1.2 Description of a Set

There are, in general, two ways of presenting a set.

Sets Presentation

- Roster form (Tabular)
- Set Builder form

1.2.1 Roster Form

In this presentation, all the elements of a given set separated by commas are listed within the braces { }.

(a) The set of all natural numbers which divide 21 is $\{1, 3, 7, 21\}$. Here number of elements are four.

(b) The set of even natural numbers $\{2, 4, 6, \ldots\}$. Here number of elements are infinite.

(c) The set of all prime numbers less than 15 is $\{2, 3, 5, 7, 11, 13\}$.

Note

- In roster form, the order of listing an element is immaterial. Thus whether we write $A = \{a, e, i, o, u\}$ or $A = \{i, a, e, u, o\}$. It is same thing.
- We must not repeat any element in roster presentation. Consider the set of letters forming the word 'NAMAN'. The set is $\{A, M, N\}$.

1.2.2 Set Builder Form

In set builder format, all the elements of a set possess a unique characteristic, which is not possessed by any elements outside the set. Thus $A = \{2, 4, 6, 8\}$. Here the set A represents even natural numbers less than or equal to 8.

Thus $A = \{x : x$ is an even natural number less than or equal to $8\}$; Set Builder form

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Type-I *Problems based on Roster form*

Example 2.

Describe the following sets in roster form :

(i) *The set of all letters in the word 'TEACHER'.*

(ii) *The set of all letters in the word 'STUDENT'.*

(iii) *The set of all letters in the word 'INTELLIGENT'.*

(iv) *The set of all prime numbers less than* 10.

(v) *The set of all even numbers less than* 10.

Solution :

(i) $\{T, E, A, C, H, R\}$

Here 'E' has appeared twice but we will write it only once.

(ii) $\{S, T, U, D, E, N\}$

Same concept as above, T has appeared twice in original word but in the set repetition is not allowed.

(iii) $\{I, N, T, E, L, G, T\}$

I, is repeated twice but it will appear once only.
E, is repeated twice but it will appear once only.
T, is repeated twice but it will appear once only.
L, is repeated twice but it will appear once only.
N, is repeated twice but it will appear once only.

(iv) Prime numbers less than $10 = 2, 3, 5, 7$.

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

(v) $\{2, 4, 6, 8\}$ even natural numbers less than 10.

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Type-II *Problems based on Set Builder form*

Example 3.

Describe the following sets in set builder form :

(i) *The set of all letters in the word 'FUNCTION'.*

(ii) *The set of all vowels in the word 'GEOMETRY'.*

(iii) *The set of all even natural numbers.*

(iv) *The set of all odd natural numbers.*

(v) *The set of square of all natural numbers.*

(vi) *The set of reciprocal of all natural numbers.*

Solution :

(i) We can write the set in set builder form as
$A = \{x : x$ is a letter in the word 'FUNCTION'$\}$.

(ii) $B = \{x : x$ is a vowel in the word 'GEOMETRY'$\}$.

(iii) $C = \{x : x = 2n, n \in N\}$
The set of all even natural numbers is represented above.

(iv) $D = \{x : x = 2n - 1, n \in N\}$
The set of all odd natural numbers is represented above.

(v) $E = \{x : x = n^2, n \in N\}$
The set containing squares of all natural numbers is represented above.

(vi) $F = \{x : x = \frac{1}{n}, n \in N\}$
The set containing reciprocal of all natural numbers is represented above.

Type-III *Conversion from Set Builder to Roster form*

Example 4.

Describe each of the following sets in roster form.

(i) $\{x : x$ *is a vowel of the word 'MATHEMATICS'*$\}$.

(ii) $\{x : x$ *is a positive integer and divisor of* $21\}$.

(iii) $\{x : x = 2n, 1 \le n \le 20, n \in N\}$.

(iv) $\{x : x = n^2, 1 < n \le 5, n \in N\}$.

(v) $\{x : x = \frac{1}{n}, 1 \le n < 5, n \in N\}$.

(vi) $\{x : x = n - 1, 1 \le n \le 5, n \in N\}$.

