

CBSE Class-11 Mathematics
NCERT Solutions
Chapter - 2 Relations and Functions
Exercise 2.1

1. If $\left(\frac{x}{3} + 1, y - \frac{2}{3}\right) = \left(\frac{5}{3}, \frac{1}{3}\right)$, find the values of x and y .

Ans. Here $\left(\frac{x}{3} + 1, y - \frac{2}{3}\right) = \left(\frac{5}{3}, \frac{1}{3}\right)$

$$\Rightarrow \frac{x}{3} + 1 = \frac{5}{3} \text{ and } y - \frac{2}{3} = \frac{1}{3}$$

$$\Rightarrow \frac{x}{3} = \frac{5}{3} - 1 \text{ and } y = \frac{1}{3} + \frac{2}{3}$$

$$\Rightarrow \frac{x}{3} = \frac{2}{3} \text{ and } y = \frac{3}{3}$$

$$\Rightarrow x = 2 \text{ and } y = 1$$

2. If the set A has 3 elements and the set $B = \{3, 4, 5\}$, then find the number of elements in $(A \times B)$.

Ans. Number of elements in set A = 3 and Number of elements in set B = 3

$$\therefore \text{Number of elements in } A \times B = 3 \times 3 = 9$$

3. If $G = \{7, 8\}$ and $H = \{5, 4, 2\}$, find $G \times H$ and $H \times G$.

Ans. Given: $G = \{7, 8\}$ and $H = \{5, 4, 2\}$

$$\therefore G \times H = \{(7, 5), (7, 4), (7, 2), (8, 5), (8, 4), (8, 2)\}$$

$$\text{And } H \times G = \{(5, 7), (4, 7), (2, 7), (5, 8), (4, 8), (2, 8)\}$$

4. State whether each of the following statements are true or false. If the statement is false, rewrite the given statement correctly:

(i) If $P = \{m, n\}$ and $Q = \{n, m\}$, then $P \times Q = \{(m, n)(n, m)\}$.

(ii) If A and B are non-empty sets, then $A \times B$ is a non-empty set of ordered pairs (x, y) such that $x \in A$ and $y \in B$.

(iii) If $A = \{1, 2\}$, $B = \{3, 4\}$, then $A \times (B \cap \phi) = \phi$

Ans. (i) Here $P = \{m, n\}$ and $Q = \{n, m\}$

Number of elements in set $P = 2$ and Number of elements in set $Q = 2$

\therefore Number of elements in $P \times Q = 2 \times 2 = 4$

But $P \times Q = \{(m, n), (n, m)\}$ and here number of elements in $P \times Q = 2$

Therefore, statement is false.

Correct statment is $P \times Q = \{(m, m), (n, n), (n, m), (m, n)\}$

(ii) True

(iii) True

5. If $A = \{-1, 1\}$, find $A \times A \times A$.

Ans. Here $A = \{-1, 1\}$

$A \times A = \{(-1, -1), (-1, 1), (1, -1), (1, 1)\}$

$\therefore A \times A \times A = \{(-1, -1, -1), (-1, -1, 1), (-1, 1, -1), (-1, 1, 1), (1, -1, -1), (1, -1, 1), (1, 1, -1), (1, 1, 1)\}$

6. If $A \times B = \{(a, x), (a, y), (b, x), (b, y)\}$, find A and B.

Ans. Given: $A \times B = \{(a, x), (a, y), (b, x), (b, y)\}$

$\therefore A = \text{set of first elements} = \{a, b\}$ and $B = \text{set of second elements} = \{x, y\}$

7. Let $A = \{1, 2\}$, $B = \{1, 2, 3, 4\}$, $C = \{5, 6\}$ and $D = \{5, 6, 7, 8\}$. Verify that:

(i) $A \times (B \cap C) = (A \times B) \cap (A \times C)$

(ii) $A \times C$ is a subset of $B \times D$.

