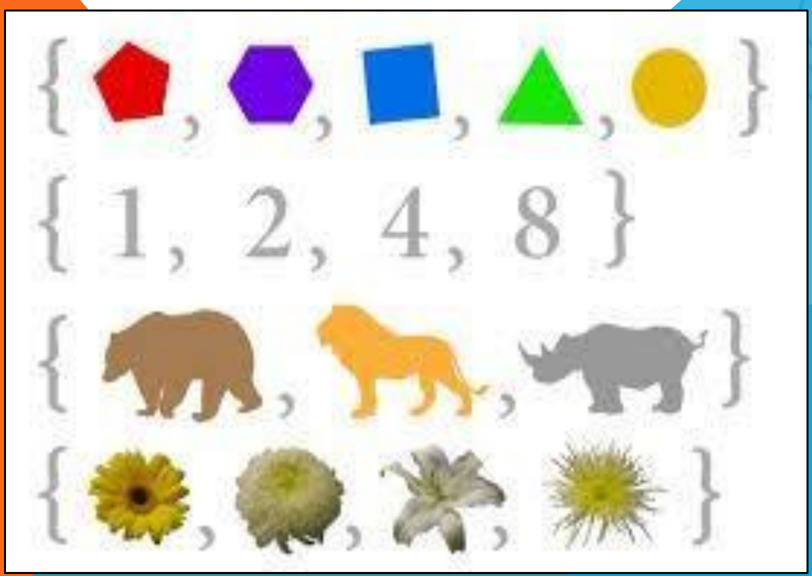
CLASS:XI

SETS

M O D U L E -1

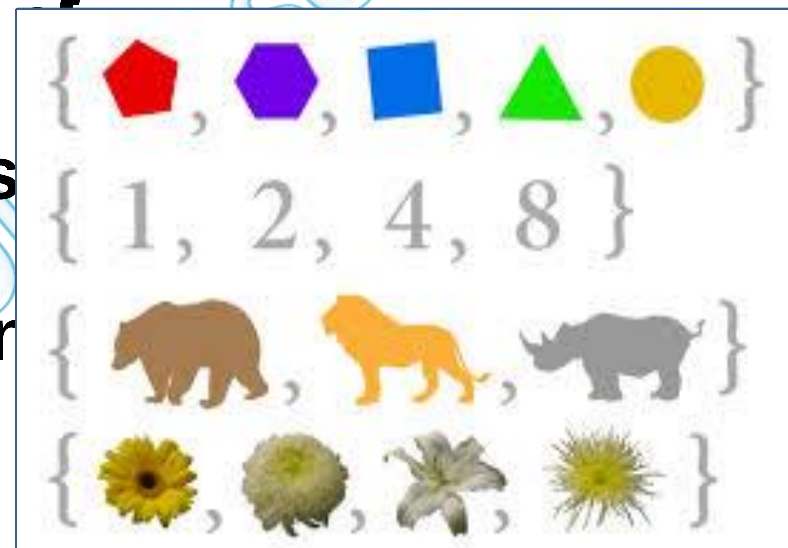


Concept of Sets in everyday life …….

A set is a well- defined collection of objects.

Eg: (i)The rivers of India
(ii) Months of the year beginning with ‘J’

The above two are examples of
sets, whereas,
(iii) Five most dangerous animals
(iv)Three most entertainin
movies of Bollywood



(iii) and (iv) are collections which are not well-defined.

Hence, (iii) and (iv) are not examples of sets.

Representation of a set

The objects in a set are called elements or members of the set. We generally use capital letters to denote a set.

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

Here, 4 is an element of the set A, written as $4 \in A$ (4 belongs to A)

whereas, 6 is not an element of A, written as $6 \notin A$(6 does not belong to A)

- Set of numbers commonly used in mathematics are :

  N : Set of natural numbers

  Z : Set of integers

  Q : Set of rational numbers

  R : Set of real numbers

Representation of a set

(i) ROSTER FORM:

In this form, the elements of a set are listed and separated by commas within braces { }

Eg: set of all vowels in English alphabet is written as

$A = \{a, e, i, o, u\}$

Note:

- In roster form, order in which elements are listed, is immaterial.
- The elements are not repeated in this form.

