SET

A well defined collection of objects is called a set.

The objects are called the elements or members of the set.

Sets are denoted by capital letters A, B, C …, X, Y, Z.

SET

The elements of a set are represented by lower case letters a, b, c, … , x, y, z.

If an object x is a member of a set A we write $x \in A$, which reads "x belongs to A" or "x is in A" or "x is an element of A"

Otherwise we write $x \notin A$, which reads "x does not belong to A" or "x is not in A" or "x is not an element of A".

TABULAR FORM

Listing all the elements of a set, separated by commas and enclosed within braces or curly brackets{}

EXAMPLES

$$A = \{1, 2, 3, 4, 5\}$$
$$B = \{2, 4, 6, 8, \ldots, 50\}$$
$$C = \{1, 3, 5, 7, 9, \ldots\}$$

DESCRIPTIVE FORM

Stating in words the elements of a set.

EXAMPLES

A = set of first five Natural Numbers.

B = set of positive even integers less or equal to fifty

C = set of positive odd integers.

SET BUILDER FORM

Writing in symbolic form the common characteristics shared by all the elements of the set.

EXAMPLES

$A = \{x \in N \mid x \leq 5\}$ N=Natural Number

$B = \{y \in E \mid 0 < y \leq 50\}$ E=Even Number

$C = \{x \in O \mid x > 0\}$ O=Odd Number

SETS OF NUMBERS

1. Set of Natural Numbers

   $N = \{1, 2, 3, \ldots\}$

2. Set of Whole Numbers

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

3. Set of Integers

   $Z = \{\ldots, -3, -2, -1, 0, +1, +2, +3, \ldots\}$

   $= \{0, \pm 1, \pm 2, \pm 3, \ldots\}$

SETS OF NUMBERS

4. Set of Even Integers

   $E = \{0, \pm 2, \pm 4, \pm 6, \ldots\}$

5. Set of Odd Integers

   $O = \{\pm 1, \pm 3, \pm 5, \ldots\}$

6. Set of Prime Numbers

   $P = \{2, 3, 5, 7, 11, 13, 17, 19, \ldots\}$

7. Set of Rational Numbers

   $Q = \{x \mid x = p/q\ ;\ p, q \in Z, q \neq 0\}$

SUBSET

If A and B are two sets, A is called a subset of B, written $A \subseteq B$, if, and only if, every element of A is also an element of B.

Symbolically:

$$A \subseteq B \leftrightarrow \text{if } x \in A \text{ then } x \in B$$

SUBSET

REMARKS:

1. When $A \subseteq B$, then B is called a superset of A.

2. When $A \not\subseteq B$, then there exist at least one $x \in A$ such that $x \notin B$.

3. Every set is a subset of itself.

EXAMPLE

Let

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

$C = \{1, 2, 3, 4\}$ $\quad$ $D = \{3, 1, 5\}$

Then

$A \subseteq B$	$A=\{1, \ , 3, \ , 5\}$
$A \subseteq D$	$D=\{3,1,5\}$
$A \not\subseteq C$	$5 \in A$ but $5 \notin C$

PROPER SUBSET

Let A and B be sets. A is a proper subset of B, if, and only if, every element of A is in B but there is at least one element of B that is not in A.

Symbolically:

$$A \subset B$$

EQUAL SETS

Two sets A and B are equal if, and only if, every element of A is in B and every element of B is in A and is denoted $A = B$.

Symbolically:

$$A = B \text{ iff } A \subseteq B \text{ and } B \subseteq A$$

EQUAL SETS

EXAMPLE

Let A = {1, 2, 3, 6}

B = the set of positive divisors of 6

C = {3, 1, 6, 2}

D = {1, 2, 2, 3, 6, 6, 6}

Then A, B, C, and D are all equal sets.

NULL SET

A set which contains no element is called a null set, or an empty set or a void set.

Symbolically:

It is denoted by the Greek letter $\varnothing$(phi) or { }.

NULL SET

EXAMPLE

$A = \{x \mid x \text{ is a person taller than 10 feet}\}$

$A = \varnothing$

$B = \{x \mid x^2 = 4, x \text{ is odd}\}$

$B = \varnothing$

EXERCISE

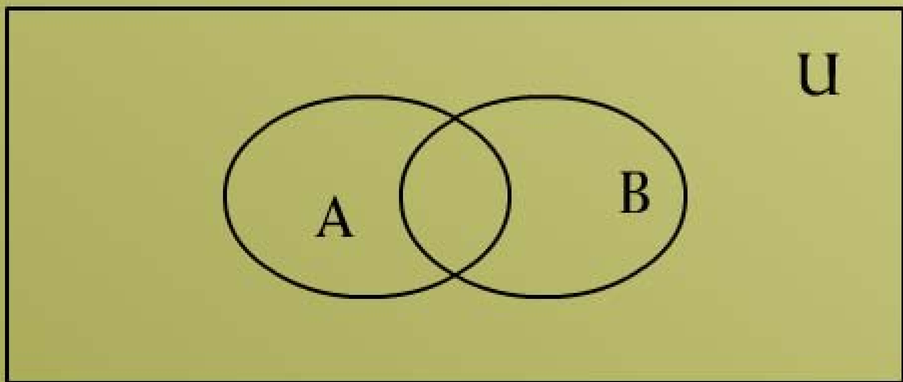
(a)	$x \in \{x\}$	TRUE
(b)	$\{x\} \subseteq \{x\}$	TRUE
(c)	$\{x\} \in \{x\}$	FALSE
(d)	$\{x\} \in \{\{x\}\}$	TRUE
(e)	$\varnothing \subseteq \{x\}$	TRUE
(f)	$\varnothing \in \{x\}$	FALSE

UNIVERSAL SET

The set of all elements under consideration is called the Universal Set.
The Universal Set is usually denoted by U.

VENN DIAGRAM

A Venn diagram is a graphical representation of sets by regions in the plane.



FINITE AND INFINITE SETS

A set S is said to be finite if it contains exactly m distinct elements where m denotes some non negative integer.
In such case we write

$$|S| = m \text{ or } n(S) = m$$

A set is said to be infinite if it is not finite.

FINITE AND INFINITE SETS

EXAMPLES

1. The set S of letters of English alphabets is finite and $|S| = 26$

2. The null set $\varnothing$ has no elements, is finite and $|\varnothing| = 0$

3. The set of positive integers $\{1, 2, 3, \ldots\}$ is infinite.

EXERCISE

1. A = {month in the year} FINITE

2. B = {even integers} INFINITE

3. C = {positive integers less than 1} FINITE

MEMBERSHIP TABLE

A table displaying the membership of elements in sets. To indicate that an element is in a set, a 1 is used; to indicate that an element is not in a set, a 0 is used.

A	A^c
1	0
0	1