

RD Sharma
Solutions
Class 11 Maths
Chapter 2
Ex 2.2

Class 11 Solutions Chapter 2 Relations Ex 2.2 Q1

We have,

$$A = \{1, 2, 3\}, B = \{3, 4\} \text{ and } C = \{4, 5, 6\}$$

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

$$\begin{aligned} \text{and, } B \times C &= \{3, 4\} \times \{4, 5, 6\} \\ &= \{(3, 4), (3, 5), (3, 6), (4, 4), (4, 5), (4, 6)\} \end{aligned}$$

$$\therefore (A \times B) \cap (B \times C) = \{3, 4\}.$$

Class 11 Solutions Chapter 2 Relations Ex 2.2 Q2

We have,

$$A = \{2, 3\}, B = \{4, 5\} \text{ and } C = \{5, 6\}$$

$$\begin{aligned} \therefore B \cup C &= \{4, 5\} \cup \{5, 6\} \\ &= \{4, 5, 6\} \end{aligned}$$

$$\begin{aligned} \therefore A \times (B \cup C) &= \{2, 3\} \times \{4, 5, 6\} \\ &= \{(2, 4), (2, 5), (2, 6), (3, 4), (3, 5), (3, 6)\} \end{aligned}$$

Now,

$$B \cap C = \{4, 5\} \cap \{5, 6\} = \{5\}$$

$$\begin{aligned} \therefore A \times (B \cap C) &= \{2, 3\} \times \{5\} \\ &= \{(2, 5), (3, 5)\} \end{aligned}$$

Now,

$$\begin{aligned} A \times B &= \{2, 3\} \times \{4, 5\} \\ &= \{(2, 4), (2, 5), (3, 4), (3, 5)\} \end{aligned}$$

$$\begin{aligned} \text{and, } A \times C &= \{2, 3\} \times \{5, 6\} \\ &= \{(2, 5), (2, 6), (3, 5), (3, 6)\} \end{aligned}$$

$$\therefore (A \times B) \cup (A \times C) = \{(2, 4), (2, 5), (2, 6), (3, 4), (3, 5), (3, 6)\}$$

Class 11 Solutions Chapter 2 Relations Ex 2.2 Q3

We have,

$$A = \{1, 2, 3\}, B = \{4\} \text{ and } C = \{5\}$$

$$\therefore B \cup C = \{4\} \cup \{5\} = \{4, 5\}$$

$$\therefore A \times (B \cup C) = \{1, 2, 3\} \times \{4, 5\}$$

$$\Rightarrow A \times (B \cup C) = \{(1, 4), (1, 5), (2, 4), (2, 5), (3, 4), (3, 5)\} \quad \text{--- (i)}$$

Now,

$$\begin{aligned} A \times B &= \{1, 2, 3\} \times \{4\} \\ &= \{(1, 4), (2, 4), (3, 4)\} \end{aligned}$$

$$\begin{aligned} \text{and, } A \times C &= \{1, 2, 3\} \times \{5\} \\ &= \{(1, 5), (2, 5), (3, 5)\} \end{aligned}$$

$$\therefore (A \times B) \cup (A \times C) = \{(1, 4), (2, 4), (3, 4)\} \cup \{(1, 5), (2, 5), (3, 5)\}$$

$$\Rightarrow (A \times B) \cup (A \times C) = \{(1, 4), (1, 5), (2, 4), (2, 5), (3, 4), (3, 5)\} \quad \text{--- (ii)}$$

From equation (i) and (ii), we get

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

Hence verified.

We have,

$$A = \{1, 2, 3\}, B = \{4\} \text{ and } C = \{5\}$$

$$\therefore B \cap C = \{4\} \cap \{5\} = \emptyset$$

$$\therefore A \times (B \cap C) = \{1, 2, 3\} \times \emptyset$$

$$\Rightarrow A \times (B \cap C) = \emptyset \quad \text{--- (i)}$$

Now,

$$\begin{aligned} A \times B &= \{1, 2, 3\} \times \{4\} \\ &= \{(1, 4), (2, 4), (3, 4)\} \end{aligned}$$

and, $A \times C = \{1, 2, 3\} \times \{5\}$

$$= \{(1, 5), (2, 5), (3, 5)\}$$

$$\therefore (A \times B) \cap (A \times C) = \{(1, 4), (2, 4), (3, 4)\} \cap \{(1, 5), (2, 5), (3, 5)\}$$

$$\Rightarrow (A \times B) \cap (A \times C) = \emptyset \quad \text{---(i)}$$

From equation (i) and equation (ii), we get

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

Hence verified.

