Sagar
Date:
Page:

# Chapter:-1

# Sets

**Sets:-**

A well defined collection of object is called sets.

**Example:-** Collection of natural numbers.

Collection of even prime number

**Set Notation**

A set is denoted by capital letters of english alphabet.

**Example:-** 'A' 'B' 'C' etc

Elements of set are denoted by small letters example 'a' 'b' 'c' etc

**Note:-** If x is and element of set A than it is denoted $x \in A$

**Example:-** $A = \{1, 2, 3\}$ $2 \in A$, $5 \notin A$

# The order of element in a set does not matter

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

# Any element of a set cannot be written more than one time

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

## Representation Of Sets

1. Roaster Method or Tabular Method

In this method element of the sets are listed and separated by commas and closed within braces $\{\ \}$

Example :— set of first five natural numbers

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

set of whole number

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

2. Set Builder Form or Rule Method or Property Method

In this method we write a common property of all the elements by a given set

Example :— $A = \{1,3,5,7,9,11,13,15,17,19\}$

$A = \{x : x \text{ is an odd natural no. less than } 20\}$

## Exercise = 1.1

Ques1. Which of the following are sets ?

Answer → 1. Sets
2. Not set
3. Not set
4. Set
5. Set
6. Set
7. Set
8. Set
9. Not set

Ques2. Let A

1. $5 \in A$
2. $4 \in A$
3. $A \notin A$
4. $2 \in A$
5. $0 \notin \Omega$
6. $10 \in A$

Ques3. Write

1. $\{-2,-1,0,1,2,3,4,5,6\}$

2. {1, 2, 3, 4, 5}

3. {(1,7) (2,6) (3,5) (4,4) (5,3) (6,2) (7,1) (8,

4. D = {2, 3, 5}

Ques 4. Write form

1. {x : x ∈ N and x = 3n and 1 ≤ n ≤ 4}

2. {x : x = 2^n, n ∈ N and 1 ≤ n ≤ 5}

3. {x : x = 5^n, n ∈ N and 1 ≤ n ≤ 4}

4. {x : x is an even natural number}

5. {x : x = n^2, N ∈ N and 1 ≤ n ≤ 10}

Ques 5. list with

1. {1, 3, 5, 7, 9 ...}

2. {0, 1, 2, 3, 4}

3. {-2, -1, 0, 1, 2}

4. {∠, Y, A}

5. {6th, April, June, Sept, Nov}

Ques 6. Match form

1. matches with C

2. matches with a

3. matches with d

4. matches with b

## Types Of Sets

### Empty set or Null set or Void set

# A set which whose zero elements is known as empty set

It is denoted by $\phi$

Example:- $A = \{x : x^2 = 16$ where $x$ is odd natural no$\}$

$B = \{x : x$ is a letter of english alphabet precedes a$\}$

### Singleton set :-

A set consisting only one element is known as singleton set

Example :- $A = \{x : x$ is an even prime number$\}$

$A = \{2\}$

# Finite set :-

If the no of the element of a set is finite then the set is called, finite set

Example:- $A = \{x : x$ is a natural no less than 10$\}$

### Infinite set :-

If the element of a set is infinite than the set is called infinite set

Example :- $A = \{x : x$ is a natural number$\}$

$B = \{x : x$ is a perfect square number$\}$

### Equal set :-

Set A & B are said to be equal set if they have exactly same element

Example :- $A \{1, 2, 3, 4, 5\}$

$B \{1, 2, 3, 4\}$

$C \{5, 4, 3, 2, 1, 0\}$

$A = B \quad A \neq C \quad B \neq C$

### Cardinal Number Of A set :-

The no. of elements in a set is known as cardinal number of set.

Cardinal number of a set A is denoted by $n(A)$

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

$n(A) = 6$

### Equivalent set :-

Two or more sets are said to be equivalent set if there cardinal number are same

Example:— $A=\{1,2,3\}$

$B=\{x,y,z\}$

$n(A)=n(B)=3$

A & B are equivalent set

Subset:— Let A & B be any two sets. If all elements of a set A is also an element of set B then A is said to be subset of set B and denoted by $A \subseteq B$.

