EXERCISE No. 3.1

Q. 1 Write the following sets in builder notation:

(i) $\{1,4,9,16,25,36, \dots ,484\}$

Solution:

$\{1,4,0,16,25,36, \dots ,484\}$

Set builder notation:

$\{x \mid x = \mathrm{n}^2, \mathrm{n}\ \mathrm{N} \wedge l \leq \mathrm{n} \leq 22\}$

(ii) $\{2,4,8,16,32, \dots ,1024\}$

Solution

let $B = \{2,4,8,16,32, \dots ,1024\}$

Set builder notation:

$\{x \mid x = 2^n, n \in N \wedge 1 \leq n \leq 10\}$

(iii) $\{0, \pm1, \pm2, \dots , \pm1000\}$

Solution:

$\{0, \pm1, \pm2, \dots , \pm1000\}$

Set builder notation:

$\{x \mid x \in Z \wedge -1000 \leq x \leq 1000\}$

(iv) $\{6,12,18, \dots 120\}$

Solution:

$\{6,12,18, \dots .120\}$

Set builder notation.

$\{x|x = 6n, n \in N \wedge 1 \leq n \leq 20\}$

(v) $\{100,102,104, \dots ,400\}$

Solution:

$= \{100,102,104, .400\}$

Set builder notation:

$= \{x \mid x = 2n, n \in N \wedge 50 \leq n \leq 200\}$

(vi) $\{1,3,9,27,81,\ldots\}$
Solution:

$\{1,3,9,27,81,\ldots\}$

Set builder notation:

$\{x \mid x = 3^n, n \in W\}$

(vii) $\{1,2,4,5,10,20,25,50,100\}$
Solution:

$\{1,2,4,5,10,20,25,50,100\}$

Set builder notation:

$\{x \mid x$ is a divisor of $100\}$

(viii) $\{5,10,15,\ldots,100\}$

solution:

$\{5,10,15,\ldots,100\}$

Set builder notation:

$\{x \mid x = 5n, n \in N \wedge 1 \leq n \leq 20\}$

(ix) The set of all integers between - 100
and 1000

$$\{x \mid x \in Z \wedge -1000 \leq x \leq 1000\}$$

Q. 2 Write each of the following sets in tabular forms:
(i) $\{x \mid x$ is a multiple of $3 \wedge x \leq 36\}09303010$

Solution: (Expected correction)
$\{x \mid x$ is a multiple of $3 \wedge x \leq 36\}$

$$\{3,6,9,\ldots,36\}$$

(ii) $\{x \mid x \in \mathbb{R} \wedge 2x + 1 = 0\}$

Solution:

$$\{x \mid x \in \mathbb{R} \wedge 2x + 1 = 0\}$$

Tabular form:
We know that

$$2x + 1 = 0$$

$$2x = -1$$
$$x = -\frac{1}{2}$$
$$\left\{-\frac{1}{2}\right\}$$

(iii) $\{x \in P \wedge x < 12\}$

Solution:

$$\{x \mid x \in \mathrm{P} \wedge x < 12\}$$

Tabular form

$$\{2,3,5,7,11\}$$

(iv) $\{x \mid x$ is a divisor of 128$\}$

Solution:

$\{x \mid x$ is a divisor of 128$\}$

Tabular form:

$$\{1,2,4,8,16,32,64,128\}$$

(v) $\{x \mid x = 2^n, n \in N \wedge n < 8\}$

Solution:

$$\{x \mid x = 2^n, \mathrm{n} \in \mathrm{N} \wedge \mathrm{n} < 8\}$$

Tabular form:

$$\{2,4,8,16,32,64,128\}$$

(vi) $\{x \mid x \in N \wedge x + 4 = 0\}$

Solution:

$$\{x \mid x \in N \wedge x + 4 = 0\}$$

Tabular form:

$$x + 4 = 0 \Rightarrow x = -4$$
$$-4 \notin N$$

(viii) $\{x \mid x \in \mathbb{N} \wedge x = x\}$

Solution:

$$\{x \mid x \in N \land x = x\}$$

Tabular form:

$$\{1,2,3,4,5, \ldots\}$$

(viii) $\{\mathrm{x} \mid x \in \mathbb{Z} \land 3x + 1 = 0\}$

Solution:

$$\{x \mid x \in Z \land 3x + 1 = 0\}$$

Tabular form:

$$\because 3x + 1 = 0 \Rightarrow x = -\frac{1}{3}$$

$$\}\because -\frac{1}{3} \notin Z$$

Q. 3 Write two proper subsets of each of the following sets:

(i) $\{a, b, c\}$

Solution:

