EXERCISE 5.1

Q.1 If X = {1, 4, 7, 9} and

Y = {2, 4, 5, 9} then find:

(i) X∪Y   (ii) X∩Y

(iii) Y∪X   (iv) Y∩X

Solution:

(i) X∪Y =   {1, 4, 7, 9} ∪ {2, 4, 5, 9}

=   {1, 2, 4, 5, 7, 9}

(ii) X∩Y =   {1, 4, 7, 9} ∩ {2, 4, 5, 9}

=   {4, 9}

(iii) Y∪X =   {2, 4, 5, 9} ∪ {1, 4, 7, 9}

=   {1, 2, 4, 5, 7, 9}

(iv) Y∩X =   {2, 4, 5, 9} ∩ {1, 4, 7, 9}

=   {4, 9}

Q.2 If X = **Set of Prime numbers less than or equal to 17.**

Y = Set of first 12 natural numbers, then find.

(i) X∪Y   (ii) X∩Y

(iii) Y∪X   (iv) Y∩X

Solution:

X   = {2, 3, 5, 7, 11, 13, 17}

Y   = {1, 2, 3, 4, …, 12}

(i) X∪Y

={2, 3, 5, 7, 11, 13, 17} ∪ {1, 2, 3, 4,…,12}

= {1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 17}

(ii) Y∪X

= {1,2,3,4, …,12} ∪ {2,3,5,7, 11, 13,17}

= {1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 17}

(iii) X∩Y

={2,3,5,7,11,13,17}∩{1,2,3,4, 5, …..,12}

= {2,3,5, 7, 11}

(iv) Y∩X

={1,2,3,5, …,12}∩{2,3,5,7,11,13, 17}

={2, 3, 5, 7, 11}

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

(i) $X \cup Y$ **(ii)** $X \cup T$ **(iii)** $Y \cup T$

(iv) $X \cap Y$ **(v)** $X \cap T$ **(vi)** $Y \cap T$

Solution:

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

$\qquad = Z^+ = Y$

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

$\qquad = O^+ = T$

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

$\qquad = \{1, 2, 3, 4, 5 ....\} \cup \{1, 3, 5, 7,....\}$

$\qquad = \{1, 2, 3, 4, 5, ...\} = Z^+ = Y$

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

$\qquad = \phi = X$

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

$\qquad = \phi = X$

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

$\qquad = \{1, 2, 3, 4, 5, ...\} \cap \{1, 3, 5, 7, ...\}$

$\qquad = \{1, 3, 5, 7, ...\} = O^+ = T$

Q.4 If $U = \{x \,|\, x \in N \wedge 3 < x \leq 25\}$
$X = \{x \,|\, x \text{ is } \textbf{Prime} \wedge 8 < x < 25\}$
$Y = \{x \,|\, x \in W \wedge 4 \leq x \leq 17\}$
then find the value of:

(i) $(X \cup Y)'$ **(ii)** $X' \cap Y'$

(iii) $(X \cap Y)'$ **(iv)** $X' \cup Y'$

Solution:

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

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

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

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

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

$\qquad = \{4,5,6,7,8,9,10,11, 12,13,14,15,16, 17,19,23\}$

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

$= \{4,5,6,7,..., 25\} - \{4,5,6,7,8,9, 10, 11,12,$
$\qquad\qquad\qquad 13,14,15, 16,17,19,23\}$

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

(ii) $X' \cap Y'$

$X' = U - X$

$= \{4, 5, 6, 7, ..., 25\} - \{11,13,17,19, 23\}$

$= \{4,5,6,7,8,9,10,12,14,15,16,18,20,21,22,24,25\}$

$Y' = U - Y$

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

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

$X' \cap Y' = \{4,5,6,7,8,9,10,12,14,15,16,18,20,21,$
$\qquad\qquad 22,24,25\} \cap \{18,19,20,21,22,23,24,25\}$

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

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

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

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

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

$\qquad = \{4, 5, 6, 7, ..., 25\} - \{11,13,17\}$

$\qquad = \{4,5,6, 7, 8, 9, 10, 12, 14, 15, 16,$
$\qquad\qquad 18, 19, 20, 21, 22,23, 24,25\}$

(iv) $X' \cup Y'$

$X' = U - X = \{4,5,6,7, ..., 25\} - \{11,13,17, 19,23\}$

$\qquad = \{4, 5, 6, 7, 8, 9, 10, 12, 14, 15,16,$
$\qquad\qquad 18, 20, 21, 22, 24, 25\}$

$Y' = U - Y$

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

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

$X' \cup Y' = \{4, 5, 6, 7, 8, 9, 10, 12, 14, 15,$
$\qquad\qquad 16, 18, 20, 21, 22, 24, 25\} \cup$
$\qquad\qquad \{18, 19, 20, 21, 22, 23, 24, 25\}$

$\qquad = \{4, 5, 6, 7, 8, 9, 10, 12, 14, 15,$
$\qquad\qquad 16,18, 19, 20, 21, 22,23, 24,25\}$

Q.5   If X = {2, 4, 6,..., 20} and
        Y={4, 8, 12,...24} then find the
        following: (i) X – Y (ii) Y – X

Solution:

(i) X–Y={2, 4, 6, 8, 10, 12, 14, 16,18,20} –
       {4, 8, 12, 16, 20, 24}
     = {2, 6, 10, 14, 18}

(ii)Y–X= {4, 8, 12, 16, 20, 24} –
       {2, 4, 6, 8, 10, 12, 14, 16, 18, 20}
     = {24}

Q.6   If A = N and B = W then find the
        value of

(i) A–B   (ii) B–A

Solution:

(i) A–B = N – W
       = {1, 2, 3, ...} – {0, 1, 2, 3, ...}
       = { }

(ii) B–A = W – N
       = {0, 1, 2, 3, ... } – {1, 2, 3, ...}
       = {0}