Defining a Set

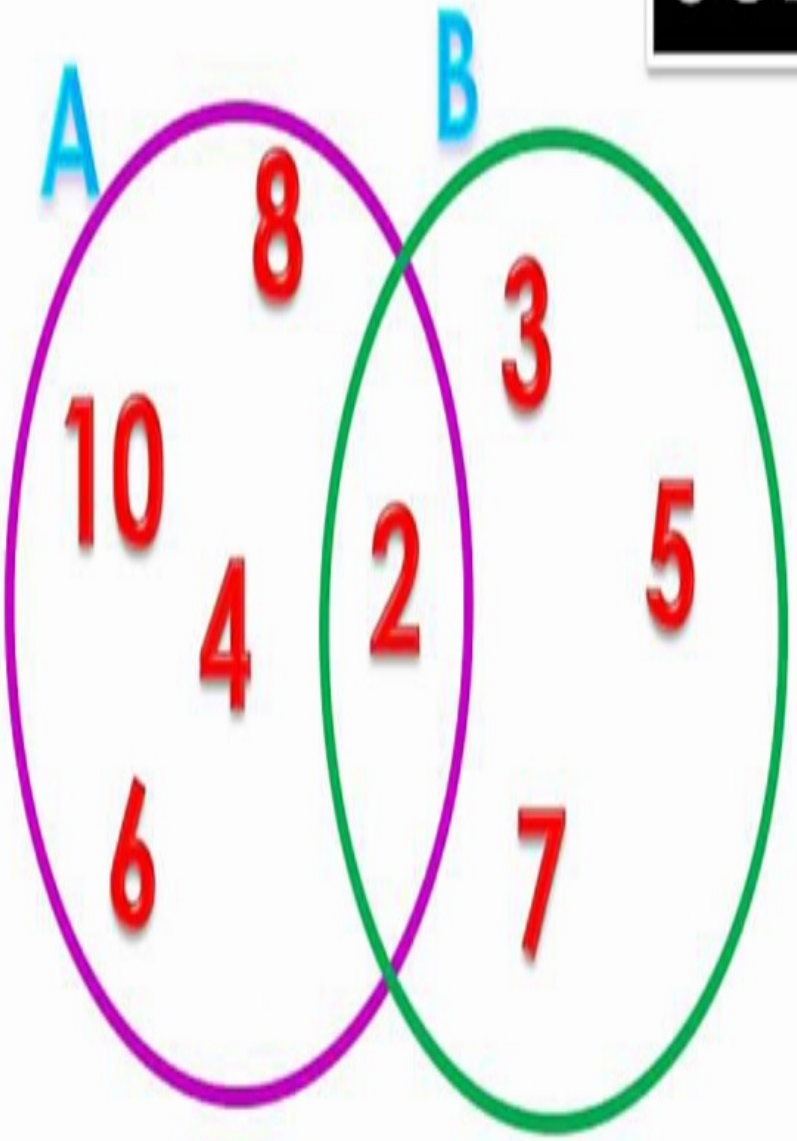
- A set is a collection of objects that are clearly identified.
- The **objects** in the set are called the members or **elements** of the set.
- Each member is said to belong to the set.
- Sets are denoted by capital letters :

  A, B, C ..., X, Y, Z.

- The elements of a set are represented by lower case letters:

  a, b, c, ... , x, y, z.

Sets



These are two sets : A and B.

1. The set A has even numbers.
2. The set B has prime numbers.
3. Elements of set A are : 2, 4, 6, 8, 10
4. Elements of the set B are: 2, 3, 5, 7.

$$A = \{2\ 4\ 6\ 8\ 10\}$$

$$B = \{2\ 3\ 5\ 7\}$$

SETS

Sets are denoted by Capital letters

Sets use "curly" brackets

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

$n(A) = |A| = 4$

The number of elements in Set A is 4

$3 \in A$

3 is an element of A

$7 \notin A$ ← 7 is not an element of A

Definition

Defining a Set

Each object in a set is called an element or a member of the set.

Sets notation: A, B, C, ...

Elements Notation: a, b, c, ...

Note

For example, $A = \{a, b, c, d\}$

$b \in A$

'b is an element of set A' or 'b is in A'

$f \notin A$

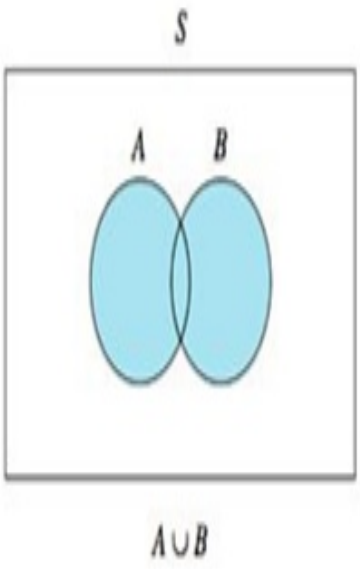
'f is not an element of set A' or 'f is not in A'