Ans. Given: $A = \{1, 2\}$, $B = \{1, 2, 3, 4\}$,

$C = \{5, 6\}$ and $D = \{5, 6, 7, 8\}$

(i) $B \cap C = \{1, 2, 3, 4\} \cap \{5, 6\} = \phi$

$\therefore A \times B \cap C = \{1, 2\} \times \phi = \phi \dots\dots\dots(i)$

$A \times B = \{(1, 1), (1, 2), (1, 3), (1, 4), (2, 1), (2, 2), (2, 3), (2, 4)\}$

$A \times C = \{(1, 5), (1, 6), (2, 5), (2, 6)\}$

$\therefore (A \times B) \cap (A \times C) = \phi \dots\dots\dots(ii)$

Therefore, from eq. (i) and (ii), $A \times B \cap C$

$= (A \times B) \cap (A \times C)$

(ii) $A \times C = \{(1, 5), (1, 6), (2, 5), (2, 6)\}$

$B \times D = \{(1, 5), (1, 6), (1, 7), (1, 8), (2, 5), (2, 6), (2, 7), (2, 8), (3, 5), (3, 6), (3, 7), (3, 8),$

$(4, 5), (4, 6), (4, 7), (4, 8),$

Therefore, it is clear that each element of $A \times C$ is present in $B \times D$.

$\therefore A \times C \subset B \times D$

8. Let $A = \{1, 2\}$ and $B = \{3, 4\}$, write $A \times B$. How many subsets will $A \times B$ have? List

them.

Ans. Given: $A = \{1, 2\}$ and $B = \{3, 4\}$

$$\therefore A \times B = \{(1, 3), (1, 4), (2, 3), (2, 4)\}$$

Number of elements in $A \times B = 4$

Therefore, Number of subsets of $A \times B = 2^4 = 16$

$\phi, \{(2,3)\}, \{(1,4)\}, \{(2,3)\}, \{(2,4)\}, \{(1, 3), (1, 4)\}, \{(1, 3), (2, 3)\}, \{(1, 3), (2, 4)\}, \{(1, 4), (2, 3)\}, \{(1, 4), (2, 4)\}, \{(2, 3), (2, 4)\}, \{(1, 3), (1, 4), (2, 3)\}, \{(1, 3), (1, 4), (2, 4)\}, \{(1, 3), (2, 3), (2, 4)\}, \{(1, 4), (2, 3), (2, 4)\}, \{(1, 3), (1, 4), (2, 3), (2, 4)\}$

9. Let A and B be two sets such that $n(A) = 3$ and $n(B) = 2$. If $(x, 1), (y, 2), (z, 1)$ are in $A \times B$.

Ans. Here $(x, 1) \in A \times B$

$$\Rightarrow x \in A \text{ and } 1 \in B$$

$$(y, 2) \in A \times B$$

$$\Rightarrow y \in A \text{ and } 2 \in B$$

$$(z, 1) \in A \times B$$

$$\Rightarrow z \in A \text{ and } 1 \in B$$

But it is given that $n(A) = 3$ and $n(B) = 2$

$$\therefore A = \{x, y, z\} \text{ and } B = \{1, 2\}$$

10. The Cartesian Product $A \times A$ has 9 elements among which are found $(-1, 0)$ and $(0, 1)$. Find the set A and the remaining elements of $A \times A$.

Ans. Here $(-1, 0) \in A \times A$

$$\Rightarrow -1 \in A \text{ and } 0 \in A$$

$$(0,1) \in A \times A$$

$$\Rightarrow 0 \in A \text{ and } 1 \in A$$

$$\therefore -1, 0, 1 \in A$$

But it is given that $n(A \times A) = 9$ which implies that $n(A) = 3$

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

$$\text{And } A \times A = \{(-1, -1), (-1, 0), (-1, 1), (0, -1), (0, 0), (0, 1), (1, -1), (1, 0), (1, 1)\}$$

Therefore, the remaining elements of $A \times A$ are

$$(-1, -1), (-1, 1), (0, -1), (0, 0), (1, -1), (1, 0), (1, 1)$$