

# Maths 10<sup>th</sup> Unit \*5.



## Exercise 5.1

**Q #1**  $X = \{1, 4, 7, 9\}$  &  $Y = \{2, 4, 5, 9\}$  اگر

(i)  $X \cup Y = \{1, 4, 7, 9\} \cup \{2, 4, 5, 9\}$   
 $= \{1, 2, 4, 5, 7, 9\}$

(ii)  $X \cap Y = \{1, 4, 7, 9\} \cap \{2, 4, 5, 9\}$   
 $= \{4, 9\}$

(iii)  $Y \cup X = \{2, 4, 5, 9\} \cup \{1, 4, 7, 9\}$   
 $= \{1, 2, 4, 5, 7, 9\}$

(iv)  $Y \cap X = \{2, 4, 5, 9\} \cap \{1, 4, 7, 9\}$   
 $= \{4, 9\}$

**Q #2**  $X =$  مفرد اعداد جو 17 سے چھوٹے یا برابر ہوں، کا سیٹ  
 $= \{2, 3, 5, 7, 11, 13, 17\}$

$Y =$  پہلے 12 قدری اعداد کا سیٹ  
 $= \{1, 2, 3, \dots, 12\}$

(i)  $X \cup Y = \{2, 3, 5, 7, 11, 13, 17\} \cup \{1, 2, 3, \dots, 12\}$   
 $= \{1, 2, 3, \dots, 12, 13, 17\} = Y \cup \{13, 17\}$

(ii)  $Y \cup X = \{1, 2, 3, \dots, 12\} \cup \{2, 3, 5, 7, 11, 13, 17\}$   
 $= \{1, 2, 3, \dots, 12, 13, 17\} = Y \cup \{13, 17\}$

(iii)  $X \cap Y = \{2, 3, 5, 7, 11, 13, 17\} \cap \{1, 2, 3, \dots, 12\}$   
 $= \{2, 3, 5, 7, 11\}$

(iv)  $Y \cap X = \{1, 2, 3, \dots, 12\} \cap \{2, 3, 5, 7, 11, 13, 17\}$   
 $= \{2, 3, 5, 7, 11\}$

