

Exercise 1.4

Q1. Find the union of each of the following pairs of sets:

(i) $X = \{1, 3, 5\}$ $Y = \{1, 2, 3\}$

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

(iii) $A = \{x : x \text{ is a natural number and multiple of } 3\}$
 $B = \{x : x \text{ is a natural number less than } 6\}$

(iv) $A = \{x : x \text{ is a natural number and } 1 < x \leq 6\}$
 $B = \{x : x \text{ is a natural number and } 6 < x < 10\}$

(v) $A = \{1, 2, 3\}$, $B = \phi$

A.1. (i) $X \cup Y = \{1, 3, 5\} \cup \{1, 2, 3\} = \{1, 2, 3, 5\}$.

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

(iii) $A = \{3, 6, 9, 12, \dots\}$

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

So, $A \cup B = \{3, 6, 9, 12, \dots\} \cup \{1, 2, 3, 4, 5\}$

$= \{1, 2, 3, 4, 5, 6, 9, 12, \dots\}$

(iv) $A = \{2, 3, 4, 5, 6\}$

$B = \{7, 8, 9\}$

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

(v) $A \cup B = \{1, 2, 3\} \cup \phi = \{1, 2, 3\}$.

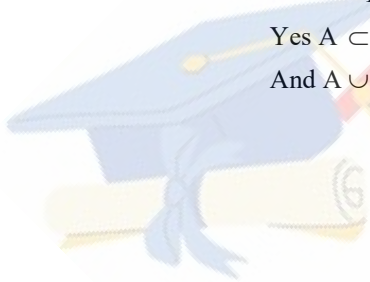
Q2. Let $A = \{a, b\}$, $B = \{a, b, c\}$. Is $A \subset B$? What is $A \cup B$?

A.2. Given, $A = \{a, b\}$

$B = \{a, b, c\}$

Yes $A \subset B$ as $a, b \in A$ and $a, b \in B$.

And $A \cup B = \{a, b\} \cup \{a, b, c\} = \{a, b, c\} = B$



Q3. If A and B are two sets such that $A \subset B$, then what is $A \cup B$?

A.3. If $A \subset B$ then let $a \in A$ and also $a \in B$.

but $b \in B$ and $b \notin A$ i.e, $A = \{a\}$ and $B = \{a, b\}$

So, $A \cup B = \{x : x \in A \text{ or } x \in B\}$

$= \{a, b\}$

$= B$

Q4. If $A = \{1, 2, 3, 4\}$, $B = \{3, 4, 5, 6\}$, $C = \{5, 6, 7, 8\}$ and $D = \{7, 8, 9, 10\}$; find

(i) $A \cup B$ (ii) $A \cup C$ (iii) $B \cup C$ (iv) $B \cup D$

(v) $A \cup B \cup C$ (vi) $A \cup B \cup D$ (vii) $B \cup C \cup D$

A.4. (i) $A \cup B = \{1, 2, 3, 4\} \cup \{3, 4, 5, 6\}$

$= \{1, 2, 3, 4, 5, 6\}$

(ii) $A \cup C = \{1, 2, 3, 4\} \cup \{5, 6, 7, 8\}$

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

(iii) $B \cup C = \{3, 4, 5, 6\} \cup \{5, 6, 7, 8\}$

$= \{3, 4, 5, 6, 7, 8\}$

(iv) $B \cup D = \{3, 4, 5, 6\} \cup \{7, 8, 9, 10\}$

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

(v) $A \cup B \cup C = (A \cup B) \cup C = \{1, 2, 3, 4, 5, 6\} \cup \{5, 6, 7, 8\}$

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

(vi) $A \cup B \cup D = (A \cup B) \cup D = \{1, 2, 3, 4, 5, 6\} \cup \{7, 8, 9, 10\}$

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

(vii) $B \cup C \cup D = (B \cup C) \cup D = \{3, 4, 5, 6, 7, 8\} \cup \{7, 8, 9, 10\}$

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

Q5. Find the intersection of each pair of sets of question 1 above.

A.5. (i) $X \cap Y = \{1, 3, 5\} \cap \{1, 2, 3\} = \{1, 3\}$

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

(iii) $A \cap B = \{3, 6, 9, 12, \dots\} \cap \{1, 2, 3, 4, 5\}$

$= \{3\}$

(iv) $A \cap B = \{2, 3, 4, 5, 6\} \cap \{7, 8, 9\} = \phi$

(v) $A \cap B = \{1, 2, 3\} \cap \phi = \phi$

Q6. If $A = \{3, 5, 7, 9, 11\}$, $B = \{7, 9, 11, 13\}$, $C = \{11, 13, 15\}$ and $D = \{15, 17\}$; find