(ii) SET-BUILDER FORM:

In this form, we describe the common property possessed by all the elements of a set, which is not possessed by any element outside the set.

Eg: set of all vowels in English alphabet is written as

$A = \{x : x$ **is a vowel in English alphabet }.**

Let’s practice…….

1) **Write the following sets in roster form:**

(i) $A = \{x: x$ **is a positive integer and** $x^2 < 40\}$

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

(ii) $B = \{x: x$ **is a natural number which divides** $42\}$

$B = \{1, 2, 3, 6, 7, 14, 21, 42\}$

(iii) $C = \{x: x$ **is a solution of the equation** $x^2 + x - 2 = 0\}$

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

2) **Write the following sets in set- builder form:**

(i) $A = \{1, 4, 9, 16, 25, \dots \dots ..\}$

$A = \{x: x = n^2$**, where** $n \epsilon N\}$

(ii) $B = \left\{\frac{1}{2}, \frac{2}{3}, \frac{3}{4}, \frac{4}{5}, \frac{5}{6}, \frac{6}{7}\right\}$

$B = \left\{x: x = \frac{n}{n+1}\right.$ **, where** $n \epsilon N$ **and** $n \leq 6\}$

(iii) A$= \{17, 26, 35, 44, 53, 62, 71, 80\}$

$\mathrm{A} = \{x: x$ **is a two- digit natural number sum of whose digits is** $8\}$

Match each of the set on the left in the roster form with the same set on the right in set-builder form :

$\{P, R, I, N, C, A, L\}$ **(a)** $\{x: x$ **is a positive integer and divisor of** $18\}$

(ii) $\{0\}$ **(b)** $\{x: x$ **is an integer and** $x^2 - 9 = 0\}$

(iii) $\{1,2,3,6,9,18\}$ **(c)** $\{x: x$ **is an integer and** $x + 1 = 1\}$

(iv) $\{3, -3\}$ **(d)** $\{x: x$ **is a letter of the word PRINCIPAL}**

Types of sets :

) Empty Set : A set which does not contain any element is called an empty set or null set or void set, denoted by the symbol $\emptyset$ or { }.

Eg: Set of all even prime numbers greater than 2.

This is an empty set because 2 is the only even prime number.

- 2) Finite and Infinite sets: A set which is empty or consists of a definite number of elements is called finite otherwise, the set is called infinite.

Eg: (i) Let S be the set of solutions of the equation $x^2 - 16 = 0$.

Here, S$= \{-4, 4\}$ which means S is finite.

(ii) Let G be the set of points on a line. Then G is infinite.

Note: It is not possible to write all the elements of an infinite set in roster form. But, we can represent some infinite sets in roster form :

❖ Set of natural numbers { 1, 2, 3, …..}

❖ Set of integers { ….. -3, -2, -1, 0, 1, 2, 3,…….}

Types of sets (contd...)

) Equal Sets: Two sets A and B are said to be equal if they have exactly the same elements, and is written as A = B.

Eg: Let A= {1, 2, 3, 4} and B= {3, 1, 4, 2} .Then A = B.

Note: A set does not change if elements of the set are written in a different order or one or more elements of the set are repeated.

For Eg: The sets A = {1, 2, 3} and B = {2, 2, 1, 3, 3} are equal.

4) Equivalent Sets: Two sets A and B are said to be equivalent if the number of elements in A is equal to the number of elements in B.

Eg: The sets $A = \{1, 2, 3, 4, 5\}$ and $B = \{a, e, i, o, u\}$ are equivalent sets as $n(A) = n(B) = 5$.

Here,

$n(A)$ means number of elements in set A or cardinal number of set A,

$n(B)$ means number of elements in set B or cardinal number of set B.

Let's practice…….

Is the set A equal to set B in the following?