**Q #3**  $X = \phi$ ,  $Y = Z^+$ ,  $T = O^+$

(i)  $X \cup Y = \phi \cup Z^+ = Z^+ = Y$

(ii)  $X \cup T = \phi \cup O^+ = O^+ = T$

(iii)  $X \cap Y = \phi \cap Z^+ = \phi = X$

(iv)  $Y \cup T = Z^+ \cup O^+ = Z^+ = Y$

(v)  $X \cap T = \phi \cap O^+ = \phi = X$

(vi)  $Y \cap T = Z^+ \cap O^+ = O^+ = T$

**Q #4**  $U = \{x | x \in \mathbb{N} \wedge 3 < x \leq 25\}$

$$= \{4, 5, 6, \dots, 25\}$$

$X = \{x | x \in \mathbb{P} \wedge 8 < x < 25\}$

$$= \{11, 13, 17, 19, 23\}$$

$Y = \{x | x \in \mathbb{W} \wedge 4 \leq x \leq 17\}$

$$= \{4, 5, 6, \dots, 17\}$$

(i)  $(X \cup Y)' = ?$

$$X \cup Y = \{11, 13, 17, 19, 23\} \cup \{4, 5, 6, \dots, 17\}$$

$$X \cup Y = \{4, 5, 6, \dots, 17, 19, 23\}$$

$$(X \cup Y)' = U - (X \cup Y)$$

$$= \{4, 5, 6, \dots, 25\} - \{4, 5, 6, \dots, 17, 19, 23\}$$

$$= \{18, 20, 21, 22, 24, 25\}$$

(ii)  $X' \cap Y' = ?$

$$X' = U - X = \{4, 5, 6, \dots, 25\} - \{11, 13, 17, 19, 23\}$$

$$= \{4, 5, 6, \dots, 10, 12, 14, 15, 16, 18, 20, 21, 22, 24, 25\}$$

$$Y' = U - Y = \{4, 5, 6, \dots, 25\} - \{4, 5, 6, \dots, 17\}$$

$$= \{18, 19, 20, 21, 22, 23, 24, 25\}$$

$$X' \cap Y' = \{4, 5, 6, \dots, 10, 12, 14, 15, 16, 18, 20, 21, 22,$$

$$24, 25\} \cap \{18, 19, 20, 21, 22, 23, 24, 25\}$$

$$= \{18, 20, 21, 22, 24, 25\}$$

(iii)  $(X \cap Y)' = ?$

$$X \cap Y = \{11, 13, 17, 19, 23\} \cap \{4, 5, 6, \dots, 17\}$$

$$= \{11, 13, 17\}$$

$$(X \cap Y)' = U - (X \cap Y)$$

$$= \{4, 5, 6, \dots, 25\} - \{11, 13, 17\}$$

$$= \{4, 5, 6, \dots, 10, 12, 14, 15, 16, 18, 19, 20, \dots, 25\}$$

(iv)  $X' \cup Y' = ?$

as part (ii) above

$$X' \cup Y' = \{4, 5, 6, \dots, 10, 12, 14, 15, 16, 18, 20, 21, 22, 24,$$

$$25\} \cup \{18, 19, 20, 21, \dots, 25\}$$

$$= \{4, 5, 6, \dots, 10, 12, 14, 15, 16, 18, 19, 20, 21, \dots, 25\}$$

**Q #5**  $X = \{2, 4, 6, \dots, 20\}$

$Y = \{4, 8, 12, \dots, 24\}$

(i)  $X - Y = \{2, 4, 6, \dots, 20\} - \{4, 8, 12, \dots, 24\}$

$$= \{2, 6, 10, 14, 18\}$$

(ii)  $Y - X = \{4, 8, 12, \dots, 24\} - \{2, 4, 6, \dots, 20\}$

$$= \{24\}$$

**Q #6**  $A = \mathbb{N} = \{1, 2, 3, 4, \dots\}$

$B = \mathbb{W} = \{0, 1, 2, 3, \dots\}$

(i)  $A - B = \{1, 2, 3, 4, \dots\} - \{0, 1, 2, 3, \dots\}$

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

(ii)  $B - A = \{0, 1, 2, 3, \dots\} - \{1, 2, 3, 4, \dots\}$

$$= \{0\}$$

**Exercise 5.2**

**Q#1**

$X = \{1, 3, 5, 7, \dots, 19\}$

$Y = \{0, 2, 4, 6, 8, \dots, 20\}$

$Z = \{2, 3, 5, 7, 11, 13, 17, 19, 23\}$

(i)  $X \cup (Y \cap Z) = ?$

$= \{1, 3, 5, 7, \dots, 19\} \cup (\{0, 2, 4, 6, 8, \dots, 20\} \cap \{2, 3, 5, 7, 11, 13, 17, 19, 23\})$   
 $= \{1, 3, 5, 7, \dots, 19\} \cup \{2, 3, 5, 7, 11, 13, 17, 19, 23\}$   
 $= \{0, 1, 2, 3, 4, 5, 6, 7, 8, \dots, 20, 23\}$

(ii)  $(X \cup Y) \cup Z = ?$

$X \cup Y = \{1, 3, 5, 7, \dots, 19\} \cup \{0, 2, 4, 6, 8, \dots, 20\}$   
 $= \{0, 1, 2, 3, 4, 5, 6, 7, \dots, 19, 20\}$   
 $(X \cup Y) \cup Z = \{0, 1, 2, 3, 4, 5, \dots, 20\} \cup \{2, 3, 5, 7, 11, 13, 17, 19, 23\}$   
 $= \{0, 1, 2, 3, 4, 5, \dots, 20, 23\}$

(iii)  $X \cap (Y \cap Z) = ?$

$Y \cap Z = \{0, 2, 4, 6, 8, \dots, 20\} \cap \{2, 3, 5, 7, 11, 13, 17, 19, 23\}$   
 $= \{2\}$   
 $X \cap (Y \cap Z) = \{1, 3, 5, 7, \dots, 19\} \cap \{2\}$   
 $= \{ \} = \emptyset$

(iv)  $(X \cap Y) \cap Z = ?$

$X \cap Y = \{1, 3, 5, 7, \dots, 19\} \cap \{0, 2, 4, 6, \dots, 20\}$   
 $= \{ \} = \emptyset$   
 $(X \cap Y) \cap Z = \emptyset \cap \{2, 3, 5, 7, 11, 13, 17, 19, 23\}$   
 $= \emptyset$

(v)  $X \cup (Y \cap Z) = ?$

$Y \cap Z = \{0, 2, 4, 6, 8, \dots, 20\} \cap \{2, 3, 5, 7, 11, 13, 17, 19, 23\}$   
 $= \{2\}$   
 $X \cup (Y \cap Z) = \{1, 3, 5, 7, \dots, 19\} \cup \{2\}$   
 $= \{1, 2, 3, 5, 7, \dots, 19\}$

(vi)  $(X \cup Y) \cap (X \cup Z) = ?$

$X \cup Y = \{1, 3, 5, 7, \dots, 19\} \cup \{0, 2, 4, 6, 8, \dots, 20\}$   
 $= \{0, 1, 2, 3, 4, 5, \dots, 20\}$   
 $X \cup Z = \{1, 3, 5, 7, \dots, 19\} \cup \{2, 3, 5, 7, 11, 13, 17, 19, 23\}$   
 $= \{1, 2, 3, 5, 7, \dots, 19, 23\}$   
 $(X \cup Y) \cap (X \cup Z) = \{0, 1, 2, 3, 4, 5, \dots, 20\} \cap \{1, 2, 3, 5, 7, \dots, 19, 23\}$   
 $= \{1, 2, 3, 5, 7, \dots, 19\}$

(vii)  $X \cap (Y \cup Z) = ?$

$Y \cup Z = \{0, 2, 4, 6, \dots, 20\} \cup \{2, 3, 5, 7, 11, 13, 17, 19, 23\}$   
 $= \{0, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 16, 17, 18, 19, 20, 23\}$   
 $X \cap (Y \cup Z) = \{1, 3, 5, 7, \dots, 19\} \cap \{0, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 16, 17, 18, 19, 20, 23\}$   
 $= \{3, 5, 7, 11, 13, 17, 19\}$