(i) $A \cap B$ (ii) $B \cap C$ (iii) $A \cap C \cap D$

(iv) $A \cap C$ (v) $B \cap D$ (vi) $A \cap (B \cup C)$

(vii) $A \cap D$ (viii) $A \cap (B \cup D)$ (ix) $(A \cap B) \cap (B \cup C)$

(x) $(A \cup D) \cap (B \cup C)$

A.6. (i) $A \cap B = \{3, 5, 7, 9, 11\} \cap \{7, 9, 11, 13\}$

$= \{7, 9, 11\}$

(ii) $B \cap C = \{7, 9, 11, 13\} \cap \{11, 13, 15\}$

$= \{11, 13\}$

(iii) $A \cap C \cap D = (A \cap C) \cap D$

$= [\{3, 5, 7, 9, 11\} \cap \{11, 13, 15\}] \cap \{15, 17\}$

$= \{11\} \cap \{15, 17\} = \phi$

(iv) $A \cap C = \{3, 5, 7, 9, 11\} \cap \{11, 13, 15\}$

$= \{11\}$

(v) $B \cap D = \{7, 9, 11, 13\} \cap \{15, 17\} = \phi$

- (vi) $A \cap (B \cup C) = \{3,5,7,9,11\} \cap [\{7,9,11,13\} \cup \{11,13,15\}]$
 $= \{3,5,7,9,11\} \cap \{7,9,11,13,15\}$
 $= \{7,9,11\}$
- (vii) $A \cap D = \{3,5,7,9,11\} \cap \{15,17\} = \phi$
- (viii) $A \cap (B \cup D) = \{3,5,7,9,11\} \cap [\{7,9,11,13\} \cup \{15,17\}]$
 $= \{3,5,7,9,11\} \cap \{7,9,11,13,15,17\}$
 $= \{7,9,11\}$
- (ix) $(A \cap B) \cap (B \cup C) = [\{3,5,7,9,11\} \cap \{7,9,11,13\}] \cap [\{7,9,11,13\} \cup \{11,13,15\}]$
 $= \{7,9,11\} \cap \{7,9,11,13,15\}$
 $= \{7,9,11\}$
- (x) $(A \cup D) \cap (B \cup C) = [\{3,5,7,9,11\} \cup \{15,17\}] \cap [\{7,9,11,13\} \cup \{11,13,15\}]$
 $= \{3,5,7,9,11,15,17\} \cap \{7,9,11,13,15\}$
 $= \{7,9,11,15\}$

Q7. If $A = \{x : x \text{ is a natural number}\}$, $B = \{x : x \text{ is an even natural number}\}$
 $C = \{x : x \text{ is an odd natural number}\}$ and $D = \{x : x \text{ is a prime number}\}$, find

- (i) $A \cap B$ (ii) $A \cap C$ (iii) $A \cap D$
 (iv) $B \cap C$ (v) $B \cap D$ (vi) $C \cap D$

A.7. $A = \{1,2,3,4,5, 6, \dots\}$

$$B = \{2,4,6, \dots\}$$

$$C = \{1,3,5, \dots\}$$

$$D = \{2,3,5, \dots\}$$

- (i) $A \cap B = \{1,2,3,4 \dots\} \cap \{2,4,6, \dots\} = \{2,4,6 \dots\} = B$
 (ii) $A \cap C = \{1,2,3,4, \dots\} \cap \{1,3,5 \dots\} = \{1,3,5, \dots\} = C$
 (iii) $B \cap C = \{2,4,6, \dots\} \cap \{1,3,5, \dots\} = \phi$
 (iv) $B \cap D = \{2,4,6 \dots\} \cap \{2,3,5 \dots\} = \{2\}$
 (v) $C \cap D = \{1,3,5, \dots\} \cap \{2,3,5 \dots\} = \{3,5,7 \dots\} = \{x : x \text{ is odd prime number}\}$

Q.8. Which of the following pairs of sets are disjoint

- (i) $\{1, 2, 3, 4\}$ and $\{x : x \text{ is a natural number and } 4 \leq x \leq 6\}$
 (ii) $\{a, e, i, o, u\}$ and $\{c, d, e, f\}$
 (iii) $\{x : x \text{ is an even integer}\}$ and $\{x : x \text{ is an odd integer}\}$

A.8. (i) $\{1,2,3,4\} \cap \{x : x \text{ is a natural number and } 4 \leq x \leq 6\}$

$$\{1, 2, 3, 4\} \cap \{4, 5, 6\}$$

$$\{4\} \neq \phi$$

Hence, the given pair of set is not disjoint.

(ii) $\{a, e, i, o, u\} \cap \{c, d, e, f\}$

$$\{e\} \neq \phi$$

Hence, the given pair of set is not disjoint.

(iii) $\{x : x \text{ is an even integer}\} \cap \{x : x \text{ is are odd integer}\}$

$$= \phi$$

As there is no integer which is both even and odd at the same time.

