Exercise 5.1

1. *If* $X = \{1, 4, 7, 9\}$ *and* $Y = \{2, 4, 5, 9\}$ *Then find:*

(i) $X \cup Y$

Solution: $X \cup Y = \{1,4,7,9\} \cup \{2,4,5,9\}$
$= \{1,2,4,5,7,9\}$

(ii) $X \cap Y$

Solution: $X \cap Y = \{1,4,7,9\} \cap \{2,4,5,9\}$
$= \{4,9\}$

(iii) $Y \cup X$

Solution: $Y \cup X = \{2,4,5,9\} \cup \{1,4,7,9\}$
$= \{1,2,4,5,7,9\}$

(iv) $Y \cap X$

Solution: $Y \cap X = \{2,4,5,9\} \cap \{1,4,7,9\}$
$= \{4,9\}$

2. *If* $X =$ *Set of prime numbers less than or equal to 17 and* $Y =$ *Set of first 12 natural numbers, then find the following*

Solution: (i) $X \cup Y$
$= \{2,3,5,7,11,13,17\} \cup \{1,2,3, \ldots \ldots 12\}$
$= \{1,2,3 \ldots \ldots 12,13,17\}$
$= Y \cup \{13,17\}$
Here, $X = \{2,3,5,7,11,13,17\}$
$Y = \{1,2,3,4,5,6,7,8,9,10,11\}$

(ii) $X \cap Y$
$= \{2,3,5,11,13,17\} \cap \{1,2,3, \ldots \ldots 12,13,17\}$
$= \{2,3,5,11,12\}$

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

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

3. *If* $X = \phi, Y = Z^+, T = O^+$, *then find*

Solution: (i) $X \cup Y$

Here $X = \{\ \}$

$Y = \{0,1,2,3, \ldots.\}$

$T = \{1,3,5, \ldots \ldots\}$

$X \cup Y = \{\ \} \cup \{0,1,2,3 \ldots..\}$

$= \{0,1,2,3 \ldots \ldots.\} = Y$

OR

$X \cup Y = \phi \cup Z^+$

$X \cup Y = Z^+$

$X \cup Y = Y$

(ii) $X \cup T$

$= \{\ \} \cup \{1,3,5 \ldots..\}$

$= \{1,3,5, \ldots.\} = T$

OR

$X \cup T = \phi \cup O^+$

$X \cup T = O^+$

$X \cup T = T$

(iii) $Y \cap T$

$= \{0,1,2,3, \ldots..\} \cup \{1,3,5 \ldots \ldots.\}$

$= \{0,1,2,3 \ldots \ldots\} = Y$

OR

$Y \cap T = Z^+ \cap O^+$

$Y \cap T = Z^+$

$Y \cap T = Y$

(iv) $X \cap Y$

$= \{\ \} \cap \{0,1,2,3 \ldots \ldots..\}$

$= \{\ \}$

$= X$

OR

$X \cap Y = \phi \cap Z^+$

$X \cap Y = \phi$

$X \cap Y = X$

(v) $X \cap T$

$= \{\ \} \cap \{1,3,5 \ldots \ldots.\}$

$= \{\ \}$

$= X$

OR

$X \cap T = \phi \cap O^+$

$X \cap T = \phi$

$X \cap T = X$

(vi) $Y \cap T$

$= \{0,1,2,3 \ldots\ldots\} \cap \{1,3,5 \ldots\ldots\}$

$= \{1,3,5 \ldots\ldots\} = T$

OR

$Y \cap T = Z^+ \cap O^+$

$Y \cap T = O^+$

$Y \cap T = T$

4. ***If*** $U = \{x | x \in N \wedge 3 < x \leq 25\}$

$X = \{x | x \text{ is prime } \wedge 8 < x < 25\}$

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

Find the value of:

Solution:

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

Here,

$U = \{4,5,6,7, \ldots .25\}$

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

$Y = \{4,5,6,7, \ldots \ldots 17\}$

$X \cup Y = \{11,13,17,19,23\} \cup \{4,5,6,7, \ldots .17\}$

$= \{4,5,6,7, \ldots \ldots .17,19,23\}$

Now

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

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

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

(ii) $X' \cap Y'$

Now $X' = U - X$

$= \{4,5,6 \ldots .,25\} - \{11,13,17,19,23\}$

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

Now $Y' = U - Y$

$= \{4,5,6 \ldots ,25\} - \{4,5,6,7, \ldots 17\}$

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

Now $X' \cap Y'$

$= \{4,5, \ldots .10,12,14,15,16,18,20,21,22,24,25\} \cap$

$= \{18,19,20 \ldots .25\}$

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

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

$L.H.S = (X \cap Y)'$

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

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

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

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

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

$R.H.S = U - (X \cap Y)$

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

$= \{4,5,6 \ldots \ldots 10,12,14,15,16,18,19,20,21,22,23,24,25\}$

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

(iv) $X' \cup Y'$

$X' = U - X$

$= \{4,5,6 \ldots \ldots 25\} - \{11,13,17,19,23\}$

$= \{4,5,6 \ldots \ldots 10,12,14,16,18,19,20,21,22,23,24,25\}$

$Y' = U - Y$

$= \{4,5,6 \ldots 25\} - \{4,5,6 \ldots \ldots 17\}$

$= \{18,19,20 \ldots \ldots, 25\}$

Now $X' \cap Y'$

$= \{4,5,6 \ldots\ldots 10,12,14,15,1618, \ldots \ldots 25\}$

5. ***If*** $X = \{2,4,6, \ldots\ldots, 20\}$ ***and*** $Y = \{4,8,12 \ldots\ldots, 24\}$, ***then find the following:***

Solution:

(i) $X - Y$

$X - Y = \{2,4,6 \ldots \ldots, 20\} - \{4,8,12, \ldots\ldots 24\}$

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

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

$= \{24\}$

6. ***If*** $A = N$ ***and*** $B = W$, ***then find the value of***

Solution:

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

$= \{\ \ \}$

OR

$A - B = N - W$

$A - B = \phi$

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

$= \{0\}$

OR

$B - A = W - N$

$B - A = \{0\}$