(viii)  $(X \cap Y) \cup (X \cap Z) = ?$

$X \cap Y = \{1, 3, 5, 7, \dots, 19\} \cap \{0, 2, 4, 6, \dots, 20\}$   
 $= \{ \}$   
 $X \cap Z = \{1, 3, 5, 7, \dots, 19\} \cap \{2, 3, 5, 7, 11, 13, 17, 19, 23\}$   
 $= \{3, 5, 7, 11, 13, 17, 19\}$   
 $(X \cap Y) \cup (X \cap Z) = \{ \} \cup \{3, 5, 7, 11, 13, 17, 19\}$   
 $= \{3, 5, 7, 11, 13, 17, 19\}$

**Q#2**

$A = \{1, 2, 3, 4, 5, 6\}$ ,  $B = \{2, 4, 6, 8\}$  اگر

(i)  $A \cap B = B \cap A$  - یہ تو ثابت کرنا ہے  
 $LHS = A \cap B = \{1, 2, 3, 4, 5, 6\} \cap \{2, 4, 6, 8\}$   
 $= \{2, 4, 6\}$   
 $RHS = B \cap A = \{2, 4, 6, 8\} \cap \{1, 2, 3, 4, 5, 6\}$   
 $= \{2, 4, 6\}$   
 $A \cap B = B \cap A$  - یہ ثابت ہوا کہ

(ii)  $A \cup B = B \cup A$   
 $LHS = A \cup B = \{1, 2, 3, 4, 5, 6\} \cup \{2, 4, 6, 8\}$   
 $= \{1, 2, 3, 4, 5, 6, 8\}$   
 $RHS = B \cup A = \{2, 4, 6, 8\} \cup \{1, 2, 3, 4, 5, 6\}$   
 $= \{1, 2, 3, 4, 5, 6, 8\}$   
 $LHS = RHS$  - یہ ثابت ہوا کہ  $A \cup B = B \cup A$

(iii)  $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$   
 $(B \cup C) = \{2, 4, 6, 8\} \cup \{1, 4, 8\} = \{1, 2, 4, 6, 8\}$   
 $A \cap (B \cup C) = \{1, 2, 3, 4, 5, 6\} \cap \{1, 2, 4, 6, 8\}$   
 $= \{1, 2, 4, 6\}$  - (i)  
 $A \cap B = \{1, 2, 3, 4, 5, 6\} \cap \{2, 4, 6, 8\} = \{2, 4, 6\}$   
 $A \cap C = \{1, 2, 3, 4, 5, 6\} \cap \{1, 4, 8\} = \{1, 4\}$   
 $(A \cap B) \cup (A \cap C) = \{2, 4, 6\} \cup \{1, 4\}$   
 $= \{1, 2, 4, 6\}$  - (ii)  
 $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$  - یہ ثابت ہوا کہ

(iv)  $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$   
 $(B \cap C) = \{2, 4, 6, 8\} \cap \{1, 4, 8\} = \{4, 8\}$   
 $A \cup (B \cap C) = \{1, 2, 3, 4, 5, 6\} \cup \{4, 8\} = \{1, 2, 3, 4, 5, 6, 8\}$   
 $(A \cup B) = \{1, 2, 3, 4, 5, 6\} \cup \{2, 4, 6, 8\} = \{1, 2, 3, 4, 5, 6, 8\}$   
 $(A \cup C) = \{1, 2, 3, 4, 5, 6\} \cup \{1, 4, 8\} = \{1, 2, 3, 4, 5, 6, 8\}$   
 $(A \cup B) \cap (A \cup C) = \{1, 2, 3, 4, 5, 6, 8\} \cap \{1, 2, 3, 4, 5, 6, 8\} = \{1, 2, 3, 4, 5, 6, 8\}$   
 $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$  - یہ ثابت ہوا کہ

Q#3  $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$

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

$(A \cap B)' = A' \cup B'$   $\&$   $(A \cup B)' = A' \cap B'$

$A \cap B = \{1, 3, 5, 7, 9\} \cap \{2, 3, 5, 7\} = \{3, 5, 7\}$

$(A \cap B)' = U - (A \cap B) = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\} - \{3, 5, 7\}$   
 $= \{1, 2, 4, 6, 8, 9, 10\}$   $\rightarrow$  (i)

$A' = U - A = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\} - \{1, 3, 5, 7, 9\}$   
 $= \{2, 4, 6, 8, 10\}$

$B' = U - B = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\} - \{2, 3, 5, 7\}$   
 $= \{1, 4, 6, 8, 9, 10\}$

$A' \cup B' = \{2, 4, 6, 8, 10\} \cup \{1, 4, 6, 8, 9, 10\}$   
 $= \{1, 2, 4, 6, 8, 9, 10\}$   $\rightarrow$  (ii)