Example:— $A=\{1,2,3,4\}$

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

$D=\{1,2,3,4\}$

$A \subseteq B$ , $A \subseteq D$ , $D \not\subset B$

Proper Subset:—

Let A & B any two sets. If all elements of set A is also an element of set B but $A \neq B$ then A is said to be the proper subset of set B denoted by $A \subset B$

Example:— $A=\{1,2,3,4\}$

$B=\{4,2,1,3\}$ $D=\{1,2,3,4\}$

$A \not\subset B$ $A \subset D$ $D \not\subset A$

Super Set:—

If $A \subset B$ then B is super set of A denoted as $B \supset A$

Note:— i) If $n(A)=n$ then number of subset of $A=2^n$ and number of proper subset of $A=2^{n-1}$

ii) Every set is subset of itself

iii) Null set is the subset of all sets

Example:— Let $A=\{x,y,z\}$

Subset of A $\{x\}$, $\{y\}$, $\{z\}$, $\{x,y\}$, $\{y,z\}$, $\{z,x\}$ $\{x,y,z\}$, $\phi$

Proper subset of A

$\{x\}$ $\{y\}$ $\{z\}$ $\{x,y\}$ $\{y,z\}$ $\{z,x\}$, $\phi$

Power Set:—

Let A be any set then power set of A is denoted by $P(A)$.

where, $P(A) = \{$ All subsets of $A\}$

Example :— Let $A = \{x, y, z\}$

$P(A) = \{\{x\}, \{y\}, \{z\}, \{x, y\}, \{y, z\}$
$\{x, z\}, \{x, y\}, \phi\}$

Universal Set :— If two or more sets taken in a sufficient of subset of A set then the set is called universal set. denoted by 'U'

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

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

$C = \{2, 4, 6, 8 \ldots\}$

$U = \{x : x$ is a natural number$\}$

$A \subseteq U$, $B \subseteq U$, $C \subseteq U$

U is universal set Ans

Intervals :—

Close Intervals

$x \in [a, b]$ where a, b are real no. $a \leq x \leq b$

Open Intervals :—

$x \in (a, b)$ or $x \in ]a, b[$ where $a, b \in$ Real no's
$a < x < b$

Venn Diagram

In this method universal set are represented by rectangle and sets are represented by circle and elements are represent by points.

Operation On Set

Union Of Set :—

Let A and B are two sets then union of A & B is denoted by $A \cup B$

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

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

Intersections Of Sets

Let A & B are two sets intersection of A & B is denoted by $A \cap B$

where $A \cap B = \{x : x \in A \text{ and } x \in B\}$

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

$B = \{3, 4, 5, 6\}$

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

## Difference Of Two Sets

Let A and B are two sets the difference of A & B is denoted by $\boxed{A-B}$

where, $A-B = \{x : x \in A \text{ but } x \notin B\}$

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

$B = \{3, 4, 5, 6\}$

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

$B-A = \{5, 6\}$

## Complement Of A Set

Let A & U be the set and universal set respectively

Complement of set A is denoted as $A'$ or $A^c$

where, $A' = \{x : x \in U \text{ but } x \notin A\}$

$$\boxed{A' = U - A}$$

Example :— $U = \{1, 2, 3, 4, 5\}$

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

$A' = \{4, 5\}$

## Properties Of Complement Of Set

1. $(A')' = A$

Example :— $U = \{1, 2, 3, 4\}$

$A = \{1, 2\}$

$A' = \{3, 4\}$

$(A')' = \{1, 2\}$ $\boxed{(A')' = A}$

2. $(A \cup B)' = A' \cap B'$ } De Morgan's Law
$(A \cap B)' = A' \cup B'$ }

Example for First

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

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

$B = \{7,8,9\}$

$A \cup B = \{1,2,3,4,7,8,9\}$

$(A \cup B)' = \{5,6\}$ ——— (i)

