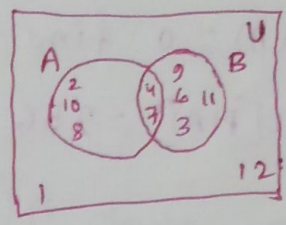


## // Exercise - 1.3 //

① Using the given venn diagram, write the elements of

- (i) A (ii) B (iii)  $A \cup B$  (iv)  $A \cap B$
- (v)  $A - B$  (vi)  $B - A$  (vii)  $A'$  (viii)  $B'$
- (ix) U



⇒ (i)  $A = \{2, 4, 7, 8, 10\}$

(ii)  $B = \{3, 4, 6, 7, 9, 11\}$

(iii)  $A \cup B = \{2, 4, 7, 8, 10\} \cup \{3, 4, 6, 7, 9, 11\}$   
 $= \{2, 3, 4, 6, 7, 8, 9, 10, 11\}$

(iv)  $A \cap B = \{2, 4, 7, 8, 10\} \cap \{3, 4, 6, 7, 9, 11\}$   
 $A \cap B = \{4, 7\}$

(v)  $A - B = \{2, 8, 10\}$

(vi)  $B - A = \{3, 6, 9, 11\}$

(vii)  $A' = \{1, 3, 6, 9, 11, 12\}$

(viii)  $B' = \{1, 2, 8, 10, 12\}$

(ix)  $U = \{1, 2, 3, 4, 6, 7, 8, 9, 10, 11, 12\}$

② Find  $A \cup B$ ,  $A \cap B$ ,  $A - B$  and  $B - A$  for the following sets.

(i)  $A = \{2, 6, 10, 14\}$  and  $B = \{2, 5, 14, 16\}$

(ii)  $A = \{a, b, e, e, u\}$  and  $B = \{a, e, i, o, u\}$

(iii)  $A = \{x: x \in \mathbb{N}, x \leq 10\}$  and  $B = \{x: x \in \mathbb{W}, x < 6\}$

(iv)  $A$  = Set of all letters in the word "mathematics"  
and  $B$  = Set of all letters in the word "geometry".

⇒ (i) Given that  $A = \{2, 6, 10, 14\}$  and  $B = \{2, 5, 14, 16\}$

$$\begin{aligned}A \cup B &= \{2, 6, 10, 14\} \cup \{2, 5, 14, 16\} \\ &= \{2, 5, 6, 10, 14, 16\}\end{aligned}$$

$$\begin{aligned}A \cap B &= \{2, 6, 10, 14\} \cap \{2, 5, 14, 16\} \\ &= \{2, 14\}\end{aligned}$$

$$\begin{aligned}A - B &= \{2, 6, 10, 14\} - \{2, 5, 14, 16\} \\ &= \{6, 10\}\end{aligned}$$

$$\begin{aligned}B - A &= \{2, 5, 14, 16\} - \{2, 6, 10, 14\} \\ &= \{5, 16\}\end{aligned}$$

(ii) Given that  $A = \{a, b, e, e, u\}$  and  $B = \{a, e, i, o, u\}$ .

$$\begin{aligned}A \cup B &= \{a, b, e, e, u\} \cup \{a, e, i, o, u\} \\ &= \{a, b, e, e, i, o, u\}\end{aligned}$$

$$\begin{aligned}A \cap B &= \{a, b, e, e, u\} \cap \{a, e, i, o, u\} \\ &= \{a, e, u\}\end{aligned}$$

$$\begin{aligned}A - B &= \{a, b, e, e, u\} - \{a, e, i, o, u\} \\ &= \{b, e, e\}\end{aligned}$$

$$\begin{aligned}B - A &= \{a, e, i, o, u\} - \{a, b, e, e, u\} \\ &= \{i, o\}\end{aligned}$$



(iii) Given that

$$A = \{x: x \in \mathbb{N}, x \leq 10\} = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$$

$$\text{and } B = \{x: x \in \mathbb{W}, x < 6\} = \{0, 1, 2, 3, 4, 5\}$$

$$A \cup B = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\} \cup \{0, 1, 2, 3, 4, 5\}$$

$$= \{0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$$

$$A \cap B = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\} \cap \{0, 1, 2, 3, 4, 5\}$$

$$= \{1, 2, 3, 4, 5\}$$

$$A - B = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\} - \{0, 1, 2, 3, 4, 5\}$$

$$= \{6, 7, 8, 9, 10\}$$

$$B - A = \{0, 1, 2, 3, 4, 5\} - \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$$

$$= \{0\}$$

(iv) Given that

A = Set of all letters in the word "mathematics".

$$= \{m, a, t, h, e, i, c, s\}$$

B = Set of all letters in the word "geometry".

$$= \{g, e, o, m, t, r, y\}$$

$$A \cup B = \{m, a, t, h, e, i, c, s\} \cup \{g, e, o, m, t, r, y\}$$

$$= \{m, a, t, h, e, i, c, s, g, o, r, y\}$$

$$A \cap B = \{m, a, t, h, e, i, c, s\} \cap \{g, e, o, m, t, r, y\}$$

$$= \{m, e, t\}$$

$$A - B = \{m, a, t, h, e, i, c, s\} - \{g, e, o, m, t, r, y\}$$

$$= \{a, h, i, c, s\}$$

$$B - A = \{g, e, o, m, t, r, y\} - \{m, a, t, h, e, i, c, s\}$$

$$= \{g, o, r, y\}$$

③ If  $U = \{a, b, c, d, e, f, g, h\}$ ,  $A = \{b, d, f, h\}$  and  $B = \{a, d, e, h\}$ , find the following sets.