$(A \cap B)' = A' \cup B'$   $\rightarrow$  ثابت ہوا

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

$(A \cup B)' = U - (A \cup B) = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\} - \{1, 2, 3, 5, 7, 9\}$   
 $= \{4, 6, 8, 10\}$   $\rightarrow$  (iii)

$A' \cap B' = \{2, 4, 6, 8, 10\} \cap \{1, 4, 6, 8, 9, 10\}$   
 $= \{4, 6, 8, 10\}$   $\rightarrow$  (iv)

$(A \cup B)' = A' \cap B'$   $\rightarrow$  ثابت ہوا

Q#4  $U = \{1, 2, 3, \dots, 20\}$

$X = \{1, 3, 7, 9, 15, 18, 20\}$ ,  $Y = \{1, 3, 5, \dots, 17\}$

(i)  $X - Y = X \cap Y'$

$X - Y = \{1, 3, 7, 9, 15, 18, 20\} - \{1, 3, 5, \dots, 17\}$   
 $= \{18, 20\}$   $\rightarrow$  (i)

$Y' = U - Y = \{1, 2, 3, \dots, 20\} - \{1, 3, 5, \dots, 17\}$   
 $= \{2, 4, 6, 8, \dots, 16, 18, 19, 20\}$

$X \cap Y' = \{1, 3, 7, 9, 15, 18, 20\} \cap \{2, 4, 6, 8, \dots, 16, 18, 19, 20\}$   
 $= \{18, 20\}$   $\rightarrow$  (ii)

$X - Y = X \cap Y'$   $\rightarrow$  ثابت ہوا

(ii)  $Y - X = Y \cap X'$

$Y - X = \{1, 3, 5, \dots, 17\} - \{1, 3, 7, 9, 15, 18, 20\}$   
 $= \{5, 11, 13, 17\}$   $\rightarrow$  (i)

$X' = U - X = \{1, 2, 3, \dots, 20\} - \{1, 3, 7, 9, 15, 18, 20\}$   
 $= \{2, 4, 5, 6, 8, 10, 11, 12, 13, 14, 16, 17, 19\}$

$Y \cap X' = \{1, 3, 5, \dots, 17\} \cap \{2, 4, 5, 6, 8, 10, 11, 12, 13, 14, 16, 17, 19\}$   
 $= \{5, 11, 13, 17\}$   $\rightarrow$  (ii)

$Y - X = Y \cap X'$   $\rightarrow$  ثابت ہوا

Exercise 5.3

Q#1  $U = \{1, 2, 3, 4, \dots, 10\}$

$A = \{1, 3, 5, 7, 9\}$ ,  $B = \{1, 4, 7, 10\}$

(i)  $A - B = A \cap B'$

$A - B = \{1, 3, 5, 7, 9\} - \{1, 4, 7, 10\} = \{3, 5, 9\}$   $\rightarrow$  (i)

(ii)  $B' = U - B = \{1, 2, 3, 4, \dots, 10\} - \{1, 4, 7, 10\}$   
 $= \{2, 3, 5, 6, 8, 9\}$

$A \cap B' = \{1, 3, 5, 7, 9\} \cap \{2, 3, 5, 6, 8, 9\}$   
 $= \{3, 5, 9\}$   $\rightarrow$  (ii)

$A - B = A \cap B'$   $\rightarrow$  ثابت ہوا

(ii)  $B - A = B \cap A'$

$B - A = \{1, 4, 7, 10\} - \{1, 3, 5, 7, 9\} = \{4, 10\}$   $\rightarrow$  (i)

$A' = U - A = \{1, 2, 3, 4, \dots, 10\} - \{1, 3, 5, 7, 9\}$   
 $= \{2, 4, 6, 8, 10\}$

$B \cap A' = \{1, 4, 7, 10\} \cap \{2, 4, 6, 8, 10\}$   
 $= \{4, 10\}$   $\rightarrow$  (ii)

$B - A = B \cap A'$   $\rightarrow$  ثابت ہوا

(iii)  $(A \cup B)' = A' \cap B'$

$A \cup B = \{1, 3, 5, 7, 9\} \cup \{1, 4, 7, 10\} = \{1, 3, 4, 5, 7, 9, 10\}$

$(A \cup B)' = U - (A \cup B) = \{1, 2, 3, \dots, 10\} - \{1, 3, 4, 5, 7, 9, 10\}$   
 $= \{2, 6, 8\}$   $\rightarrow$  (i)

$A' = U - A = \{1, 2, 3, \dots, 10\} - \{1, 3, 5, 7, 9\}$   
 $= \{2, 4, 6, 8, 10\}$

$B' = U - B = \{1, 2, 3, \dots, 10\} - \{1, 4, 7, 10\}$   
 $= \{2, 3, 5, 6, 8, 9\}$

$A' \cap B' = \{2, 4, 6, 8, 10\} \cap \{2, 3, 5, 6, 8, 9\}$   
 $= \{2, 6, 8\}$   $\rightarrow$  (ii)