$\{a, b, c\}$

Two proper subsets are $\{\mathrm{a}\}, \{\mathrm{b}\}$

(ii) $\{0,1\}$

Solution:

$\{0,1\}$

Two proper subsets are $\{0\}$ and $\{1\}$

(iii) $\mathbf{N}$

Solution:

$$N = \{1,2,3,4,5 \ldots\}$$

Two proper subsets:

$$\{1,3,5,7, \ldots\} \text{ and } \{2,4,6,8 \ldots\}$$

(iv) $\mathbf{Z}$

Solution:

$$Z = \{0, \pm 1, \pm 2, \pm 3, \pm 4, \ldots\}$$

Two proper subsets:

$$\{1,2,3,4, \ldots\} \text{ and } \{-1, -2, -3, -4 \ldots\}$$

(v) Q

Solution:
Two subsets: N and W
(vi) R

Solution:
Since, $\mathrm{R} = \mathrm{Q} \cup \mathrm{Q}'$

Two proper subsets: Q and Q'
(vii) $\{x \mid x \in Q \wedge 0 < x \leq 2\}$

Solution:
$\{x \mid x \in \mathrm{Q} \wedge 0 < x \leq 2\}$
Take any two positive rational number.

Two proper subsets: $\left\{\frac{1}{2}\right\}\left\{\frac{2}{3}\right\}$
Q. 4 Is there any set which has proper subset? If so, name that set.

Solution:
Yes, there is empty set has no proper subset.

Q. 5 What is the difference between $\{a, \mathrm{b}\}$ and $\{\{a, \mathrm{b}\}\}$?
Solution
$\{a, b\}$ is a set containing two elements a and b while $\{\{a, b\}\}$ is a singleton set havir only one element $\{a, b\}$.

Q. 6 What is the number of elements of the power set of each of the following sets?
(i) { }
Solution:
No. of elements $= \mathbf{n} = 0$
No. of elements in power set $= 2^{n} = 2^{0} = 1$
(ii) $\{0,1\}$
Solution:
$\{0,1\}$
No. of elements in given $\mathrm{set} = \mathrm{n} = 2$
No. of elements in power set $2^{n} = 2^{2} = 4$
(iii) $\{1,2,3,4,5,6,7\}$
Solution:
$\{1,2,3,4,5,6,7\}$
No. of elements in given set $= \mathrm{n} = 7$
No. of elements in power set $= 2^{\mathrm{n}} = 2^{7} = 128$
(iv) $\{0,1,2,3,4,5,6,7\}$
Solution:

$$\{0,1,2,3,4,5,6,7\}$$

No. of elements in given set $= \mathrm{n} = 8$
No. of elements in power set $= 2^n = 2^8 = 256$
(v) $\{a,\{b,c\}\}$

Solution:
$\{a,\{b,c\}\}$
No. of elements in given set $= \mathrm{n} = 2$
No. of elements in power set $= 2^n = 2^2 = 4$
(vi) $\{\{a,b\},\{b,c\},\{d,e\}\}$

Solution:
$\{\{a,b\},\{b,c\},\{d,e\}\}$
No. of elements in given set $= \mathrm{n} = 3$
No. of elements in power set $= 2^n = 2^3 = 8$
Q. 7 Write down the power set of each of the following sets:
(i) $\{9,11\}$

Solution
$\{9,11\}$
No. of elements in given set $= \mathrm{n} = 2$
No. of elements in power set $= 2^n = 2^2 = 4$
Power set: $\{\phi,\{9\},\{11\},\{9,11\}\}$
(ii) $\{+,-,x,\div\}$
Solution:
$\{+,-,x,\div\}$
No. of elements in power set $= 2^n = 2^4 = 16$
Power set:

$$\{\phi,\{+\},\{-\},\{x\},\{+\},\{+,-\},\{+,x\},\{+,+\},$$
$$\{-,x\},\{-,+\},\{x,+\},\{+,-,x\},\{+,-,\div\}.$$
$$\{+,x,\div\},\{-,x,+\},\{+,-,x,\div\}\}$$

(iii) $\{\phi\}$

Solution:
$\{\phi\}$
No. of elements in power set $= 2^n = 2^1 = 2$ Power set:

$$\{\phi,\{\phi\}\}$$

(iv) $\{a,\{b,c\}\}$

Solution:

$\{a, \{b, c\}\}$

No. of elements in power set $= 2^n = 2^2 = 4$ Power set:

$$\{\phi, \{a\}, \{b, c\}, \{a, \{b, c\}\}\}$$