# 1 Sets

## Problem set 1

(1) Choose the correct alternative answer for each of the following questions.

(i) If $M = \{1, 3, 5\}$, $N = \{2, 4, 6\}$, then $M \cap N = ?$

(A) $\{1, 2, 3, 4, 5, 6\}$ (B) $\{1, 3, 5\}$ (C) $\phi$ (D) $\{2, 4, 6\}$

Soln:-

$M = \{1, 3, 5\}$

$N = \{2, 4, 6\}$

$M \cap N = \{\} = \phi$

option (c)

(ii) $P = \{x \mid x \text{ is an odd natural number}, 1 < x \leq 5\}$

How to write this set in roster form?

(A) $\{1, 3, 5\}$ (B) $\{1, 2, 3, 4, 5\}$ (C) $\{1, 3\}$ (D) $\{3, 5\}$

Soln:-

$P = \{x \mid x \text{ is an odd number}, 1 < x \leq 5\}$

$\therefore \quad P = \{3, 5\}$

option (D)

(iii) P = {1, 2, ....., 10}, What type of set P is ?

(A) Null set (B) Infinite set (C) Finite set (D) None of these

Soln:- Here,

$$P = \{1, 2, 3, \ldots\ldots 10\}$$

As the elements of set P are countable, the set 'P' is finite test.

Option (C)

(iv) $M \cup N = \{1, 2, 3, 4, 5, 6\}$ and $M = \{1, 2, 4\}$ then which of the following represent set N ?

(A) {1, 2, 3} (B) {3, 4, 5, 6} (C) {2, 5, 6} (D) {4, 5, 6}

Soln:-

$$M \cup N = \{1, 2, 3, 4, 5, 6\}$$

$$M = \{1, 2, 4\}$$

$$\therefore \quad N = \{3, 4, 5, 6\}$$

Option (B)

(v) If $P \subseteq M$, then Which of the following set represent $P \cap (P \cup M)$ ?

(A) P (B) M (C) $P \cup M$ (D) $P' \cap M$

Soln:- Let, $P = \{1, 2\}$

& $M = \{1, 2, 3\}$

$\therefore \quad P \cup M = \{1, 2, 3\}$

$\therefore \quad P \cap (P \cup M) = \{1, 2\}$

$P \cap (P \cup M) = P$

Option (A)

(vi) Which of the following sets are empty sets ?

(A) set of intersecting points of parallel lines (B) set of even prime numbers.

(C) Month of an english calendar having less than 30 days.

(D) $P = \{x \mid x \in I, -1 < x < 1\}$

Soln:-

Set of intersecting points of parallel lines.

As parallel lines do not intersect at all.

$\therefore$ This is an empty set.

Option (A)

(2) Find the correct option for the given question.

(i) Which of the following collections is a set ?

(A) Colours of the rainbow (B) Tall trees in the school campus

(C) Rich people in the village (D) Easy examples in the book

Soln :- Colours of the rainbow,

= { Violet, Indigo, Blue, Green, Yellow

Orange, Red }

This is a set.

Option (A)

(ii) Which of the following set represent $N \cap W$?

(A) {1, 2, 3, .....} (B) {0, 1, 2, 3, ....} (C) {0} (D) { }

Soln :-

$N = \{ 1, 2, 3, ..... \}$

$W = \{ 0, 1, 2, 3, ..... \}$

$N \cap W = \{ 1, 2, 3, ..... \}$

Option (A)

(iii) P = {$x$ | $x$ is a letter of the word ' indian'} then which one of the following is set P in listing form ?

(A) {i, n, d} (B) {i, n, d, a} (C) {i, n, d, i, a} (D) {n, d, a}

Soln :-

$P = \{ x \mid x$ is a letter of the word ` indian' $\}$

$\therefore \quad P = \{ i, n, d, a \}$

Option (B)

(iv) If $T = \{1, 2, 3, 4, 5\}$ and $M = \{3, 4, 7, 8\}$ then $T \cup M = ?$

(A) $\{1, 2, 3, 4, 5, 7\}$ (B) $\{1, 2, 3, 7, 8\}$

(C) $\{1, 2, 3, 4, 5, 7, 8\}$ (D) $\{3, 4\}$

Soln:-

$T = \{1, 2, 3, 4, 5\}$

$M = \{3, 4, 7, 8\}$

$T \cup M = \{1, 2, 3, 4, 5, 7, 8\}$

Option (C)

(3) Out of 100 persons in a group, 72 persons speak English and 43 persons speak French. Each one out of 100 persons speak at least one language. Then how many speak only English ? How many speak only French ? How many of them speak English and French both ?