$(A \cup B)' = A' \cap B'$   $\rightarrow$  ثابت ہوا

(iv)  $(A \cap B)' = A' \cup B'$

$A \cap B = \{1, 3, 5, 7, 9\} \cap \{1, 4, 7, 10\} = \{1, 7\}$

$(A \cap B)' = U - (A \cap B) = \{1, 2, 3, 4, \dots, 10\} - \{1, 7\}$   
 $= \{2, 3, 4, 5, 6, 8, 9, 10\}$   $\rightarrow$  (i)

$A' \cup B' = \{2, 4, 6, 8, 10\} \cup \{2, 3, 5, 6, 8, 9\}$   
 $= \{2, 3, 4, 5, 6, 8, 9, 10\}$   $\rightarrow$  (ii)

$(A \cap B)' = A' \cup B'$   $\rightarrow$  ثابت ہوا

(v)  $(A - B)' = A' \cup B$

$A - B = \{1, 3, 5, 7, 9\} - \{1, 4, 7, 10\} = \{3, 5, 9\}$

$(A - B)' = U - (A - B) = \{1, 2, 3, \dots, 10\} - \{3, 5, 9\}$   
 $= \{1, 2, 4, 6, 7, 8, 10\}$   $\rightarrow$  (i)

$A' = U - A = \{1, 2, 3, \dots, 10\} - \{1, 3, 5, 7, 9\} = \{2, 4, 6, 8, 10\}$

$A' \cup B = \{2, 4, 6, 8, 10\} \cup \{1, 4, 7, 10\}$   
 $= \{1, 2, 4, 6, 7, 8, 10\}$   $\rightarrow$  (ii)

$(A - B)' = A' \cup B$   $\rightarrow$  ثابت ہوا

(vi)  $(B - A)' = B' \cup A$

$B - A = \{1, 4, 7, 10\} - \{1, 3, 5, 7, 9\} = \{4, 10\}$

$(B - A)' = U - (B - A) = \{1, 2, 3, 4, \dots, 10\} - \{4, 10\}$   
 $= \{1, 2, 3, 5, 6, 7, 8, 9\}$   $\rightarrow$  (i)

$B' = U - B = \{1, 2, 3, 4, \dots, 10\} - \{1, 4, 7, 10\} = \{2, 3, 5, 6, 8, 9\}$

$B' \cup A = \{2, 3, 5, 6, 8, 9\} \cup \{1, 3, 5, 7, 9\}$   
 $= \{1, 2, 3, 5, 6, 7, 8, 9\}$   $\rightarrow$  (ii)

$(B - A)' = B' \cup A$   $\rightarrow$  ثابت ہوا

**Q#2**  $U = \{1, 2, 3, 4, \dots, 10\}$   $C = \{1, 5, 8, 10\}$

$A = \{1, 3, 5, 7, 9\}$  &  $B = \{1, 4, 7, 10\}$

(i)  $(A \cup B) \cup C = A \cup (B \cup C)$  - ثابت کریں۔

$(A \cup B) = \{1, 3, 5, 7, 9\} \cup \{1, 4, 7, 10\} = \{1, 3, 4, 5, 7, 9, 10\}$

$(A \cup B) \cup C = \{1, 3, 4, 5, 7, 9, 10\} \cup \{1, 5, 8, 10\}$   
 $= \{1, 3, 4, 5, 7, 8, 9, 10\}$  - (i)

$(B \cup C) = \{1, 4, 7, 10\} \cup \{1, 5, 8, 10\} = \{1, 4, 5, 7, 8, 10\}$

$A \cup (B \cup C) = \{1, 3, 5, 7, 9\} \cup \{1, 4, 5, 7, 8, 10\}$

$= \{1, 3, 4, 5, 7, 8, 9, 10\}$  - (ii)

$(A \cup B) \cup C = A \cup (B \cup C)$  ثابت ہے۔

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

$(B \cap C) = \{1, 4, 7, 10\} \cap \{1, 5, 8, 10\} = \{1, 10\}$

$A \cap (B \cap C) = \{1, 3, 5, 7, 9\} \cap \{1, 10\} = \{1\}$  - (i)

$(A \cap B) = \{1, 3, 5, 7, 9\} \cap \{1, 4, 7, 10\} = \{1, 7\}$

$(A \cap B) \cap C = \{1, 7\} \cap \{1, 5, 8, 10\} = \{1\}$  - (ii)

$(A \cap B) \cap C = A \cap (B \cap C)$  ثابت ہے۔

(iii)  $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$

$(B \cap C) = \{1, 4, 7, 10\} \cap \{1, 5, 8, 10\} = \{1, 10\}$

$A \cup (B \cap C) = \{1, 3, 5, 7, 9\} \cup \{1, 10\} = \{1, 3, 5, 7, 9, 10\}$  - (i)

$(A \cup B) = \{1, 3, 5, 7, 9\} \cup \{1, 4, 7, 10\} = \{1, 3, 4, 5, 7, 9, 10\}$

$(A \cup C) = \{1, 3, 5, 7, 9\} \cup \{1, 5, 8, 10\} = \{1, 3, 5, 7, 8, 9, 10\}$

$(A \cup B) \cap (A \cup C) = \{1, 3, 4, 5, 7, 9, 10\} \cap \{1, 3, 5, 7, 8, 9, 10\}$   
 $= \{1, 3, 5, 7, 9, 10\}$  - (ii)

