Chapter # 3

SETS AND FUNCTIONS

Exercise # 3.1

Question # 1: **Write the following sets in set builder notation:**

i. $\{1, 4, 9, 16, 25, 36, \ldots, 484\}$
$\{x|x = n^2, n \in N \wedge 1 \leq n \leq 22\}$

ii. $\{2, 4, 8, 16, \ldots, 256\}$
$\{x|x = 2^n, n \in N \wedge 1 \leq n \leq 8\}$

iii. $\{0, \pm 1, \pm 2, \ldots, \pm 1000\}$
$\{x|x \in Z \wedge -1000 \leq x \leq 1000\}$

iv. $\{6, 12, 18, \ldots, 120\}$
$\{x|x = 6n, n \in N \wedge 1 \leq n \leq 20\}$

v. $\{100, 102, 104, \ldots, 400\}$
$\{x|x = 100 + 2n, n \in W \wedge 0 \leq n \leq 150\}$

vi. $\{1, 3, 9, 27, 81, \ldots\}$
$\{x|x = 3^n, n \in W\}$

vii. $\{1, 2, 4, 5, 10, 20, 25, 50, 100\}$
$\{x|x\ is\ divisor\ of\ 100, x \in N \wedge 1 \leq x \leq 100\}$

viii. $\{5, 10, 15, \ldots 100\}$
$\{x|x = 5n, n \in N \wedge 1 \leq n \leq 20\}$

ix. $\boldsymbol{The\ set\ of\ all\ integers\ between\ -100\ and\ 1000}$
$\{x|x \in Z \wedge -100 < n < 1000\}$

Question # 2: Write each of the following sets in tabular form:

i. $\{x|x\ \boldsymbol{is\ a\ multiple\ of}\ 3 \wedge x \leq 35\}$
$\{3,6,9,12,15,18,21,24,27,30,33\}$

ii. $\{x|x \in R \wedge 2x + 1 = 0\}$
$\left\{-\frac{1}{2}\right\}$

iii. $\{x|x \in P \wedge x < 12\}$
$\{2,3,5,7,11\}$

iv. $\{x|x\ \boldsymbol{is\ a\ divisor\ of}\ 128\}$
$\{1,2,4,8,16,32,64,128\}$

v. $\{x|x = 2^n, n \in N \wedge n < 8\}$
$\{2,4,8,16,32,64,128\}$

vi. $\{x|x \in N \wedge x + 4 = 0\}$
$\{\ \}$

vii. $\{x|x \in N \wedge x = x\}$
$\{1,2,3,4, \ldots\}$

viii. $\{x|x \in Z \wedge 3x + 1 = 0\}$
$\{\ \}$

Question # 3: Write two proper subsets of each of the following sets:

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

ii. $\{0, 1\}$
$\{0\}, \{1\}$

iii. N
Prime Numbers
Even Natural Numbers

iv. Z
Prime Numbers
Whole Numbers

v. Q
Integers
Natural Numbers

vi. R
Rational Numbers
Irrational Numbers

vii. $\{x|x \in Q \wedge 0 < x \leq 2\}$
$\left\{\frac{1}{2}\right\}, \left\{\frac{3}{4}\right\}$

Question # 4: Is there any set which has no proper subset? If so, name that set.

Ans: Yes, there exist a set which has no proper subset, that is called 'empty set' $\{\ \}$.

Question # 5: What is the difference between $\{a, b\}$ and $\{\{a, b\}\}$?

Ans: $\{a, b\}$ set has two elements: 'a' and 'b'. While $\{\{a, b\}\}$ set has only one element $\{a, b\}$.

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Question # 6: What is the number of elements of the power set of each of the following sets?

i. $\{\ \}$

n = 0

No of elements = 2^n

= 2^0

= 1

ii. $\{0, 1\}$

n = 2

No of elements = 2^n

= 2^2

= 4

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

n = 7

No of elements = 2^n

= 2^7

= 128

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

n = 8

No of elements = 2^n

= 2^8

= 256

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

n = 2

No of elements = 2^n

= 2^2

= 4

vi. $\{\{a, b\}, \{b, c\}, \{d, e\}\}$

n = 3

No of elements = 2^n

= 2^3

= 8

Question # 7: Write down the power set of each of the following sets:

i. $\{9, 11\}$

Let, $A = \{9,11\}$

$P(A) = \{\emptyset, \{9\}, \{11\}, \{9,11\}\}$

ii. $\{+, -, \times, \div\}$

Let, $A = \{+, -, \times, \div\}$

$P(A) = \{\emptyset, \{+\}, \{-\}, \{\times\}, \{\div\}, \{+, -\}, \{+, \times\}, \{+, \div\}, \{-, \times\}, \{-, \div\}, \{\times, \div\}, \{+, -, \times\},$
$\{+, -, \div\}, \{-, \times, \div\}, \{+, \times, \div\}, \{+, -, \times, \div\}\}$

iii. $\{\emptyset\}$

Let, $A = \{\emptyset\}$

$P(A) = \{\emptyset, \{\emptyset\}\}$

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

Let, $A = \{a, \{b, c\}\}$

$P(A) = \{\emptyset, \{a\}, \{\{b, c\}\}, \{a, \{b, c\}\}\}$

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