We have,

$$A = \{1, 2, 3\}, B = \{4\} \text{ and } C = \{5\}$$

$$\therefore B - C = \{4\}$$

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

$$\Rightarrow A \times (B - C) = \{(1, 4), (2, 4), (3, 4)\} \quad \text{---(i)}$$

Now,

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

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

and, $A \times C = \{1, 2, 3\} \times \{5\}$

$$= \{(1, 5), (2, 5), (3, 5)\}$$

$$\therefore (A \times B) - (A \times C) = \{(1, 4), (2, 4), (3, 4)\} \quad \text{---(ii)}$$

From equation (i) and equation (ii), we get

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

Hence verified.

Class 11 Solutions Chapter 2 Relations Ex 2.2 Q4

We have,

$$A = \{1, 2\}, B = \{1, 2, 3, 4\}, C = \{5, 6\} \text{ and } D = \{5, 6, 7, 8\}$$

$$\therefore B \times D = \{1, 2, 3, 4\} \times \{5, 6, 7, 8\}$$

$$= \left[\begin{array}{l} (1, 5), (1, 6), (1, 7), (1, 8), (2, 5), (2, 6), (2, 7), (2, 8), \\ (3, 5), (3, 6), (3, 7), (3, 8), (4, 5), (4, 6), (4, 7), (4, 8) \end{array} \right] \quad \text{---(i)}$$

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

$$= \{(1, 5), (1, 6), (2, 5), (2, 6)\} \quad \text{---(ii)}$$

Clearly from equation (i) and equation (ii), we get

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

Hence verified.

We have,

$$A = \{1, 2\}, B = \{1, 2, 3, 4\}, C = \{5, 6\} \text{ and } D = \{5, 6, 7, 8\}$$

$$\therefore B \cap C = \{1, 2, 3, 4\} \cap \{5, 6\} = \emptyset$$

$$A \times (B \cap C) = \{1, 2\} \times \emptyset = \emptyset \quad \text{---(i)}$$

Now,

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

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

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

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

$$\therefore (A \times B) \cap (A \times C) = \emptyset \quad \text{---(ii)}$$

From equation (i) and equation (ii), we get

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

Hence verified.

Class 11 Solutions Chapter 2 Relations Ex 2.2 Q5

(i) we have,

$$A = \{1, 2, 3\}, B = \{3, 4\} \text{ and } C = \{4, 5, 6\}$$

$$\therefore B \cap C = \{3, 4\} \cap \{4, 5, 6\} = \{4\}$$

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

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

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

(ii) We have,

$$A = \{1, 2, 3\}, B = \{3, 4\} \text{ and } C = \{4, 5, 6\}$$

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

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

and,

$$A \times C = \{1, 2, 3\} \times \{4, 5, 6\}$$

$$= \{(1, 4), (1, 5), (1, 6), (2, 4), (2, 5), (2, 6), (3, 4), (3, 5), (3, 6)\}$$

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

(iii) we have,

$$A = \{1, 2, 3\}, B = \{3, 4\} \text{ and } C = \{4, 5, 6\}$$

$$\therefore B \cup C = \{3, 4\} \cup \{4, 5, 6\}$$

$$= \{3, 4, 5, 6\}$$

$$\therefore A \times (B \cup C) = \{1, 2, 3\} \times \{3, 4, 5, 6\}$$

$$= \{(1, 3), (1, 4), (1, 5), (1, 6), (2, 3), (2, 4), (2, 5), (2, 6), (3, 3), (3, 4), (3, 5), (3, 6)\}$$

Class 11 Solutions Chapter 2 Relations Ex 2.2 Q6

Let (a, b) be an arbitrary element of $(A \cup B) \times C$. Then,

$$(a, b) \in (A \cup B) \times C$$

$$\Rightarrow a \in A \cup B \text{ and } b \in C \quad \text{[By definition]}$$

$$\Rightarrow (a \in A \text{ or } a \in B) \text{ and } b \in C \quad \text{[By definition]}$$

$$\Rightarrow (a \in A \text{ and } b \in C) \text{ or } (a \in B \text{ and } b \in C)$$

$$\Rightarrow (a, b) \in A \times C \text{ or } (a, b) \in B \times C$$

$$\Rightarrow (a, b) \in (A \times C) \cup (B \times C)$$

$$\Rightarrow (a, b) \in (A \cup B) \times C$$

$$\Rightarrow (a, b) \in (A \times C) \cup (B \times C)$$

$$\Rightarrow (A \cup B) \times C \subseteq (A \times C) \cup (B \times C) \quad \text{---(i)}$$