\therefore Given pair of set are disjoint.

Q9. If $A = \{3, 6, 9, 12, 15, 18, 21\}$, $B = \{4, 8, 12, 16, 20\}$,
 $C = \{2, 4, 6, 8, 10, 12, 14, 16\}$, $D = \{5, 10, 15, 20\}$; find

- (i) $A - B$ (ii) $A - C$ (iii) $A - D$ (iv) $B - A$
 (v) $C - A$ (vi) $D - A$ (vii) $B - C$ (viii) $B - D$
 (ix) $C - B$ (x) $D - B$ (xi) $C - D$ (xii) $D - C$

A.9. (i) $A - B = \{3,6,9,12,15,18,21\} - \{4,8,12,16,20\}$

- $$= \{3, 6, 9, 15, 18, 21\}$$
- (ii) $A - C = \{3, 6, 9, 12, 15, 18, 21\} - \{2, 4, 6, 8, 10, 12, 14, 16\}$
 $= \{3, 9, 15, 18, 21\}$
- (iii) $A - D = \{3, 6, 9, 12, 15, 18, 21\} - \{5, 10, 15, 20\}$
 $= \{3, 6, 9, 12, 18, 21\}$
- (iv) $B - A = \{4, 8, 12, 16, 20\} - \{3, 6, 9, 12, 15, 18, 21\}$
 $= \{4, 8, 16, 20\}$
- (v) $C - A = \{2, 4, 6, 8, 10, 12, 14, 16\} - \{3, 6, 9, 12, 15, 18, 21\}$
 $= \{2, 4, 8, 10, 14, 16\}$
- (vi) $D - A = \{5, 10, 15, 20\} - \{3, 6, 9, 12, 15, 18, 21\}$
 $= \{5, 10, 20\}$
- (vii) $B - C = \{4, 8, 12, 16, 20\} - \{2, 4, 6, 8, 10, 12, 14, 16\}$
 $= \{20\}$
- (viii) $B - D = \{4, 8, 12, 16, 20\} - \{5, 10, 15, 20\}$
 $= \{4, 8, 12, 16\}$
- (ix) $C - B = \{2, 4, 6, 8, 10, 12, 14, 16\} - \{4, 8, 12, 16, 20\}$
 $= \{2, 6, 10, 14\}$
- (x) $D - B = \{5, 10, 15, 20\} - \{4, 8, 12, 16, 20\}$
 $= \{5, 10, 15\}$
- (xi) $C - D = \{2, 4, 6, 8, 10, 12, 14, 16\} - \{5, 10, 15, 20\}$
 $= \{2, 4, 6, 8, 12, 14, 16\}$
- (xii) $D - C = \{5, 10, 15, 20\} - \{2, 4, 6, 8, 10, 12, 14, 16\}$
 $= \{5, 15, 20\}$

Q10. If $X = \{a, b, c, d\}$ and $Y = \{f, b, d, g\}$, find

- (i) $X - Y$ (ii) $Y - X$ (iii) $X \cap Y$
- A.10.** (i) $X - Y = \{a, b, c, d\} - \{f, b, d, g\}$
 $= \{a, c\}$
- (ii) $Y - X = \{f, b, d, g\} - \{a, b, c, d\}$
 $= \{f, g\}$
- (iii) $X \cap Y = \{a, b, c, d\} \cap \{f, b, d, g\}$
 $= \{b, d\}$

Q11. If R is the set of real numbers and Q is the set of rational numbers, then what is $R - Q$?

A.11. $R - Q = \{x: x \text{ is a real number but not rational number}\}$
 $= \{x: x \text{ is an irrational number}\}$

Since real number = rational number + irrational number

Q12. State whether each of the following statement is true or false. Justify your answer.

- (i) $\{2, 3, 4, 5\}$ and $\{3, 6\}$ are disjoint sets.
- (ii) $\{a, e, i, o, u\}$ and $\{a, b, c, d\}$ are disjoint sets.
- (iii) $\{2, 6, 10, 14\}$ and $\{3, 7, 11, 15\}$ are disjoint sets.
- (iv) $\{2, 6, 10\}$ and $\{3, 7, 11\}$ are disjoint sets.
- A.12.** (i) False, as $\{2, 3, 4, 5\} \cap \{3, 6\} = \{3\} \neq \phi$. Hence sets are not disjoint.
- (ii) False as $\{a, e, i, o, u\} \cap \{a, b, c, d\} = \{a\} \neq \phi$. Hence sets are not disjoint.
- (iii) True as $\{2, 6, 10, 14\} \cap \{3, 7, 11, 15\} = \phi$. Hence sets are disjoint.
- (iv) True as $\{2, 6, 10\} \cap \{3, 7, 11\} = \phi$. Hence sets are disjoint.