Soln:- Let,

$U$ = Set of total persons in a group

$A$ = Set of persons who speak English

$B$ = Set of persons who speak French.

$\therefore \quad n(U) = 100 = n(A \cup B)$

$n(A) = 72$

$n(B) = 43$

Now,

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

$$100 = 72 + 43 - n(A \cap B)$$

$$\therefore \quad 100 = 115 - n(A \cap B)$$

$$\therefore \quad n(A \cap B) = 115 - 100$$

$$\therefore \quad n(A \cap B) = 15$$

$\therefore$ Number of persons who speak English and French both are 15.

Also, Number of persons who speak only English $= n(A) - n(A \cap B)$

$= 72 - 15$

$= 57$

And, Number of persons who speak only French $= n(B) - n(A \cap B)$

$= 43 - 15$

$= 28$

(4) 70 trees were planted by Parth and 90 trees were planted by Pradnya on the occasion of Tree Plantation Week. Out of these; 25 trees were planted by both of them together. How many trees were planted by Parth or Pradnya ?

Soln:- Let,

A = Set of trees planted by Parth.

B = Set of trees planted by Pradnya.

$\therefore \quad n(A) = 70$

$n(B) = 90$

$n(A \cap B) = 25$

Now, Number of trees planted by Parth or Pradnya $= n(A \cup B)$

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

$= 70 + 90 - 25$

$= 160 - 25$

$= \underline{135}$

(5) If $n(A) = 20$, $n(B) = 28$ and $n(A \cup B) = 36$ then $n(A \cap B) = ?$

Soln:- $n(A) = 20$

$n(B) = 28$

$n(A \cup B) = 36$

$n(A \cap B) = ?$

Now,

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

$$36 = 20 + 28 - n(A \cap B)$$

$$\therefore \quad 36 = 48 - n(A \cap B)$$

$$\therefore \quad n(A \cap B) = 48 - 36$$

$$\therefore \quad \boxed{n(A \cap B) = 12}$$

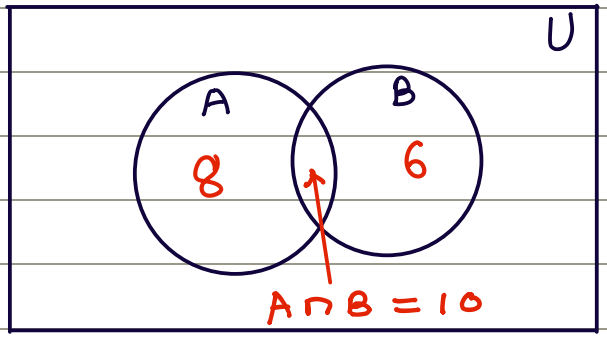
(6) In a class, 8 students out of 28 have only dog as their pet animal at home, 6 students have only cat as their pet animal. 10 students have dog and cat both, then how many students do not have a dog or cat as their pet animal at home ?

Soln:- Let,

U = Set of total number of students in a class.

A = Set of students who have dog as their pet animal.

B = Set of students who have Cat as their pet animal.




$\therefore \quad n(U) = 28$

$n(A \cap B) = 10$

$n(A) = 8 + 10 = 18$

$n(B) = 6 + 10 = 16$

Now,

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

$$= 18 + 16 - 10$$

$$= 34 - 10$$

$$\boxed{n(A \cup B) = 24}$$

$\therefore$ Number of students who do not have a dog or a cat as their pet animal

$$= n(U) - n(A \cup B)$$

$$= 28 - 24$$

$$= \underline{4}$$

(7) Represent the union of two sets by Venn diagram for each of the following.

(i) $A = \{3, 4, 5, 7\}$ $B = \{1, 4, 8\}$

(ii) $P = \{a, b, c, e, f\}$ $Q = \{l, m, n, e, b\}$

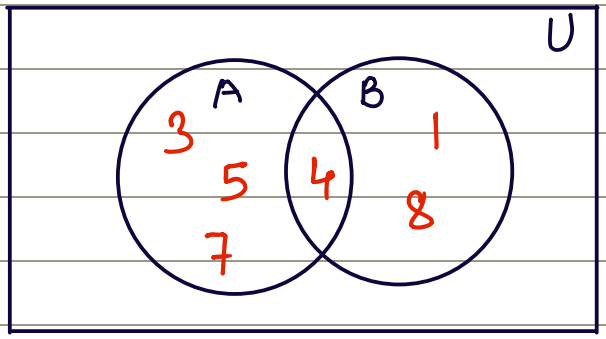
(iii) $X = \{x \mid x \text{ is a prime number between 80 and 100}\}$