Famous Sets in Math

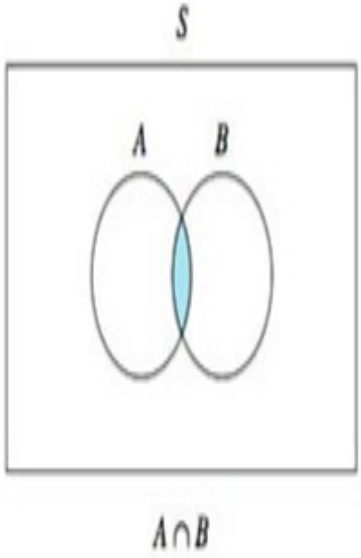
- **N** = Set of natural numbers
- **Z** = Set of integers.
- **Z+** = Set of positive integers.
- **Q** = $\{p/q \mid p \in Z, q \in Z, \text{ and } q \neq 0\}$, set of rational numbers.
- **Q+** =The set of positive rational number.
- **R** = The set of real numbers.
- **R+** =The set of positive real numbers.
- **C** =The set of complex numbers

Operations on Sets

- The **union** of set A and B, denoted by $A \cup B$ is the set that contains all elements in either set A or set B, i.e. $A \cup B = \{x \mid x \in A \text{ or } x \in B\}$.
- The **intersection** of set A and B, denoted by $A \cap B$ contain all elements that are common to both sets i.e. $A \cap B = \{x \mid x \in A \text{ and } x \in B\}$



$A \cup B$



$A \cap B$

- If $A = \{1,3,5,7,9\}$ and $B = \{3,7,9,10,15\}$;

  $A \cup B = \{1, 3, 5, 7, 9, 10, 15\}$ and $A \cap B = \{3, 7, 9\}$.

Overlapping Set

- Two sets that have at least one common element are called overlapping sets.
- In case of overlapping sets :

$n(A \cup B) = n(A) + n(B) - n(A \cap B)$

$n(A \cup B) = n(A - B) + n(B - A) + n(A \cap B)$

$n(A) = n(A - B) + n(A \cap B)$

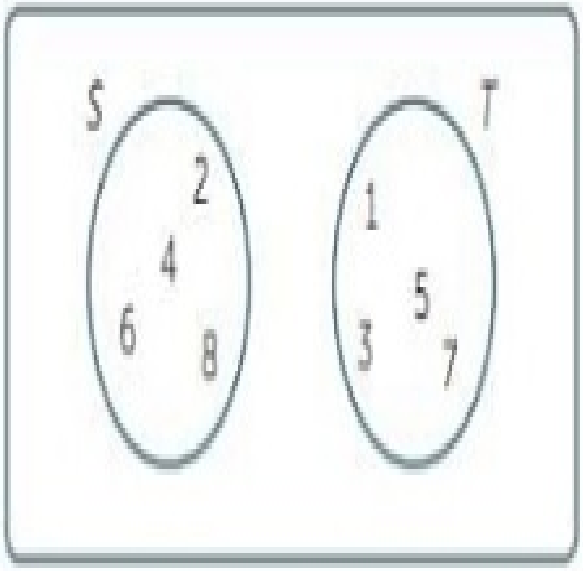
$n(B) = n(B - A) + n(A \cap B)$

Example: Let, $A = \{1, 2, 6\}$ and $B = \{6, 12, 42\}$.
There is a common element '6', hence these sets are overlapping sets.

Disjoint Sets

- **Disjoint sets:**
- Two sets are called disjoint if they have no elements in common.

- **For Example:**
- The sets S = {2, 4, 6, 8} and T = {1, 3, 5, 7} are disjoint.



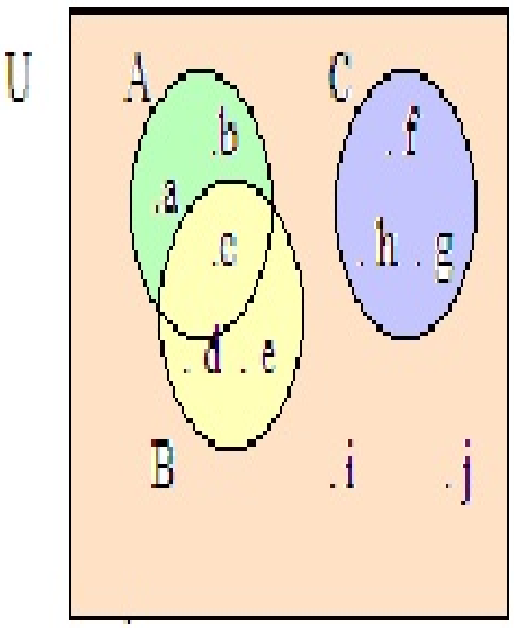
The Universal Set

Definition

The Universal set is the set of all elements under consideration in a given discussion.

Denotation: U

For instance, U = {a, b, c, d, e, f, g, h, I, j}



A = {a, b, c}

B = {c, d, e}

C = {f, g, h}

Empty sets

- A set which does not contain any elements is called as Empty set or Null or Void set. Denoted by ∅ or { }

  e.g. Set A= {set of months containing 32 days}

  Here n (A)= 0; hence A is an empty set.