$A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$  ثابت ہے۔

(iv)  $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$

$(B \cup C) = \{1, 4, 7, 10\} \cup \{1, 5, 8, 10\} = \{1, 4, 5, 7, 8, 10\}$

$A \cap (B \cup C) = \{1, 3, 5, 7, 9\} \cap \{1, 4, 5, 7, 8, 10\} = \{1, 5, 7\}$  - (i)

$(A \cap B) = \{1, 3, 5, 7, 9\} \cap \{1, 4, 7, 10\} = \{1, 7\}$

$(A \cap C) = \{1, 3, 5, 7, 9\} \cap \{1, 5, 8, 10\} = \{1, 5\}$

$(A \cap B) \cup (A \cap C) = \{1, 7\} \cup \{1, 5\} = \{1, 5, 7\}$  - (ii)

$A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$  ثابت ہے۔

**Q#3**  $U = N = \{1, 2, 3, 4, \dots\}$

$A = \emptyset = \{ \}$ ,  $B = P = \{2, 3, 5, 7, 11, \dots\}$

دی جا رہی ہیں ان کے متعلق ثابت کریں۔

$(A \cup B)^c = A^c \cap B^c$  &  $(A \cap B)^c = A^c \cup B^c$

$A \cup B = \{ \} \cup \{2, 3, 5, 7, 11, \dots\} = \{2, 3, 5, 7, 11, \dots\}$

$(A \cup B)^c = U - (A \cup B) = \{1, 2, 3, 4, \dots\} - \{2, 3, 5, 7, 11, \dots\}$   
 $= \{1, 4, 6, 8, 9, 10, 12, \dots\}$  - (i)

$A^c = U - A = \{1, 2, 3, 4, \dots\} - \{ \}$

$= \{1, 2, 3, 4, \dots\}$

$B^c = U - B = \{1, 2, 3, 4, \dots\} - \{2, 3, 5, 7, 11, \dots\}$

$= \{1, 4, 6, 8, 9, 10, 12, \dots\}$

$A^c \cap B^c = \{1, 2, 3, 4, \dots\} \cap \{1, 4, 6, 8, 9, 10, 12, \dots\}$

$= \{1, 4, 6, 8, 9, 10, 12, \dots\}$  - (ii)

$(A \cup B)^c = A^c \cap B^c$  ثابت ہے۔

(4)  $(A \cap B) = \{ \} \cap \{2, 3, 5, 7, 11, \dots\}$   
 $= \{ \}$

$(A \cap B)^c = U - (A \cap B) = \{1, 2, 3, 4, \dots\} - \{ \}$   
 $= \{1, 2, 3, 4, \dots\}$  - (iii)

$A^c \cup B^c = \{1, 2, 3, 4, \dots\} \cup \{2, 3, 5, 7, 11, \dots\}$   
 $= \{1, 2, 3, 4, \dots\}$  - (iv)

