Scientists and P represents politicians.



(i) American those are politicians but not scientists will be:

b

(ii) Scientists which are politicians but not Americans will be:

a & f.

Q $U = \{$ whole number from 10 to 24 $\}$.

$A = \{$ Even number $\}$.

$B = \{$ Number divisible by 5 $\}$.

Solution:

$U = \{ 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24 \}$

$A = \{ 10, 12, 14, 16, 18, 20, 22, 24 \}$.

$B = \{ 10, 15, 20 \}$.

$A \cap B = \{ 10, 20 \}$.