$Y = \{y \mid y \text{ is an odd number between 90 and 100}\}$

Soln:-

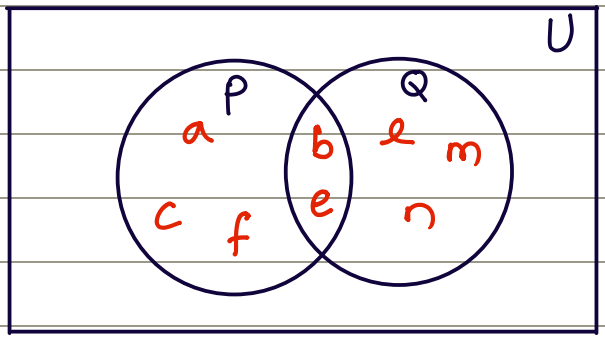
i) $A = \{3, 4, 5, 7\}$

$B = \{1, 4, 8\}$




ii) $P = \{a, b, c, e, f\}$

$Q = \{l, m, n, e, b\}$



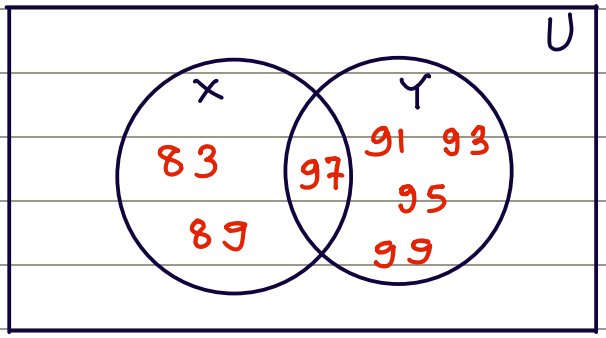

iii)

$X = \{x \mid x \text{ is a prime number between } 80 \text{ and } 100\}$

$\therefore \quad X = \{83, 89, 97\}$

& $Y = \{y \mid y$ is an odd number between 90 and 100 $\}$

$\therefore \quad Y = \{91, 93, 95, 97, 99\}$




(8) Write the subset relations between the following sets

X = set of all quadrilaterals

Y = set of all rhombuses

S = set of all squares

T = set of all parallelograms

V = set of all rectangles

Soln:- Here,

X = Set of all quadrilaterals

Y = Set of all rhombuses

S = Set of all squares.

T = Set of all parallelograms

V = Set of all rectangles.

$\therefore$ Subset relations →

$V \subseteq X$, $T \subseteq X$, $S \subseteq X$, $Y \subseteq X$,

$V \subseteq T$, $S \subseteq T$, $S \subseteq V$, $S \subseteq Y$

$Y \subseteq T$.

(9) If M is any set, then write $M \cup \phi$ and $M \cap \phi$.

Soln:- Let,

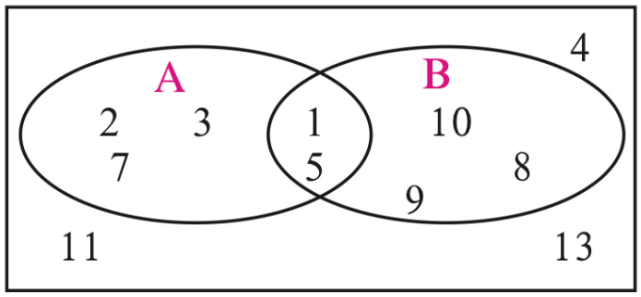
$$m = \{1, 2, 3\}$$

$$\phi = \{\ \}$$

$$\therefore\ m \cup \phi = \{1, 2, 3\} = m$$

$$\&\ \ m \cap \phi = \{\ \} = \phi$$

(10*)




Observe the Venn diagram and write the given sets U, A, B, $A \cup B$ and $A \cap B$.

Soln:-

$$U = \{1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 13\}$$

$$A = \{1, 2, 3, 5, 7\}$$

$$B = \{1, 5, 8, 9, 10\}$$

$A \cup B = \{1, 2, 3, 5, 7, 8, 9, 10\}$

$A \cap B = \{1, 5\}$

(11) If $n(A) = 7$, $n(B) = 13$, $n(A \cap B) = 4$, then $n(A \cup B) = ?$

Soln:- Here,

$n(A) = 7$

$n(B) = 13$

$n(A \cap B) = 4$

$n(A \cup B) = ?$

Now,

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

$$= 7 + 13 - 4$$

$$= 20 - 4$$

$$\boxed{n(A \cup B) = 16}$$