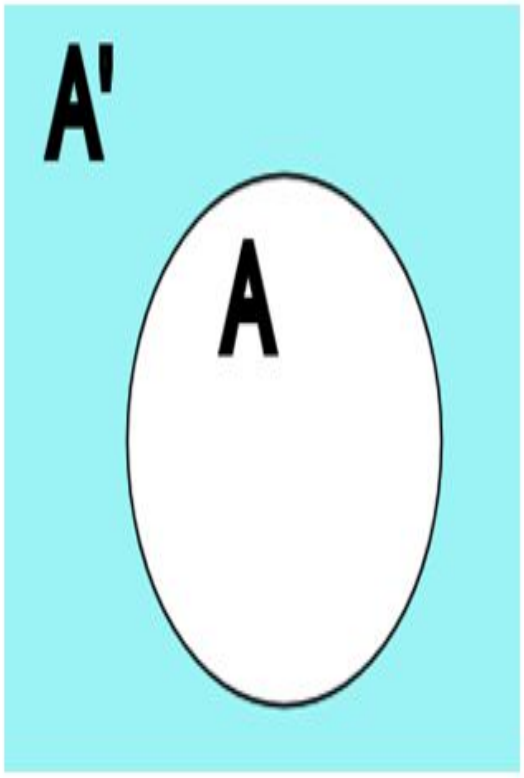
  e.g. set H={no of cars with three wheels}

- Here n (H)= 0; hence it is an empty set.

The Complement of a Set

The **complement** of a set A is defined as the set of elements that are contained in U, the universal set, but not contained in set A. The symbolism and notation for the complement of set A are

$$A' = \{x \in U \mid x \notin A\}$$



In the Venn diagram on the left, the rectangle represents the universe. A' is the shaded area outside the set A.

EXAMPLE 1 Finding the Complement of a Set

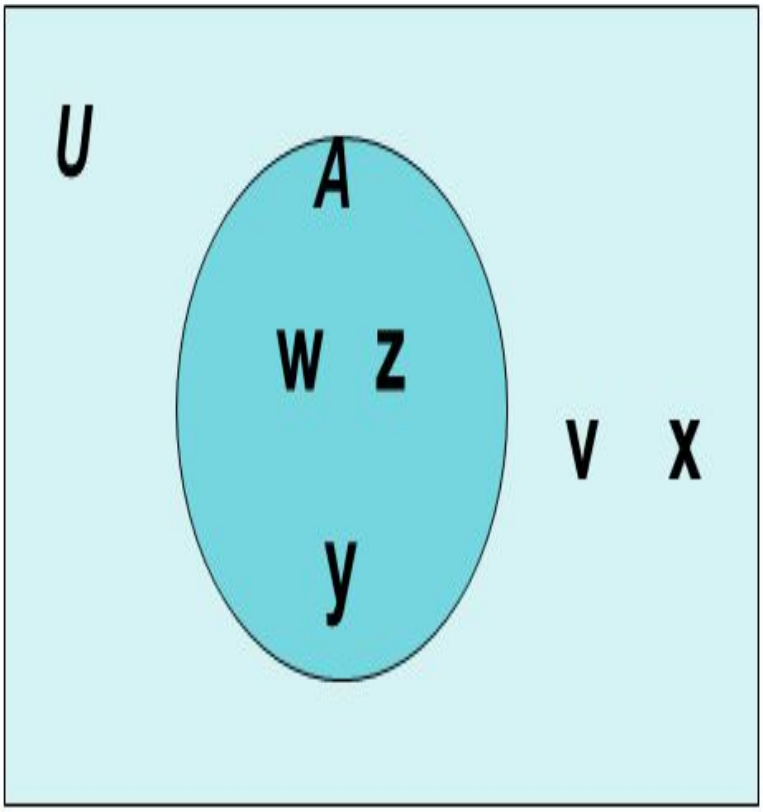
Let $U = \{v, w, x, y, z\}$ and $A = \{w, y, z\}$. Find A' and draw a Venn diagram that illustrates these sets.

SOLUTION

Using the list of elements in U, we just have to cross out the ones that are also in A. The elements left over are in A'.

$$U = \{v, \cancel{w}, x, \cancel{y}, \cancel{z}\}$$

$$A' = \{v, x\}$$



Set Theory Symbols

Symbol	Name	Example	Explanation
$\{\}$	Set	$A=\{1,3\}$ $B=\{2,3,9\}$ $C=\{3,9\}$	Collection of objects
$\cap$	Intersect	$A\cap B=\{3\}$	Belong to both set A and set B
$\cup$	Union	$A\cup B=\{1,2,3,9\}$	Belong to set A or set B
$\subset$	Proper Subset	$\{1\}\subset A$ $C\subset B$	A set that is contained in another set
$\subseteq$	Subset	$\{1\}\subseteq A$ $\{1,3\}\subseteq A$	A set that is contained in or equal to another set
$\not\subset$	Not a Proper Subset	$\{1.3\}\not\subset A$	A set that is not contained in another set
$\supset$	Superset	$B\supset C$	Set B includes set C
$\in$	Is a member	$3\in A$	3 is an element in set A
$\notin$	Is not a member	$4\notin A$	4 is not an element in set A