Class 11 Solutions Chapter 2 Relations Ex 2.2 Q4

We have,

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

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

$$= \begin{Bmatrix} (1,5), & (1,6), & (1,7), & (1,8), & (2,5), & (2,6), & (2,7), & (2,8), \\ (3,5), & (3,6), & (3,7), & (3,8), & (4,5), & (4,6), & (4,7), & (4,8) \end{Bmatrix} \quad \text{---(i)}$$

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,

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

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

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

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

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

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

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,

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

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

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

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

(ii) We have,

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

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

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,

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

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

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

Class 11 Solutions Chapter 2 Relations Ex 2.2 Q6

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

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

$\Rightarrow \quad a \in A \cup B$ and $b \in C$ [By defination]

$\Rightarrow \quad (a \in A$ or $a \in B)$ and $b \in C$ [By defination]

$\Rightarrow \quad (a \in A$ and $b \in C)$ or $(a \in B$ and $b \in C)$

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$\Rightarrow \quad (A \times C) \cup (B \times C) \subseteq (A \cup B) \times C$ ---(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,

$$
\begin{array}{lll}
 & (a,b) \in (A \cap B) \times C & \\
\Rightarrow & a \in A \cap B \text{ and } b \in C & \\
\Rightarrow & (a \in A \text{ and } a \in B) \text{ and } \quad b \in C & [\text{By defination}] \\
\Rightarrow & (a \in A \text{ and } b \in C) \text{ and } \quad (a \in B \text{ and } b \in C) & \\
\Rightarrow & (a,b) \in A \times C \quad \text{ and } (a,b) \in B \times C & \\
\Rightarrow & (a,b) \in (A \times C) \cap (B \times C) & \\
\Rightarrow & (a,b) \in (A \cap B) \times C & \\
\Rightarrow & (a,b) \in (A \times C) \cap (B \times C) & \\
\Rightarrow & (A \cap B) \times C \subseteq (A \times C) \cap (B \times C) & \text{---(i)}
\end{array}
$$

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

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

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,

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

Now,

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

and,

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

Hence, proved

*********** END **********