$(A \cap B)^c = A^c \cup B^c$  ثابت ہے۔

**Exercise 5.4**

**Q#1**  $A = \{a, b\}$   $B = \{c, d\}$

$A \times B = \{(a, c), (a, d), (b, c), (b, d)\}$

$B \times A = \{(c, a), (c, b), (d, a), (d, b)\}$

**Q#2**  $A = \{0, 2, 4\}$ ,  $B = \{-1, 3\}$

$A \times B = \{0, 2, 4\} \times \{-1, 3\}$

$= \{(0, -1), (0, 3), (2, -1), (2, 3), (4, -1), (4, 3)\}$

$B \times A = \{-1, 3\} \times \{0, 2, 4\}$

$= \{(-1, 0), (-1, 2), (-1, 4), (3, 0), (3, 2), (3, 4)\}$

$A \times A = \{0, 2, 4\} \times \{0, 2, 4\}$

$= \{(0, 0), (0, 2), (0, 4), (2, 0), (2, 2), (2, 4), (4, 0), (4, 2), (4, 4)\}$

$B \times B = \{-1, 3\} \times \{-1, 3\}$

$= \{(-1, -1), (-1, 3), (3, -1), (3, 3)\}$

**Q#3**

$a$  اور  $b$  کی قیمتیں معلوم کریں۔

(i)  $(a-4, b-2) = (2, 1)$

$a-4=2$  اور  $b-2=1$

$a=2+4$  |  $b=1+2$

$= 6$  |  $= 3$

(ii)  $(2a+5, 3) = (7, b-4)$

$2a+5=7$  اور  $3=b-4$

$2a=7-5$  |  $3+4=b$

$2a=2$  |  $7=b$

$a=\frac{2}{2}$  |  $b=7$

$a=1$  |  $b=7$

(iii)  $(3-2a, b-1) = (a-7, 2b+5)$

$3-2a=a-7$  اور  $b-1=2b+5$

$3=a+2a-7$  |  $-1=2b-b+5$

$3+7=3a$  |  $-1-5=b$

$10=3a$  |  $-6=b$

$\frac{10}{3}=a$  |  $b=-6$

$a=\frac{10}{3}$

**Q#4**

$X$  اور  $Y$  کی قیمتیں معلوم کریں۔

$X \times Y = \{(a, a), (b, a), (c, a), (d, a)\}$

ترتیب جڑے ہیں پہلا  $X$  سے اور دوسرا  $Y$  سے ہو گا لہذا

$X = \{a, b, c, d\}$  &  $Y = \{a\}$

**Q#5**  $X = \{a, b, c\}$ ,  $Y = \{d, e\}$

$X$  میں '3' ارکان ہیں جبکہ  $Y$  میں '2' ارکان ہیں لہذا

(i)  $X \times Y = 3 \times 2 = 6$

(ii)  $Y \times X = 2 \times 3 = 6$

(iii)  $X \times X = 3 \times 3 = 9$

### Exercise 5.5

**Q #1**  $L = \{a, b, c\}$ ,  $M = \{3, 4\}$  اگر

ہر دو تثنائی روابط لکھیں۔

$$L \times M = \{a, b, c\} \times \{3, 4\}$$

$$= \{(a, 3), (a, 4), (b, 3), (b, 4), (c, 3), (c, 4)\}$$

$$R_1 = \{(a, 3), (a, 4)\} \quad R_2 = \{(a, 4), (b, 3), (b, 4)\}$$

$$R_3 = \{(b, 3), (b, 4), (c, 3)\} \quad R_4 = \{(a, 3), (b, 3)\}$$

so  $m \times L = \{3, 4\} \times \{a, b, c\}$

$$= \{(3, a), (3, b), (3, c), (4, a), (4, b), (4, c)\}$$

$$R_1 = \{(3, a), (3, b), (3, c), (4, a)\}$$

$$R_2 = \{(4, a), (4, c)\} \quad R_3 = \{(3, a), (4, a)\}$$

so  $m$

**Q #2**  $Y = \{-2, 1, 2\}$  کے دو تثنائی روابط لکھیں جبکہ

$$Y \times Y = \{-2, 1, 2\} \times \{-2, 1, 2\}$$

$$= \{(-2, -2), (-2, 1), (-2, 2), (1, -2), (1, 1), (1, 2), (2, -2), (2, 1), (2, 2)\}$$

$$R_1 = \{(-2, -2), (-2, 1)\} \quad R_2 = \{(-2, 2), (1, 1), (1, 2)\}$$

$$\text{Dom}(R_1) = \{-2\} \quad \text{Dom}(R_2) = \{-2, 1\}$$

$$\text{Range}(R_1) = \{-2, 1\} \quad \text{Range}(R_2) = \{2, 1\}$$

**Q #3**  $L = \{a, b, c\}$ ,  $M = \{d, e, f, g\}$  اگر

ہر دو تثنائی روابط لکھیں۔

$$L \times L = \{a, b, c\} \times \{a, b, c\}$$

$$= \{(a, a), (a, b), (a, c), (b, a), (b, b), (b, c), (c, a), (c, b), (c, c)\}$$

$$R_1 = \{(a, a), (a, c), (b, c)\}$$

$$R_2 = \{(a, b), (b, a), (c, b)\}$$

(ii)  $L \times M = \{a, b, c\} \times \{d, e, f, g\}$

$$= \{(a, d), (a, e), (a, f), (a, g), (b, d), (b, e), (b, f), (b, g), (c, d), (c, e), (c, f), (c, g)\}$$

$$R_1 = \{(a, d), (a, e), (a, g), (b, e)\}$$

$$R_2 = \{(b, d), (b, f), (c, d), (c, c)\}$$

(iii)  $M \times M = \{d, e, f, g\} \times \{d, e, f, g\}$

$$= \{(d, d), (d, e), (d, f), (d, g), (e, d), (e, e), (e, f), (e, g), (f, d), (f, e), (f, f), (f, g), (g, d), (g, e), (g, f), (g, g)\}$$

$$R_1 = \{(d, d), (d, g), (e, f), (f, g)\}$$

$$R_2 = \{(d, g), (e, g), (f, f), (g, f)\}$$

**Q #4** اگر  $M$  کے 5 ارکان ہوں تثنائی روابط کی تعداد معلوم کریں

تثنائی روابط کی تعداد درج ذیل فارمولہ سے معلوم کی جاسکتی ہے۔

$$= 2^{mn}$$

$$= 2^{5 \times 5} = 2^5$$

**Q #5**  $L = \{x \mid x \in N \wedge x \leq 5\} = \{1, 2, 3, 4, 5\}$

$$M = \{y \mid y \in P \wedge y < 10\} = \{2, 3, 5, 7\}$$

$L$  سے  $M$  پر روابط بنائیں۔

$$L \times M = \{1, 2, 3, 4, 5\} \times \{2, 3, 5, 7\}$$

$$= \{(1, 2), (1, 3), (1, 5), (1, 7), (2, 2), (2, 3), (2, 5), (2, 7), (3, 2), (3, 3), (3, 5), (3, 7), (4, 2), (4, 3), (4, 5), (4, 7), (5, 2), (5, 3), (5, 5), (5, 7)\}$$

