Sets

Set :- Any well-defined collection of objects is called a set.
or Any collection of well-defined objects is called a set.

Example. 1. The collection of even natural numbers less than 20 is a set.
2. The collection of all the states of India is a set.
3. The collection of all prime factors of 230 i.e 2, 5 & 23. is a set.
4. The collection of students of Std. XI is a set.
etc.

Representation of set

A set can be represented in two ways
(1) Roster or Tabular form
(2) Set builder or Rule Method.

1. Roster or Tabular form: In this form we list all the elements or members of the set within curly brackets and separate them by commas.
Example: set of all even natural numbers less than 15.
$A = \{2, 4, 6, 8, 10, 12, 14\}$

Ex. 2: Set of all vowels in English Alphabet.

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

Example 3: Set of all letters in the word JODHAPUR

$A = \{J, O, D, H, A, P, U, R\}$

Remark 1. The order of listing the elements in a set can be changed. Thus.

$\{3, 7, 8, 15\} = \{7, 3, 8, 15\}$.

2. The elements of the set can be repeated, then the set remains the same.

$\{2, 2, 3, 2, 5, 7, 8, 8\}$

$= \{2, 3, 5, 7, 8\}$

Therefore in listing the elements of the set, it is sufficient to list the elements only once.

2. Set builder form or Rule method

In this form, we write ~~the~~ ~~xam~~ a variable (let x) representing any member of the set which followed by a colon : and thereafter, we write the property satisfied by each member of the set and then enclose the whole description within curly brackets.

the Colon : stands for such that.

Example 1 : $A = \{1, 4, 9, 16, 25 \dots\}$ is the Roster from

$\therefore$ $A = \{x \mid x$ is the square of a natural number$\}$

set builder from.

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

$A = \{x \mid x$ is the vowel of the English Alphabets$\}$.

Kind of sets

1. Empty set – A set which does not contain any element is called empty set or null set. It is denoted by ϕ.

Ex. 1. collection of all boys in a girls school.

Ex. 2. collection of all natural numbers less than one.

Ex. 3. Collection of all history books in a science library.

2. Singleton set : A set which contains only one element is called singleton set.

Ex. $A = \{2\}$. $B = \{0\}$

3. finite set → A set which contains countable number of elements is called finite set.

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

$B = \{x : x$ is a natural numbers and less than $6\}$

4. **Infinite set-**: A set which contains uncountable number of elements.

Ex. $N = \{1, 2, 3, 4, ---\}$

$Z = \{0, \pm 1, \pm 2, ---\}$

Cardinal number (order) of a finite set-

The number of different elements of a finite set is called the cardinal number or order of a set.

It is denoted by $n(A)$ or $O(A)$

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

$n(A) = 4$ or $O(A) = 4$

Then we may say that

Cardinal no. of a set

$=$ Total number of elements of the set.

Some standard set of numbers

$N = \{1, 2, 3, 4, ---\}$

$=$ set of natural number

(iii) Rational numbers: It is denoted by Q

And $Q = \{x \mid x = \frac{p}{q},\ p, q \in I \text{ but } q \neq 0\}$

By this definition of Rational numbers all natural numbers and integers are rational numbers. Also the numbers of the type $3/5$, $\frac{1}{2}$, $\frac{3}{7}$ etc are also Rational numbers.

(iv) Irrational numbers: The numbers which are not Rational numbers are called irrational numbers. Set of irrational numbers are denoted by T. Therefore

$T = \{x \mid x \notin Q\}$

(v) Real numbers → All above types of numbers are called real numbers.

Q^+ denotes the set of +ve Rational number.

R^+ denotes the set of +ve Real numbers.

Questions

Q1. Use Roster method to represent the following sets.

(a) The counting numbers (Natural numbers) which are multiple of 6 and less than ~~to~~ 50.

(b) The fractions whose numerator is 1 and whose denominator is less than 7.

(c) $\{x \mid x \in N$ and x is a prime factor of $84\}$

(d) $\{x \mid x \in I,\ -1/2 < x < \frac{9}{2}\}$

(e) $\{x \mid x \in N$ and $4x - 3 \leq 15\}$

(f) The set of all the digits in our number system.

Solⁿ. (a) $A = \{6, 12, 18, 24, 30, 36, 42, 48\}$

(b) $B = \{1, \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \frac{1}{5}, \frac{1}{6}\}$

(c) $C = \{2, 3, 7\}$

(d) $D = \{0, 1, 2, 3, 4\}$

(e) $E = \{1, 2, 3, 4\}$

(f) $F = \{0, 1, 2, 3, 4, 5, 6, 7, 8, 9\}$

Q2. Write the following sets in set builder form.

(a) $\{1, 3, 5, 7, 9, 11, 13\}$.

(b) $\{2, 4, 6, 8, ---\}$

(c) $\{1, 4, 9, 25, ---\}$

(d) $\{\frac{1}{2}, \frac{2}{3}, \frac{3}{4}, \frac{4}{5}, ---\}$

Solⁿ. (a) $\{x \mid x$ is an odd number less than $14\}$.

~~(b) $\{x \mid x = 2^n, n \in N$ and $n <$~~

(b) $\{x \mid x$ is an even natural number

(c) $\{x : x = n^2, n \in N\}$

(d) $\{x : x = \frac{n}{n+1}, n \in N\}$

Equivalent sets

Two finite sets are said to be equivalent sets if they have the same number of elements. If two finite sets are equivalent sets then we write as $A \leftrightarrow B$.

$\leftrightarrow$ denotes Equivalent.

i.e. If $n(A) = n(B)$ then $A \leftrightarrow B$.

Example.

Let $A = \{x \mid x$ is ~~a letter~~ a letter of the word FLOWER$\}$

$B = \{x \mid x$ is a letter of the word FOLLOWER$\}$

$\therefore n(A) = 6$

And $n(B) = 6$ $\quad \therefore n(A) = n(B)$

$\therefore A \leftrightarrow B$.

Equal sets.

Two sets A and B are said to be equal sets if they have exactly the same elements. And we write $A = B$.

Ex. $A = \{1, 2\}$

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

$\therefore A = B$

If A and B are not equal, then we write $A \neq B$.

Subsets

Let A and B are two non-empty sets, then A is called the subset of B if every member of A is also a member of B. And we write $A \subset B$

i.e. A is subset of B or we also say that A is contained in B.

B is called super set of A.

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

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

~~Proper subset~~ $A \subset B$.

Proper subset :- proper subset and subset is the same. i.e.

proper subset = subset

Remark. 1

If $A \subset B$ and $B \subset A$
then $A = B$.

Remark. 2

(a) Every set is the subset of itself.
i.e. $A \subset A$, then A is called improper ~~subset~~ subset.

(b) Every set has only one improper subset

(c) Empty set the subset of every set.

~~(d) Φ Empty~~

Number of subsets of a set

Let A be a non-empty set.
such that $n(A) = P$
then total number of subsets of
$A = 2^P$.

Example. Let $A = \{1, 2, 3\}$.
$\therefore n(A) = P = 3$
$\therefore$ Total subsets $= 2^P = 2^3 = 8$
And they are.

(1) Φ is the subset of Every set
(2) Every set is subset of itself.
i.e. $\{1, 2, 3\}$.
(3) $\{1\}$ (4) $\{2\}$ (5) $\{3\}$
(6) $\{1, 2\}$, (7) $\{2, 3\}$ (8) $\{1, 3\}$.

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