$A' \cap B' = \{5,6,7,8,9\} \cap \{1,2,3,4,5,6\}$

$A' \cap B' = \{5,6\}$ ——— (ii)

from (i) and (ii) we get

$\boxed{(A \cup B)' = A' \cap B'}$ Hence

Important Formula

1. If $x \in (A \cup B) \Leftrightarrow x \in A$ or $x \in B$
2. If $x \in (A \cap B) \Leftrightarrow x \in A$ and $x \in B$
3. If $x \notin (A \cup B) \Leftrightarrow x \notin A$ and $x \notin B$
4. If $x \notin (A \cap B) \Leftrightarrow x \notin A$ or $x \notin B$
5. $A \subseteq B$ and $B \subseteq A \Leftrightarrow A = B$

Prove that $(A \cup B)' = A' \cap B'$

Proof:— Let $x \in (A \cup B)' \Leftrightarrow x \notin (A \cup B)$

$\Leftrightarrow x \notin A$ and $x \notin B$

$\Leftrightarrow x \notin A'$ and $x \in B'$

$\Leftrightarrow x \in A' \cap B'$

$\boxed{(A \cup B)' = (A' \cap B')'}$

Prove that $(A \cap B)' = A' \cup B'$

Proof:— Let $\in (A \cap B)' \Rightarrow x \notin (A \cap B)$

$\Leftrightarrow x \notin A$ or $x \notin B$

$\Leftrightarrow x \in A'$ or $x \in B'$

$\Leftrightarrow x \in (A' \cup B')$

$\boxed{(A \cap B)' = A' \cup B'}$

## Exercise → 1.1

Ques 1: Which set

i. Well

ii. Not Well

iii. Well

iv. Well

Ques 2: Which infinite

i. Finite

ii. Infinite

iii. Finite

iv. Infinite

v. Finite

Ques 3: State infinite

i. Infinite because lines // to x-axis are infinite number.

ii. Finite because it has 26 letters.

iii. Infinite because multiple of 5 are infinite in no.

iv. Finite because no. of animals living on earth is finite

v. Infinite because infinite no. of circles can pass through origin.

Ques 4: In not

i. $A = B$

ii. $A \neq B$

iii. $A = B$

iv. $A \neq B$

Ques 5: $A = (2,3)$ $B = \{x : x \text{ is a real of } x^2 + 5x + 6 = 0\}$

Solution :- $x(x+3) + 2(x+3) = 0$

$x = -2, -3$

$A = \{2, 3\}$ $B = \{-2, -3\}$ $[A \neq B]$

ii. $A = B$

Ques 1: $A \neq C$
$B = D$
$E = G$

## Exercise :- 1.3

Ques 1: Fill

1. $\subset$
2. $\not\subset$
3. $\subset$
4. $\not\subset$
5. $\not\subset$
6. $\subset$
7. $\subset$

Ques 2: State

1. False
2. True
3. True
4. False
5. True
6. False

3. But why
4. Incorrect
5. Correct
6. Incorrect
7. Incorrect
8. Incorrect
9. Incorrect
10. Correct

Ques 4: Write all the subsets

1. Subsets of $\{a\}$ are $\phi$ and $\{a\}$
2. Subsets of $\{1,2,3\}$ are $\phi \{1\} \{2\} \{3\} \{1,2\} \{2,3\} \{1,3\}$ and $\{1,2,3\}$
3. The only subset of $\phi$ is $\phi$
4. Subset of $\{a,b\}$ $\phi$ $\{a\}$ $\{b\}$ and $\{a,b\}$

Ques 5: How many $\phi$ ?

Solution: We know that if A is a set with n element i.e, $n(A) = m$ then $n[P(A)] = 2^m$

If $A = \phi$ then $n(A) = 0$

$n[P(A)] = 2^1 = 1$

Thus, $P(A)$ has one element.