یا  $R_1 = \{(x, y) \mid y < x\}$

یہ مشرتب جوڑے جن میں پہلا رکن دوسرے رکن سے بڑا ہو۔

(i)  $R_1 = \{(3, 2), (4, 2), (4, 3), (5, 2), (5, 3)\}$

(ii)  $R_2 = \{(x, y) \mid y = x\}$

یہ مشرتب جوڑے جن میں پہلا اور دوسرا رکن برابر ہوں

$R_2 = \{(2, 2), (3, 3), (5, 5)\}$

(iii)  $R_3 = \{(x, y) \mid x + y = 6\}$

یہ مشرتب جوڑے جن کا مجموعہ 6 کے برابر ہو

$R_3 = \{(1, 5), (3, 3), (4, 2)\}$

(iv)  $R_4 = \{(x, y) \mid y - x = 2\}$

یہ مشرتب جوڑے جن میں پہلے رکن کو دوسرے رکن سے تین گنا سے بڑا ہے

$R_4 = \{(1, 3), (3, 5), (5, 7)\}$

$\text{Dom}(R_1) = \{3, 4, 5\}$      $\text{Range}(R_1) = \{2, 3\}$

$\text{Dom}(R_2) = \{2, 3, 5\}$      $\text{Range}(R_2) = \{2, 3, 5\}$

$\text{Dom}(R_3) = \{1, 3, 4\}$      $\text{Range}(R_3) = \{5, 3, 2\}$

$\text{Dom}(R_4) = \{1, 3, 5\}$      $\text{Range}(R_4) = \{3, 5, 7\}$

**Q #6** (i)  $R_1 = \{(1, 1), (2, 2), (3, 3), (4, 4)\}$

$\text{Dom}(R_1) = \{1, 2, 3, 4\}$      $\text{Range}(R_1) = \{1, 2, 3, 4\}$

$R_1$  بائیں جیکٹر فنکشن ہے کیونکہ تغافل دن دن میں آں آں ہے۔

(ii)  $R_2 = \{(1, 2), (2, 1), (3, 4), (3, 5)\}$

$\text{Dom}(R_2) = \{1, 2, 3\}$      $\text{Range}(R_2) = \{1, 2, 4, 5\}$

$R_2$  ربط ہے۔

(iii)  $R_3 = \{(b, a), (c, a), (d, a)\}$

$\text{Dom}(R_3) = \{b, c, d\}$      $\text{Range}(R_3) = \{a\}$

$R_3$  تغافل ہے۔

(iv)  $R_4 = \{(1, 1), (2, 3), (3, 4), (4, 3), (5, 4)\}$

$\text{Dom}(R_4) = \{1, 2, 3, 4, 5\}$      $\text{Range}(R_4) = \{1, 3, 4\}$

$R_4$  ان تغافل ہے

(v)  $R_5 = \{(a, b), (b, a), (c, d), (d, e)\}$

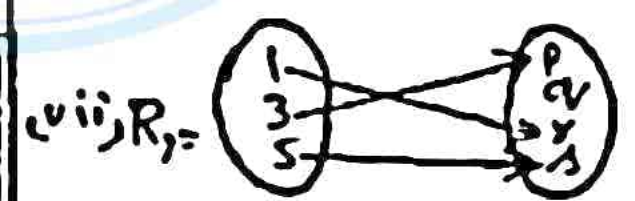
$\text{Dom}(R_5) = \{a, b, c, d\}$      $\text{Range}(R_5) = \{a, b, d, e\}$

$R_5$  دن-دن تغافل ہے۔

(vi)  $R_6 = \{(1, 2), (2, 3), (1, 3), (3, 4)\}$

$\text{Dom}(R_6) = \{1, 2, 3\}$      $\text{Range}(R_6) = \{2, 3, 4\}$

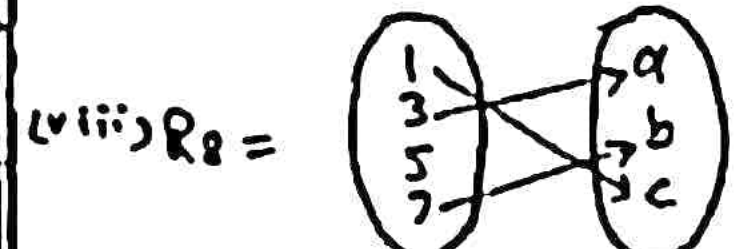
$R_6$  ربط ہے۔



(vii)  $R_7 = \{(1, p), (3, r), (5, s)\}$

$\text{Dom}(R_7) = \{1, 3, 5\}$      $\text{Range}(R_7) = \{p, r, s\}$

$R_7$  دن-دن تغافل ہے۔



(viii)  $R_8 = \{(1, a), (3, b), (7, c)\}$

$\text{Dom}(R_8) = \{1, 3, 7\}$      $\text{Range}(R_8) = \{a, b, c\}$

$R_8$  ربط ہے۔