

**Exercise 1.6**

**Question 1:**

If X and Y are two sets such that  $n(X) = 17$ ,  $n(Y) = 23$  and  $n(X \cup Y) = 38$ , find  $n(X \cap Y)$ .

**Answer 1:**

It is given that:

$$n(X) = 17, n(Y) = 23, n(X \cup Y) = 38$$

$$n(X \cap Y) = ?$$

We know that:

$$n(X \cup Y) = n(X) + n(Y) - n(X \cap Y)$$

$$\therefore 38 = 17 + 23 - n(X \cap Y)$$

$$\Rightarrow n(X \cap Y) = 40 - 38 = 2$$

$$\therefore n(X \cap Y) = 2$$

**Question 2:**

If X and Y are two sets such that  $X \cup Y$  has 18 elements, X has 8 elements and Y has 15 elements; how many elements does  $X \cap Y$  have?

**Answer 2:**

It is given that:

$$n(X \cup Y) = 18, n(X) = 8, n(Y) = 15$$

$$n(X \cap Y) = ?$$

We know that:

$$n(X \cup Y) = n(X) + n(Y) - n(X \cap Y)$$

$$\therefore 18 = 8 + 15 - n(X \cap Y)$$

$$\Rightarrow n(X \cap Y) = 23 - 18 = 5$$

$$\therefore n(X \cap Y) = 5$$

**Question 3:**

In a group of 400 people, 250 can speak Hindi and 200 can speak English. How many people can speak both Hindi and English?

**Answer 3:**

Let H be the set of people who speak Hindi, and E be the set of people who speak English

$$\therefore n(H \cup E) = 400, \quad n(H) = 250, \quad n(E) = 200 \quad n(H \cap E) = ?$$

We know that:  $n(H \cup E) = n(H) + n(E) - n(H \cap E)$

$$\therefore 400 = 250 + 200 - n(H \cap E)$$

$$\Rightarrow 400 = 450 - n(H \cap E) \Rightarrow n(H \cap E) = 450 - 400$$

$$\therefore n(H \cap E) = 50$$

Thus, 50 people can speak both Hindi and English.

**Question 4:**

If S and T are two sets such that S has 21 elements, T has 32 elements, and  $S \cap T$  has 11 elements, how many elements does  $S \cup T$  have?

**Answer 4:**

It is given that:  $n(S) = 21, n(T) = 32, n(S \cap T) = 11$

We know that:  $n(S \cup T) = n(S) + n(T) - n(S \cap T)$

$$\therefore n(S \cup T) = 21 + 32 - 11 = 42$$

Thus, the set  $(S \cup T)$  has 42 elements.

**Question 5:**

If X and Y are two sets such that X has 40 elements,  $X \cup Y$  has 60 elements and  $X \cap Y$  has 10 elements, how many elements does Y have?

**Answer 5:**

It is given that:  $n(X) = 40$ ,  $n(X \cup Y)$

$= 60$ ,  $n(X \cap Y) = 10$  We know that:

$n(X \cup Y) = n(X) + n(Y) - n(X \cap Y) \therefore$

$$60 = 40 + n(Y) - 10$$

$$\therefore n(Y) = 60 - (40 - 10) = 30$$

Thus, the set Y has 30 elements.

**Question 6:**

In a group of 70 people, 37 like coffee, 52 like tea, and each person likes at least one of the two drinks. How many people like both coffee and tea?

**Answer 6:**

Let C denote the set of people who like coffee, and T denote the set of people who like tea  $n(C \cup T) = 70$ ,  $n(C) = 37$ ,  $n(T) = 52$  We know that:

$$n(C \cup T) = n(C) + n(T) - n(C \cap T) \therefore 70 = 37 + 52 - n(C \cap T)$$

$$\Rightarrow 70 = 89 - n(C \cap T)$$

$$\Rightarrow n(C \cap T) = 89 - 70 = 19$$

Thus, 19 people like both coffee and tea.

**Question 7:**

In a group of 65 people, 40 like cricket, 10 like both cricket and tennis. How many like tennis only and not cricket? How many like tennis?

**Answer 7:**

Let C denote the set of people who like cricket, and T denote the set of people who like tennis

$$\therefore n(C \cup T) = 65, \quad n(C) = 40, \quad n(C \cap T) = 10$$

We know that:  $n(C \cup T) = n(C) + n(T) - n(C \cap T)$

$$\therefore 65 = 40 + n(T) - 10$$

$$\Rightarrow 65 = 30 + n(T)$$

$$\Rightarrow n(T) = 65 - 30 = 35$$

Therefore, 35 people like tennis.

Now,

$$(T - C) \cup (T \cap C) = T$$

Also,

$$(T - C) \cap (T \cap C) = \Phi$$

$$\therefore n(T) = n(T - C) + n(T \cap C)$$

$$\Rightarrow 35 = n(T - C) + 10$$

$$\Rightarrow n(T - C) = 35 - 10 = 25$$

Thus, 25 people like only tennis.

**Question 8:**

In a committee, 50 people speak French, 20 speak Spanish and 10 speak both Spanish and French. How many speak at least one of these two languages?

**Answer 8:**

Let F be the set of people in the committee who speak French, and  
S be the set of people in the committee who speak Spanish

$$\therefore n(F) = 50, \quad n(S) = 20, \quad n(S \cap F) = 10$$

We know that:  $n(S \cup F) = n(S) + n(F) - n(S \cap F)$

$$= 20 + 50 - 10$$

$$= 70 - 10 = 60$$

Thus, 60 people in the committee speak at least one of the two languages.