

CHAPTER - 1

SETS

1) Write the following sets in the roster form :

i) $B = \{ y | y \text{ is a colour in the rainbow } \}$

ii) $C = \{ x | x \text{ is an integer and } -4 < x < 4 \}$

iii) $D = \{ x | x \in I, -3 < x \leq 3 \}$

iv) $E = \{ x | x = (n - 1)^3, n < 3, n \in W \}$

2) Write the following sets in the set builder form :

i) $F = \{ 5, 10, 15, 20 \}$

ii) $G = \{ 9, 16, 25, 36, \dots, 81 \}$

iii) $H = \{ 5, 5^2, 5^3, 5^4 \}$

iv) $X = \{ 8, -8 \}$

v) $Y = \{ 1, \frac{1}{8}, \frac{1}{27}, \frac{1}{64}, \frac{1}{125} \}$

Solutions

1. Write the following sets in the roster form :

i) $B = \{y | y \text{ is a colour in the rainbow} \}$

Solution:

$$B = \{\text{red, orange, yellow green, blue, indigo, violet}\}$$

ii) $C = \{x | x \text{ is an integer and } -4 < x < 4\}$

Solution:

$$C = \{-3, -2, -1, 0, 1, 2, 3\}$$

iii) $D = \{x | x \in I, -3 < x \leq 3\}$

Solution:

$$D = \{-2, -1, 0, 1, 2, 3\}$$

iv) $E = \{x | x = (n - 1)^3, n < 3, n \in W\}$

Solution :

$$E = \{(n - 1)^3, n < 3, n \in W\}$$

$$\therefore E = \{-1, 0, 1\}$$

$$\begin{aligned} n &= 0, 1, 2 \\ &= (0 - 1)^3 = (-1)^3 = -1 \\ &= (1 - 1)^3 = (0)^3 = 0 \\ &= (2 - 1)^3 = (1)^3 = 1 \end{aligned}$$

2. State which of the following sets are singleton Sets :

i) $A = \{x | \sqrt{x} = 16\}$

Solution :

$$A = \{x | \sqrt{x} = 16\}$$

$$\sqrt{x} = 16$$

$$x = 256 \quad \text{--- (Squaring both sides)}$$

$$\therefore A = \{256\}$$

$$\therefore \mathbf{A = Singleton Set}$$

ii) $B = \{y | y^2 = 36\}$

Solution :

$$y^2 = 36$$

$$y = \pm 6 \quad \text{--- (Taking square roots on both side)}$$

$$\therefore B = \{6, -6\}$$

$$\therefore \mathbf{B \neq Singleton Set}$$

iii) $C = \{p | p \in I, p^3 = -8\}$

Solution :

$$p^3 = -8$$

$$p = -2 \quad \text{--- (Taking cube roots on both sides)}$$

$$\therefore C = \{-2\}$$

$$\therefore C = \text{Singleton Set}$$

$$\text{iv) } D = \{q \mid (q - 4)^2 = 0\}$$

Solution :

$$D = \{q \mid (q - 4)^2 = 0\}$$

$$(q - 4)^2 = 0$$

$$q - 4 = 0 \quad \text{--- (Taking square roots on both sides)}$$

$$q = 4$$

$$\therefore D = \{4\}$$

$$\therefore D = \text{Singleton Set}$$

$$\text{v) } E = \{x \mid 1 + 2x = 3x, x \in W\}$$

Solution :

$$E = \{x \mid 1 + 2x = 3x, x \in W\}$$

$$1 + 2x = 3x$$

$$2x - 3x = -1$$

$$-x = -1$$

$$x = 1$$

$$\therefore E = \{1\}$$

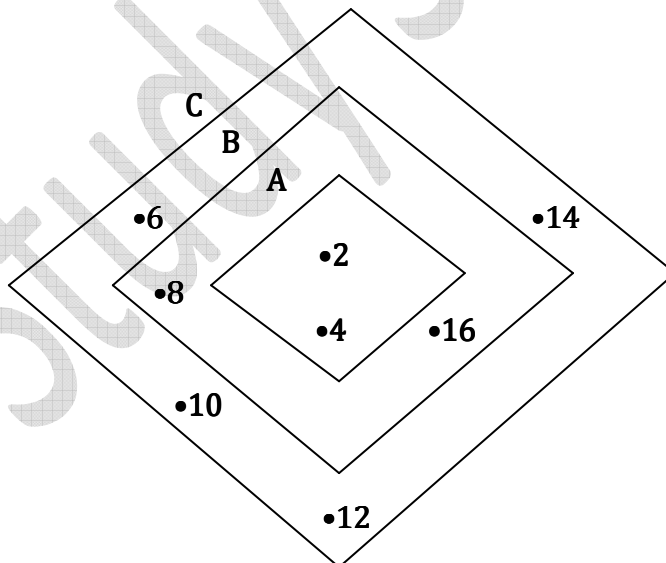
$\therefore E = \text{Singleton Set.}$

3) Draw a Venn diagram, showing sub-set relations of the following sets.