(i)  $A'$  (ii)  $B'$  (iii)  $A' \cup B'$  (iv)  $A' \cap B'$  (v)  $(A \cup B)'$   
(vi)  $(A \cap B)'$  (vii)  $(A')'$  (viii)  $(B')'$

$$\Rightarrow \text{(i) } U = \{a, b, c, d, e, f, g, h\}$$
$$\text{and } A = \{b, d, f, h\}$$

$$A' = \{a, c, e, g\}$$

$$\text{(ii) } U = \{a, b, c, d, e, f, g, h\}$$
$$\text{and } B = \{a, d, e, h\}$$

$$B' = \{b, c, f, g\}$$

$$\text{(iii) } A' \cup B' = \{a, c, e, g\} \cup \{b, c, f, g\}$$
$$= \{a, b, c, e, f, g\}$$

$$\text{(iv) } A' \cap B' = \{a, c, e, g\} \cap \{b, c, f, g\}$$
$$= \{c, g\}$$

$$\text{(v) } A \cup B = \{b, d, f, h\} \cup \{a, d, e, h\}$$
$$= \{a, b, d, e, f, h\}$$

$$(A \cup B)' = \{a, b, c, e, f, g\} \cup - (A \cup B)$$
$$= \{c, g\}$$

$$\text{(vi) } A \cap B = \{b, d, f, h\} \cap \{a, d, e, h\}$$
$$= \{d, h\}$$

$$(A \cap B)' = U - (A \cap B) = \{a, b, c, e, f, g\}.$$



$$(vii) (A')'$$

$$= (U - A)'$$

$$= U - (U - A)$$

$$= U - U + A$$

$$= A$$

$$\therefore (A')' = \{b, d, f, h\}$$

$$(viii) (B')'$$

$$= (U - B)'$$

$$= U - (U - B)$$

$$= U - U + B$$

$$= B$$

$$\therefore (B')' = \{a, d, e, h\}$$

④ Let  $U = \{0, 1, 2, 3, 4, 5, 6, 7\}$ ,  $A = \{1, 3, 5, 7\}$  and  $B = \{0, 2, 3, 5, 7\}$ , find the following sets.

(i)  $A'$  (ii)  $B'$  (iii)  $A' \cup B'$  (iv)  $A' \cap B'$  (v)  $(A \cup B)'$

(vi)  $(A \cap B)'$  (vii)  $(A')'$  (viii)  $(B')'$

⇒ (i)  $U = \{0, 1, 2, 3, 4, 5, 6, 7\}$

and  $A = \{1, 3, 5, 7\}$

$$\therefore A' = U - A = \{0, 2, 4, 6\}$$

(ii)  $U = \{0, 1, 2, 3, 4, 5, 6, 7\}$

and  $B = \{0, 2, 3, 5, 7\}$

$$\therefore B' = \{1, 4, 6\}$$

(iii)  $A' \cup B' = \{0, 2, 4, 6\} \cup \{1, 4, 6\}$

$$= \{0, 1, 2, 4, 6\}$$

(iv)  $A' \cap B' = \{0, 2, 4, 6\} \cap \{1, 4, 6\}$

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

(v)  $A \cup B = \{1, 3, 5, 7\} \cup \{0, 2, 3, 5, 7\}$

$$= \{0, 1, 2, 3, 5, 7\}$$

$$\therefore (A \cup B)' = U - (A \cup B) = \{4, 6\}$$

$$\begin{aligned} \text{(vi)} \quad A \cap B &= \{1, 3, 5, 7\} \cap \{0, 2, 3, 5, 7\} \\ &= \{3, 5, 7\} \end{aligned}$$

$$\begin{aligned} (A \cap B)' &= U - (A \cap B) \\ &= \{0, 1, 2, 4, 6\} \end{aligned}$$

$$\begin{aligned} \text{(vii)} \quad (A')' &= (U - A)' \\ &= U - (U - A) \\ &= U - U + A \\ &= A \end{aligned}$$

$$\begin{aligned} \text{(viii)} \quad (B')' &= (U - B)' \\ &= U - (U - B) \\ &= U - U + B \\ &= B \end{aligned}$$

$$\therefore (A')' = \{1, 3, 5, 7\}$$

$$\therefore (B')' = \{0, 2, 3, 5, 7\}$$

⑤ Find the symmetric difference between the following sets.