Again, let (x, y) be an arbitrary element of $(A \times C) \cup (B \times C)$. Then,

$$(x, y) \in (A \times C) \cup (B \times C)$$

$$\Rightarrow (x, y) \in A \times C \quad \text{or} \quad (x, y) \in B \times C$$

$$\Rightarrow x \in A \text{ and } y \in C \quad \text{or} \quad x \in B \text{ and } y \in C$$

$$\Rightarrow (x \in A \text{ or } x \in B) \quad \text{and} \quad y \in C$$

$$\Rightarrow x \in A \cup B \quad \text{and} \quad y \in C$$

$$\Rightarrow (x, y) \in (A \cup B) \times C$$

$$\Rightarrow (x, y) \in (A \times C) \cup (B \times C)$$

$$\Rightarrow (x, y) \in (A \cup B) \times C$$

$$\Rightarrow (A \times C) \cup (B \times C) \subseteq (A \cup B) \times C \quad \text{---(ii)}$$

Using equation (i) and equation (ii), we get

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

Hence proved.

Let (a, b) be an arbitrary element of $(A \cap B) \times C$. Then,

$$(a, b) \in (A \cap B) \times C$$

$$\Rightarrow a \in A \cap B \text{ and } b \in C$$

$$\Rightarrow (a \in A \text{ and } a \in B) \text{ and } b \in C \quad \text{[By definition]}$$

$$\Rightarrow (a \in A \text{ and } b \in C) \text{ and } (a \in B \text{ and } b \in C)$$

$$\begin{aligned}
\Rightarrow & (a,b) \in A \times C \quad \text{and} \quad (a,b) \in B \times C \\
\Rightarrow & (a,b) \in (A \times C) \cap (B \times C) \\
\Rightarrow & (a,b) \in (A \cap B) \times C \\
\Rightarrow & (a,b) \in (A \times C) \cap (B \times C) \\
\Rightarrow & (A \cap B) \times C \subseteq (A \times C) \cap (B \times C) \quad \text{---(i)}
\end{aligned}$$

Let (x,y) be an arbitrary element of $(A \times C) \cap (B \times C)$. Then,

$$\begin{aligned}
& (x,y) \in (A \times C) \cap (B \times C) \\
\Rightarrow & (x,y) \in A \times C \quad \text{and} \quad (x,y) \in B \times C \quad \text{[By definition]} \\
\Rightarrow & (x \in A \text{ and } y \in C) \quad \text{and} \quad (x \in B \text{ and } y \in C) \\
\Rightarrow & (x \in A \text{ and } x \in B) \quad \text{and} \quad y \in C \\
\Rightarrow & x \in A \cap B \quad \text{and} \quad y \in C \\
\Rightarrow & (x,y) \in (A \cap B) \times C \\
\Rightarrow & (x,y) \in (A \times C) \cap (B \times C) \\
\Rightarrow & (x,y) \in (A \cap B) \times C \\
\Rightarrow & (A \times C) \cap (B \times C) \subseteq (A \cap B) \times C \quad \text{---(ii)}
\end{aligned}$$

Using equation (i) and equation (ii), we get

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

Class 11 Solutions Chapter 2 Relations Ex 2.2 Q7

Let (a,b) be an arbitrary element of $A \times B$. then,

$$\begin{aligned}
& (a,b) \in A \times B \\
\Rightarrow & a \in A \quad \text{and} \quad b \in B \quad \text{---(i)}
\end{aligned}$$

Now,

$$\begin{aligned}
& (a,b) \in A \times B \\
\Rightarrow & (a,b) \in C \times D \quad [\because A \times B \subseteq C \times D] \\
\Rightarrow & a \in C \text{ and } b \in D \quad \text{---(ii)} \\
\therefore & a \in A \Rightarrow a \in C \quad \text{[Using (i) and (ii)]}
\end{aligned}$$

$$\Rightarrow A \subseteq C$$

and,

$$\begin{aligned}
& b \in B \Rightarrow b \in D \\
\Rightarrow & B \subseteq D
\end{aligned}$$

Hence, proved