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- (ii) $A \cap C = \{1, 2, 3, 4, \dots\} \cap \{1, 3, 5, 7, \dots\}$
 $= \{1, 3, 5, 7, \dots\} = C$
- (iii) $A \cap D = \{1, 2, 3, 4, \dots\} \cap \{2, 3, 5, 7, 11, 13, \dots\}$
 $= \{2, 3, 5, 7, 11, 13, \dots\} = D$
- (iv) $B \cap C = \{2, 4, 6, 8, \dots\} \cap \{1, 3, 5, 7, \dots\}$
 $= \phi$
- (v) $B \cap D = \{2, 4, 6, 8, \dots\} \cap \{2, 3, 5, 7, 11, 13, \dots\}$
 $= \{2\}$
- (vi) $C \cap D = \{1, 3, 5, 7, \dots\} \cap \{2, 3, 5, 7, 11, 13, \dots\}$
 $= \{3, 5, 7, 11, 17, 19, \dots\}$
 $= \{x : x \text{ is an odd prime number}\}$

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 $\{x : x \text{ is an odd integer}\}$.

Sol. (i) $\{1, 2, 3, 4\}$ and $\{x : x \text{ is a natural number and } 4 \leq x \leq 6\}$
 i.e., $\{4, 5, 6\}$ are **not disjoint** sets as they have 4 as a common element.

(ii) $\{a, e, i, o, u\}$ and $\{c, d, e, f\}$ are **not disjoint** sets because they have common element e .

(iii) $\{x : x \text{ is an even integer}\}$ and $\{x : x \text{ is an odd integer}\}$ are **disjoint sets** because they have no common element.

9. Let $A = \{3, 6, 9, 12, 15, 18, 21\}$, $B = \{4, 8, 12, 16, 20\}$, $C = \{2, 4, 6, 8, 10, 12, 14, 16\}$ and $D = \{5, 10, 15, 20\}$. 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) $D - C$ |

Sol. (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) $C - A = \{2, 4, 6, 8, 10, 12, 14, 16\} - \{3, 6, 9, 12, 15, 18, 21\}$
 $= \{2, 4, 8, 10, 14, 16\}$

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STUDY MATERIAL BASED ON

- (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) $D - C = \{5, 10, 15, 20\} - \{2, 4, 6, 8, 10, 12, 14, 16\}$
 $= \{5, 15, 20\}$.

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

(i) $X - Y$

Sol. (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) $X \cap Y = \{a, b, c, d\} \cap \{f, b, d, g\} = \{b, d\}$.

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

Sol. Since set of real numbers contains the set of rational numbers and the set of irrational numbers, therefore $R - Q =$ the set of irrational numbers.

12. 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.

Sol. (i) False, $A \cap B = \{2, 3, 4, 5\} \cap \{3, 6\} = \{3\} \neq \phi$

\therefore The given sets are not disjoint.

(ii) False, because $\{a, e, i, o, u\} \cap \{a, b, c, d\} = \{a\} \neq \phi$

(iii) True, because $\{2, 6, 10, 14\} \cap \{3, 7, 11, 15\} = \phi$

(iv) True, because $\{2, 6, 10\} \cap \{3, 7, 11\} = \phi$.

EXEMPLAR PROBLEMS

1. Given $L = \{1, 2, 3, 4\}$, $M = \{3, 4, 5, 6\}$ and $N = \{1, 3, 5\}$
 Verify that $L - (M \cup N) = (L - M) \cap (L - N)$.

Sol. $L = \{1, 2, 3, 4\}$, $M = \{3, 4, 5, 6\}$, $N = \{1, 3, 5\}$