Solution :

(i) M A T H E M A T I C S so the set is represented by
$V = \{A, E, I\}$.

(ii) Divisors of $21 = 1 \times 3 \times 7$. So, $A = \{1, 3, 7, 21\}$.

(iii) $B = \{2, 4, 6, 8, \ldots, 20\}$.

(iv) $C = \{2^2, 3^2, 4^2, 5^2\}$ So, $C = \{4, 9, 16, 25\}$.

Note

- That $n \neq 1$ so we begin from $n = 2$.

(v) $D = \left\{1, \frac{1}{2}, \frac{1}{3}, \frac{1}{4}\right\}$. Here $n < 5$, so $n \neq 5$.

(vi) $E = \{1 - 1, 2 - 1, 3 - 1, 4 - 1, 5 - 1\}$
$E = \{0, 1, 2, 3, 4\}$.

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Type-IV *Conversion from Roster to Set Builder form*

Example 5.

Describe the following sets in set builder form.

(*i*) $A = \left\{1, \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \frac{1}{5}\right\}$ (*ii*) $B = \left\{1, \frac{1}{4}, \frac{1}{9}, \frac{1}{16}, \frac{1}{25}, \ldots\right\}$

(*iii*) $C = \{0, 3, 6, 9, 12, \ldots\}$ (*iv*) $D = \{4, 5, 6, 7, 8, 9\}$

(*v*) $E = \{0\}$ (*vi*) $F = \{1, 4, 9, 16, \ldots, 100\}$

(*vii*) $G = \{5, 10, 15, 20, 25, \ldots.\}$

(*viii*) $H = \{5, 25, 125, 625\}$

Solution :

(i) $A = \left\{x : x = \frac{1}{n}, 1 \le n \le 5, n \in N\right\}$.

(ii) $B = \left\{x : x = \frac{1}{n^2}, n \in N\right\}$.

(iii) $C = \{x : x = 3n$, where n is non-negative integers$\}$

(iv) $D = \{x : x = n, 4 \le n \le 9, n \in N\}$.

(v) $E = \{x : x = 0\}$.

(vi) $F = \{x : x = n^2, 1 \le n \le 10, n \in N\}$.

(vii) $G = \{x : x = 5n, n \in N\}$.

(viii) $H = \{x : x = 5^n, 1 \le n \le 4, n \in N\}$.

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➢ Exercise 1.2

1. Which of the following are examples of the null set ?
   (i) Set of odd natural numbers divisible by 2.
   (ii) Set of even prime numbers.
   (iii) $\{x : x$ is a natural number, $x < 5$ and $x > 7\}$
   (iv) $\{y : y$ is a point common to any two parallel lines$\}$
2. Which of the following sets are finite or infinite ?
   (i) The set of months of a year.
   (ii) $\{1, 2, 3, \ldots\}$.
   (iii) $\{1, 2, 3, \ldots 99, 100\}$.
   (iv) The set of positive integers greater than 100.
   (v) The set of prime numbers less than 99.
3. State whether each of the following set is finite or infinite:
   (i) The set of lines which are parallel to the x-axis.
   (ii) The set of letters in the English alphabet.
   (iii) The set of numbers which are multiple of 5.
   (iv) The set of animals living on the earth.
   (v) The set of circles passing through the origin (0,0).
4. In the following, state whether $A = B$ or not :
   (i) $A = \{a, b, c, d\}$, $B = \{d, c, b, a\}$
   (ii) $A = \{4, 8, 12, 16\}$, $B = \{8, 4, 16, 18\}$
   (iii) $A = \{2, 4, 6, 8, 10\}$,
   $B = \{x : x$ is positive even integer and $x \leq 10\}$
   (iv) $A = \{x : x$ is a multiple of $10\}$,
   $B = \{10, 15, 20, 25, 30, \ldots\}$
5. Are the following pair of sets equal ? Give reasons.
   (i) $A = \{2, 3\}$, $B = \{x : x$ is solution of $x^2 + 5x + 6 = 0\}$.
   (ii) $A = \{x : x$ is a letter in the word FOLLOW$\}$.
   $B = \{y : y$ is a letter in the word WOLF$\}$

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