$$A = \{2, 4\}, \quad B = \{x \mid x = 2^n, n < 5, n \in \mathbb{N}\}$$

$$C = \{x \mid x \text{ is an even natural number} \leq 16\}$$

Solution:



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

$$B = \{x | x = 2^n, n < 5, n \in \mathbb{N}\}$$

$$B = \{2, 4, 8, 16\}$$

$$n = 1, 2, 3, 4, = 2^1, 2^2, 2^3, 2^4$$

$$= 2, 4, 8, 16$$

$$C = \{x | x \text{ is an even N no. } \leq 16\}$$

$$C = \{2, 4, 6, 8, 10, 12, 14, 16\}$$

4) If $A = \{1, 2, 3, 4\}$, $B = \{4, 5, 6\}$, $C = \{1, 3, 5\}$

Find : i) $A - B$, ii) $B - C$, iii) $C - A$

Solution: $A = \{1, 2, 3, 4\}$, $B = \{4, 5, 6\}$, $C = \{1, 3, 5\}$

i) $A - B = \{1, 2, 3\}$

ii) $B - C = \{4, 6\}$

iii) $C - A = \{5\}$

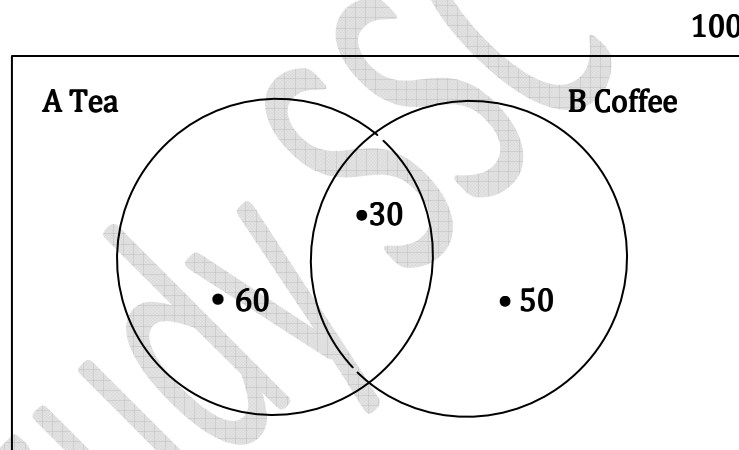
- 5) In a school hostel there are 100 students out of which 60 drink tea, 50 drink coffee and 30 drink both tea and coffee. Find the number of students who do not take tea or coffee.

Solution:

Total no. of students = 100.

Let no. of students drinking Tea be A

No. of students drinking Coffee be B



According to the given condition.

$$n(A) = 60$$

$$n(B) = 50$$

$$n(A \cap B) = 30$$

According to the formula :

$$n(A \cup B) = n(A) + n(B) - n(A \cap B)$$

$$n(A \cup B) = 60 + 50 - 30$$

$$n(A \cup B) = 110 - 30$$

$$n(A \cup B) = 80$$

Total no. of students = 100

No. of students drinking Tea and Coffee = 80

\therefore No. of student who do not take Tea or Coffee = $100 - 80 = 20$

6) Let, $U = \{x | x \in \mathbb{N}, x < 10\}$

$A = \{a | a \text{ is even, } a \in U\}$

$B = \{b | b \text{ is a factor of 6, } b \in U\}$

Verify that $n(A) + n(B) = n(A \cup B) + n(A \cap B)$

Solution:

Given : $U = \{x | x \in \mathbb{N}, x < 10\}$

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

$$A = \{a \mid a \text{ is even, } a \in U\}$$

$$A = \{2, 4, 6, 8\}$$

$$B = \{b \mid b \text{ is a factor of } 6, b \in U\}$$

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

Prove that :

$$n(A) + n(B) = n(A \cup B) + n(A \cap B)$$

$$n(A) = 4$$

$$n(B) = 4$$

$$A \cup B = \{1, 2, 3, 4, 6, 8\}$$

$$n(A \cup B) = 6$$

$$A \cap B = \{2, 6\}$$

$$n(A \cap B) = 2$$

$$n(A) + n(B) = n(A \cup B) + n(A \cap B)$$

$$4 + 4 = 6 + 2$$

$$8 = 8$$

$$\therefore \text{LHS} = \text{RHS}$$

$$\therefore n(A) + n(B) = n(A \cup B) + n(A \cap B)$$

7) For any two sets A and B, prove that $(A' - B') = (B - A)$.

Prove that : $(A' - B') = (B - A)$

Solution :

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

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

$$A' = \{1, 6, 7, 8\}$$

$$B' = \{3, 4, 7, 8\}$$

$$A' - B' = \{1, 6\} \quad \text{--- (1)}$$

$$B - A = \{1, 6\} \quad \text{--- (2)}$$

$$\text{LHS} = \text{RHS} \quad \text{--- (From (1) and (2))}$$

$$\therefore (A' - B') = (B - A)$$