Ques 6

i. $\{x : x \in R, -4 < x \leq 6\} = (-4, 6]$

ii. $\{x : x \in R, -12 < x < -10\} = (-12, -10)$

iii. $\{x : x \in R, 0 \leq x < 7\} = [0, 7)$

iv. $\{x : x \in R, 3 \leq x \leq 4\} = [3, 4]$

Ques 7

i. $(-3, 0) = \{x : x \in R, -3 < x < 0\}$

ii. $(6, 12) = \{x : x \in R, 6 \leq x \leq 12\}$

iii. $(6, 12) = \{x : x \in R, 6 < x \leq 12\}$

iv. $(-23, 5) = \{x : x \in R, -23 \leq x < 5\}$

Ques 8

i. Universal set can be set of triangles or set of polygons.

ii. The universal set can be set of triangle

Ques 9. $x = \{1, 3, 5\}$, $y = \{2, 4, 6\}$ and $z = \{0, 2, 4\}$

i. $AC\{0, 1, 2, 3, 4, 5, 6\}$
$BC\{0, 1, 2, 3, 4, 5, 6\}$
$C\{0, 1, 2, 3, 4, 5, 6\}$
Set is not universal

ii. $A \neq \phi$, $B \neq \phi$, $C \neq \phi$
$\phi$ cannots be universal set.

## Exercise – 1.4

Ques 1. Find

i. $x = \{1, 3, 5\}$ $y = \{1, 2, 3\}$
$X \cup Y = \{1, 2, 3, 5\}$

ii. $A \cup B = \{a, b, c, e, i, o, u\}$

iii. $A \cup B = \{x : x = 1, 2, 4, 5$ or a multiple of $3\}$

iv. $A \cup B = \{x : x \in N$ and $1 < x < 10\}$

v. $A \cup B = \{1, 2, 3\}$

Ques 2

Solution Here, $A=\{a,b\}$ $B=\{a,b,u\}$ yes $A \subset B$

$A \cup B = \{a,b,u\} = B$

Ques 3

Solution – If A & B are two sets such that $A \subset B$ then $A \cup B = B$

Ques 4 If P

i. $A \cup B = \{1,2,3,4,5,6\}$

ii. $A \cup C = \{1,2,3,4,5,6,7,8\}$

iii. $B \cup C = \{3,4,5,6,7,8\}$

iv. $B \cup D = \{3,4,5,6,7,8,9,10\}$

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

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

vii. $B \cup C \cup D = \{3,4,5,6,7,8,9,10\}$

Ques 5 Find

i. $x \cap y = \{1,3\}$

ii. $A \cap B = \{a\}$

iii. $A \cap B = \{3\}$

iv. $A \cap B = \{\phi\}$

v. $A \cap B = \{\phi\}$

Ques 6 If A

i. $\{7,9,11\}$ iv. $\{11\}$

ii. $\{11,13\}$ v. $\phi$

iii. $\{11\}$ $\{15,17\} = \phi$ vi. $\{A \cap B\} \cup \{A \cap C\}$ $\{7,9,11\}$

Ques 7

i. $A \cap B = \{x : x$ is even natural no.$\}$ B

ii. $A \cap C = \{x : x$ is an odd natural no.$\}$ C

iii. $A \cap C = \{x : x$ is a prime no.$\}$ D

iv. $B \cap C = \phi$

Ques8: Write

i. $\{3, 6, 9, 15, 18, 21\}$

ii. $\{3, 9, 15, 18, 21\}$

iii. $\{3, 6, 9, 12, 18, 21\}$

iv. $\{4, 16, 20\}$

v. $\{2, 4, 8, 10, 14, 16\}$

vi. $\{5, 10, 20\}$

vii. $\{4, 8, 12, 16\}$

Ques10: If

i. $x - y = \{a, c\}$

ii. $y - x = \{f, g\}$

iii. $x \cap y = \{b, d\}$

Ques11: What

Solution:- R: set of real no.

Q: set of rational no.

Thus, R-Q is set of irrational no.

Ques12: State

i. False

ii. False

iii. True

iv. True

Done 5/07/19

V. Good