(i) $A = \{2, 3\}$ **,** $B = \{x : x$ **is a solution of** $x^2 + 5x + 6 = 0\}$

$x^2 + 5x + 6 = 0 \Rightarrow (x + 2)(x + 3) = 0$

$\Rightarrow x = -2, -3$

$\Rightarrow$ **Solution set of** $B = (-2, -3)$

But $A = \{2, 3\}$**. Hence** $A \neq B$

(ii) $\mathrm{A} = \{x : x$ **is a letter of the word** $FOLLOW\}$

$\mathrm{B} = \{x : x$ **is a letter of the word** $WOLF\}$

$A = \{F, O, L, W\}$ **and** $B = \{W, O, L\ F\}$

Hence $A = B$**.**

RECAP…….

- What is a set?
- Representation of a set
  - Roster form
  - Set-builder form
- Types of sets
  - Empty set
  - Finite set
  - Infinite set
  - Equal sets
  - Equivalent sets

SUBSET :

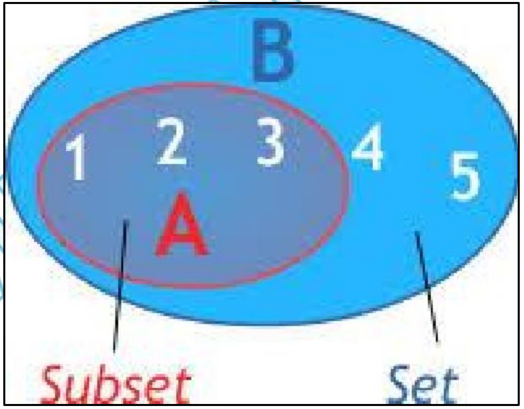
A set A is said to be a subset of a set B if every element of A is also an element of B.

In other words, $A \subset B$ if $a \in A \Rightarrow a \in B$

Here, the symbol $\subset$ stands for ' is a subset of ' or ' is contained in '.

If A is not a subset of B, we write A$\not\subset B$.

If $A \subset B$ and $A \neq B$, then A is called a proper subset of B and B is called superset of A.



NOTE : (i) Every set is a subset of itself.

(ii) Empty set is a subset of every set.

LET'S LOOK AT AN EXAMPLE :

Example: Let **A be all multiples of 4** and **B be all multiples of 2**. Is A a subset of B? And is B a subset of A?

The sets are:

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

By pairing off members of the two sets, we can see that every member of A is also a member of B, but not every member of B is a member of A:

$$A = \{..., -8, -4, 0, 4, 8, ...\}$$

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

So:

A is a subset of B, but B is not a subset of A

SUBSETS OF REAL NUMBERS:

We know that the following sets are subsets of the set of real numbers (R):

(i) Set of **natural numbers**, $N = \{1, 2, 3 \ldots\}$

(ii) Set of **integers**, $Z = \{\ldots -3, -2, -1, 0, 1, 2, 3, \ldots\}$

(iii) Set of **rational numbers**, $Q = x : x = \frac{p}{q}$, where $p, q \in Z$ and $q \neq 0$

(iv) Set of **irrational numbers**, $Q' = \{x : x \in R,\ x \notin Q\}$

Clearly,

$N \subset Z \subset Q \subset R,\ Q' \subset R$

INTERVALS AS SUBSETS OF *R*:

On the real number line, the following types of intervals described as subsets of R, are shown in the figure below:

