

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

(i) $A = \{x : x \in \mathbb{N}, 2 \leq x \leq 7\}$, $B = \{x : x \in \mathbb{N}, 5 \leq x \leq 10\}$

(ii) $A = \{a, b, c, d\}$, $B = \{c, d, e\}$

(iii) $A = \{4, 5, 6, 7\}$, $B = \phi$

(iv) $A = \{x : x \in \mathbb{N}, -1 < x \leq 4\}$, $B = \{x : x \in \mathbb{N}, 2 \leq x < 6\}$

2. Find the intersection of each of the following pairs of sets:

(i) $A = \{2, 4, 6, 8\}$, $B = \{6, 8, 10, 12\}$

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

(iii) $A = \{x : x \in \mathbb{N}, 5 \leq x \leq 10\}$, $B = \{x : x \in \mathbb{N}, 15 \leq x \leq 20\}$

(iv) $A = \{x : x \in \mathbb{N}, 2 < x \leq 7\}$, $B = \{x : x \in \mathbb{N}, 4 \leq x < 9\}$

3. If $A = \{a, b, c, d\}$ and $B = \{a, b, e, f\}$, find

(i) $A - B$

(ii) $B - A$

(iii) $A \cap B$

(iv) $A \Delta B$

4. Let $U = \{a, i, o, u, e\}$, $A = \{a, i, e\}$, $B = \{o, u, e\}$, $C = \{a, e, i\}$. Verify that

(i) $A \cup U = U$

(ii) $A \cap U = A$

(iii) $A \cap \phi = \phi$

(iv) $A \cup \phi = A$

(v) $A - (B \cup C) = (A - B) \cap (A - C)$

(vi) $A - (B \cap C) = (A - B) \cup (A - C)$

(vii) $A \cap (B - C) = (A \cap B) - (A \cap C)$

5. Let $A = \{1, 3, 5, 7, 9\}$, $B = \{2, 4, 6, 8, 10\}$, $C = \{2, 3, 4, 5\}$. Find.

(i) $A - (B \cup C)$

(ii) $A - (B \cap C)$

(iii) $A \cap (B - C)$

(iv) $B - (A - C)$

6. Let $A = \{1, 2, 3, 4, 5, 6\}$, $B = \{2, 3, 7, 9\}$, $C = \{2, 4, 6, 8\}$. Verify that

(i) $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$

(ii) $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$

(iii) $(A \cup B) \cup C = A \cup (B \cup C)$


(iv) $(A \cap B) \cap C = A \cap (B \cap C)$

7. Prove the following:

(i) $A - (B - C) = (A - B) \cup (A \cap C)$

(ii) $A - (B \cup C) = (A - B) \cap (A - C)$

(iii) $(A - B) \cap C = (A \cap C) - B$

[ **Hint:** Use Venn Diagrams to prove.]


8. Prove the following:

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

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

[ **Hint:** (i) $A \cup (A \cap B) = (A \cup A) \cap (A \cup B) = A \cap (A \cup B) = A$]

9. If A and B are sets, then prove that $A - B$, $B - A$ and $A \cap B$ are pairwise disjoint.

[ **Hint:** Here $A - B = \{x : x \in A \text{ and } x \notin B\}$ $B - A = \{x : x \in B \text{ and } x \notin A\}$

This shows that $A - B$ and $B - A$ are disjoint

Now $x \in A - B \Rightarrow x \in A \text{ and } x \notin B \Rightarrow x \notin A \cap B$

This shows that $A - B$ and $A \cap B$ are disjoint

Also $x \in B - A \Rightarrow x \in B \text{ and } x \notin A \Rightarrow x \notin A \cap B$

This shows that $B - A$ and $A \cap B$ are disjoint.]

Answers

1. (i) $\{2, 3, 4, 5, 6, 7, 8, 9, 10\}$ (ii) $\{a, b, c, d, e\}$ (iii) $\{4, 5, 6, 7\}$ (iv) $\{1, 2, 3, 4, 5\}$

2. (i) $\{6, 8\}$ (ii) $\{1\}$ (iii) ϕ (iv) $\{4, 5, 6, 7\}$

3. (i) $\{c, d\}$ (ii) $\{e, f\}$ (iii) $\{a, b\}$ (iv) $\{c, d, e, f\}$

5. (i) $\{1, 7, 9\}$ (ii) $\{1, 3, 5, 7, 9\}$ (iii) ϕ (iv) $\{2, 4, 6, 8, 10\}$