$$\text{(i)} \quad P = \{2, 3, 5, 7, 11\} \text{ and } Q = \{1, 3, 5, 11\}$$

$$\text{(ii)} \quad R = \{l, m, n, o, p\} \text{ and } S = \{j, l, n, q\}$$

$$\text{(iii)} \quad X = \{5, 6, 7\} \text{ and } Y = \{5, 7, 9, 10\}$$

$$\Rightarrow \text{(i)} \quad \text{Given } P = \{2, 3, 5, 7, 11\} \text{ and } Q = \{1, 3, 5, 11\}$$

$$\begin{aligned} P - Q &= \{2, 3, 5, 7, 11\} - \{1, 3, 5, 11\} \\ &= \{2, 7\} \end{aligned}$$

$$\begin{aligned} Q - P &= \{1, 3, 5, 11\} - \{2, 3, 5, 7, 11\} \\ &= \{1\} \end{aligned}$$

$$\begin{aligned} \text{Now, } P \Delta Q &= (P - Q) \cup (Q - P) \\ &= \{2, 7\} \cup \{1\} \\ &= \{1, 2, 7\} \end{aligned}$$



(ii)

Given that  $R = \{l, m, n, o, p\}$  and  $S = \{j, l, n, q\}$

$$\begin{aligned} \text{Now, } R - S &= \{l, m, n, o, p\} - \{j, l, n, q\} \\ &= \{m, o, p\} \end{aligned}$$

$$\begin{aligned} S - R &= \{j, l, n, q\} - \{l, m, n, o, p\} \\ &= \{j, q\} \end{aligned}$$

$$\begin{aligned} R \Delta S &= (R - S) \cup (S - R) \\ &= \{m, o, p\} \cup \{j, q\} \\ &= \{m, o, p, j, q\} \end{aligned}$$

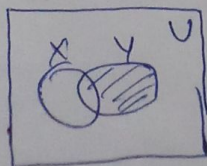
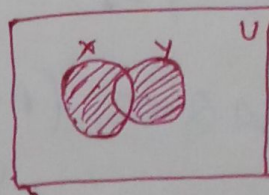
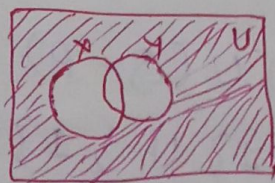
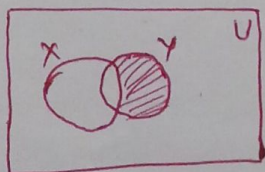
(iii) Given that,  $X = \{5, 6, 7\}$  and  $Y = \{5, 7, 9, 10\}$

$$\begin{aligned} X - Y &= \{5, 6, 7\} - \{5, 7, 9, 10\} \\ &= \{6\} \end{aligned}$$

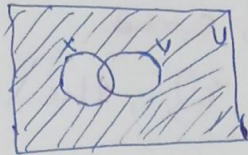
$$\begin{aligned} Y - X &= \{5, 7, 9, 10\} - \{5, 6, 7\} \\ &= \{9, 10\} \end{aligned}$$

$$\begin{aligned} \text{Now, } X \Delta Y &= (X - Y) \cup (Y - X) \\ &= \{6\} \cup \{9, 10\} \\ &= \{6, 9, 10\} \end{aligned}$$

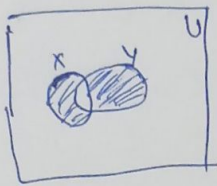
6) Using the Set symbols, write down the expressions for the shaded region in the following.



$Y - X$



$$\Rightarrow U - (X \cup Y) \\ = (\overline{X \cup Y})'$$



$$\Rightarrow (X - Y) \cup (Y - X)$$

7 Let A and B be two overlapping sets and the Universal Set be U. Draw appropriate Venn diagram for each of the following,

(i)  $A \cup B$  (ii)  $A \cap B$  (iii)  $(A \cap B)'$  (iv)  $(B - A)'$

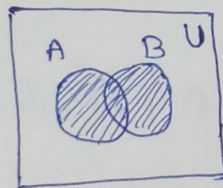
(v)  $A' \cup B'$  (vi)  $A' \cap B'$

(vii) What do you observe from the Venn diagram

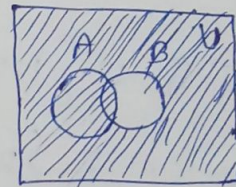
(iii) and (v)?

$\Rightarrow$

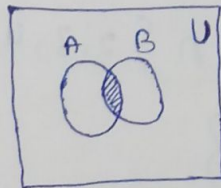
(i)  $A \cup B$



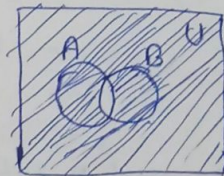
(iv)  $(B - A)'$



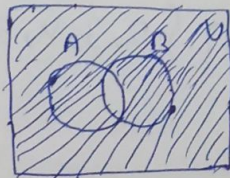
(ii)  $A \cap B$



(v)  $A' \cup B'$



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



(vi)  $A' \cap B'$



(vii)

Now, (iii) and (v) Venn diagram same.

So, ~~(iii) and (v)~~

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