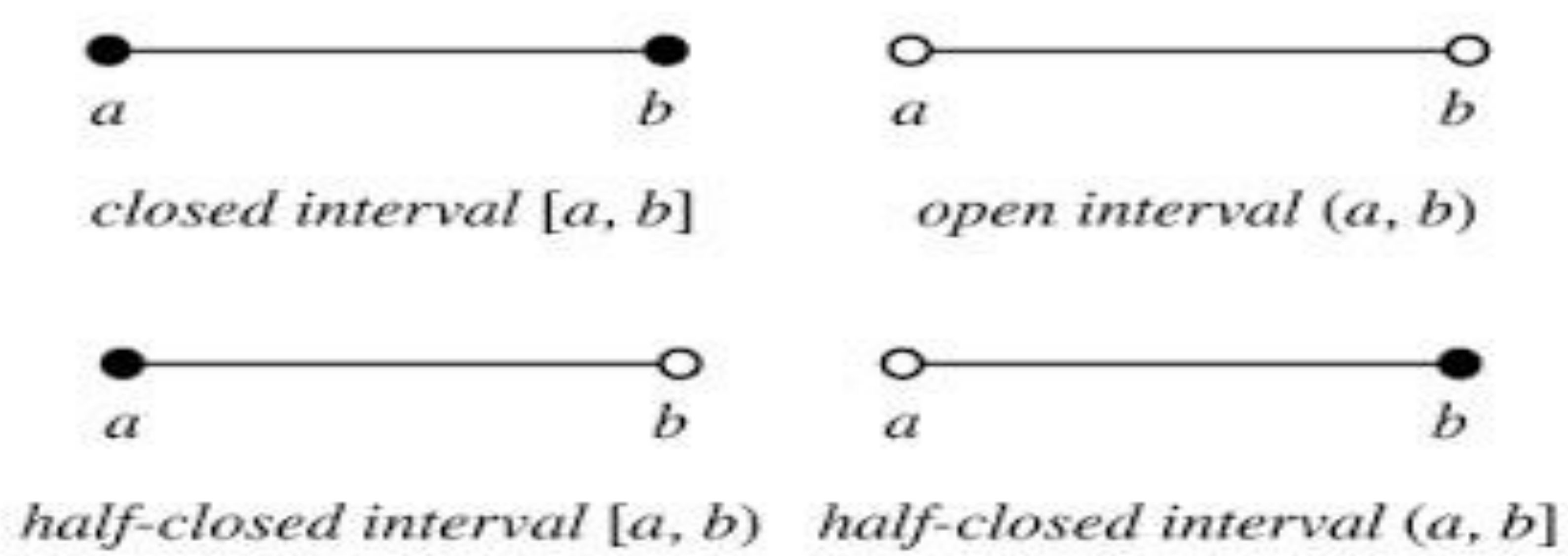
Let $a, b \epsilon R$ and $a < b$. Then,

$[a, b] = \{x: a \leq x \leq b\}$ **is an interval from a to b, including points a and b.**

$(a, b) = \{x: a < x < b\}$ **is an interval from a to b, excluding points a and b.**

$a, b = \{x: a \leq x < b\}$ **is an interval from a to b, including a but excluding b.**

$a, b = \{x: a < x \leq b\}$ **is an interval from a to b, excluding a but including b.**



LET'S PRACTICE……

The set $\{x : x \in R, -5 < x \leq 7\}$ **, written in set-builder form, can be written in the form of interval as** $-5, 7$ **and the interval** $-3, 5$ **can be written in set-builder form as** $\{x : x \in R, -3 \leq x < 5\}$

Let $A = \{1, 2, \{3, 4\}, 5\}$ **, which of the following statements are incorrect?**

(i) $\{3, 4\} \subset A$ $\longrightarrow$ **Incorrect as** $\{3, 4\}$ **is an element of set A.**

(ii) $\{3, 4\} \in A$ $\longrightarrow$ **Correct as** $\{3, 4\}$ **is contained in set A.**

(iii) $\emptyset \in A$ $\longrightarrow$ **Incorrect as** $\emptyset$ **is not an element of the set A.**

(iv) $\{\emptyset\} \subset A$ $\longrightarrow$ **Incorrect as** $\emptyset$ **is by itself a set.**

(v) $\{\{3, 4\}\} \subset A$ $\longrightarrow$ **Correct as** $\{3, 4\}$ **is contained in set A.**

(vi) $\{1, 2, 3\} \subset A$ $\longrightarrow$ **Incorrect as** $\{3\}$ **is not an element of set A.**

(vii) $\{1, 2, 5\} \subset A$ $\longrightarrow$ **Correct as all the elements of the set** $\{1, 2, 5\}$ **are present in set A.**

<u>Homework</u> :

Ex 1.1 to be completed (Q.3 & Q.4 in notebook)
and the rest in the text book itself.
Ex 1.2 to be completed
Ex 1.3 – Q.No.1, 2, 6, 7.


Thank You and Happy Learning
STAY HOME
STAY SAFE