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Mathematics: Relations Functions Sets: Venn Diagram, Different of Sets and Complement of a Set

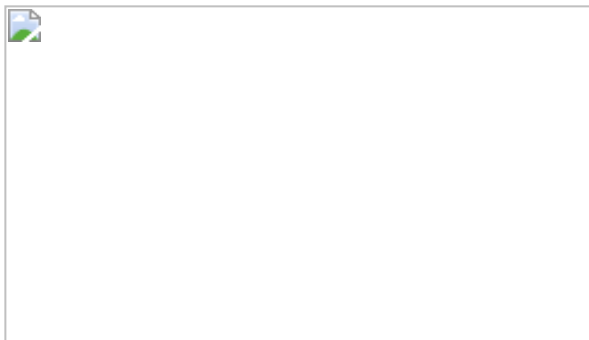
Venn Diagram

- British mathematician John Venn (1834 – 1883 AD) introduced the concept of diagrams to represent sets. According to him universal set is represented by the interior of a rectangle and other sets are represented by interior of circles.
- Diagrammatical representation of sets is known as a Venn diagram.

Example:

If $U = \{1, 2, 3, 4, 5\}$, $A = \{2, 4\}$ and $B = \{1, 3\}$, then these sets can be represented as the Venn diagram.

Solution:



Difference of Sets

Consider the sets

$$A = \{1, 2, 3, 4, 5\} \text{ And } B = \{2, 4, 6\}.$$

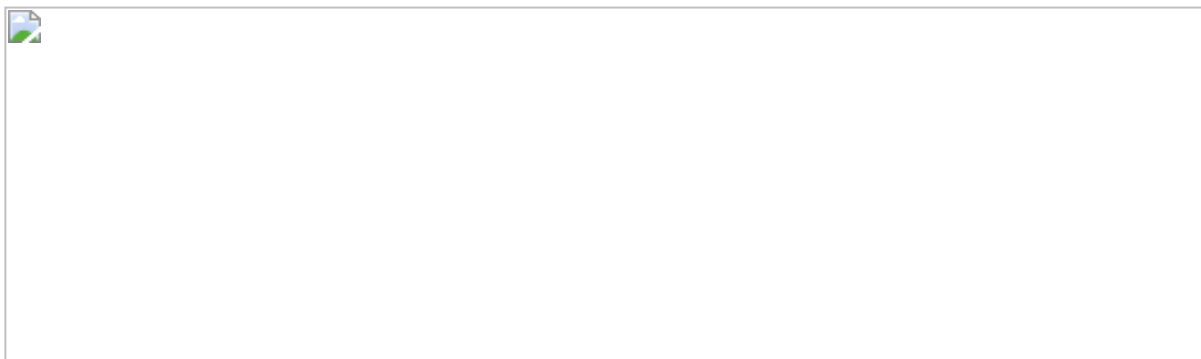
A new set having those elements which are in A but not in B is said to be the difference of sets A and B and it is denoted by $A - B$. $\therefore A - B = \{1, 3, 5\}$

Similarly, a set of those elements which are in B but not in A is said to be the difference of B and A and it is denoted by $B - A$. $\therefore B - A = \{6\}$

In general, if A and B are two sets then

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

Difference of two sets can be represented using Venn diagram as:



Complement of a Set

Let X denote the universal set and Y, Z its subsets where

$X = \{x : x \text{ is any member of a family}\}$

$Y = \{x : x \text{ is a male member of the family}\}$

$Z = \{x : x \text{ is a female member of the family}\}$

- $X - Y$ is a set having female members of the family.
- $X - Z$ is a set having male members of the family.
- $X - Y$ is said to be the complement of Y and is usually denoted by Y' or Y^c .
- $X - Z$ is said to be complement of Z and denoted by Z' or Z^c .

Example:

Let U be the universal set and A its subset where

$$U = \{x : x \in N \text{ and } x \leq 10\}$$

$$A = \{y : y \text{ is a prime number less than } 10\}$$

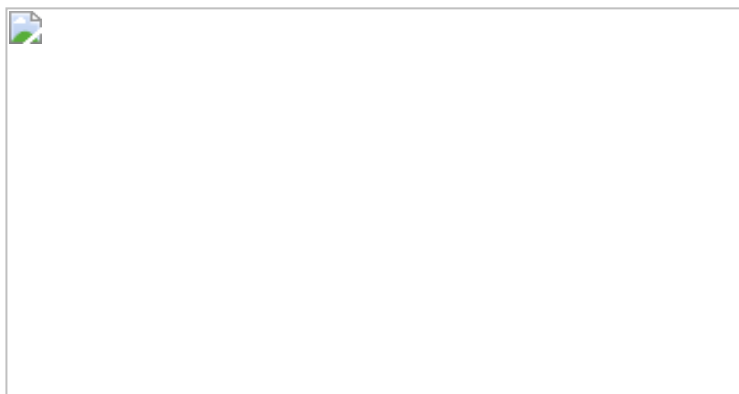
Find (i) A^c (ii) Represent A^c in Venn diagram.

Solution:

It is given

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

$$i. A^c = U - A = \{1, 4, 6, 8, 9, 10\}$$



Note:

- Difference of two sets can be found even if none is a subset of the other but complement of a set can be found only when the set is a subset of some universal set.

- $\psi^C = U$

- $U^C = \psi$