Set Operations: Examples & Problems

Set Operations

Set operations are fundamental concepts in mathematics, used to handle collections of objects. The primary set operations include Union, Intersection, Difference, and Complement.

1. Union (∪)

The union of two sets A and B is the set containing all elements from both sets. If an element is in A or B (or both), it is in $A \cup B$.
Example:
$A = \{1, 2, 3\}$
$B = \{3, 4, 5\}$
$A \cup B = \{1, 2, 3, 4, 5\}$

2. Intersection (∩)

The intersection of two sets A and B is the set containing only the elements that are in both sets.
Example:
$A = \{1, 2, 3\}$
$B = \{3, 4, 5\}$
$A \cap B = \{3\}$

3. Difference (−)

The difference of sets A and B (also known as the relative complement of B in A) is the set containing elements that are in A but not in B.
Example:
$A = \{1, 2, 3\}$
$B = \{3, 4, 5\}$
$A - B = \{1, 2\}$
$B - A = \{4, 5\}$

4. Complement (A')

The complement of a set A contains all the elements that are not in A, typically in relation to a universal set U.
Example:
If the universal set $U = \{1, 2, 3, 4, 5, 6\}$ and $A = \{1, 2, 3\}$, then the complement of A is:
$A' = \{4, 5, 6\}$

Problems

1. Let $A = \{1, 2, 4, 5\}$ and $B = \{2, 3, 5, 7\}$. Find $A \cup B$.
2. Let $A = \{a, b, c, d\}$ and $B = \{c, d, e, f\}$. Find $A \cap B$.
3. Let $A = \{2, 4, 6, 8\}$ and $B = \{1, 2, 3, 4\}$. Find $A - B$.
4. If the universal set $U = \{1, 2, 3, 4, 5\}$ and $A = \{2, 3\}$, find A'.
5. Given sets $A = \{1, 3, 5, 7\}$ and $B = \{3, 6, 9\}$, find $A \cap B$.
6. Let $A = \{x \mid x \text{ is a vowel in the English alphabet}\}$ and $B = \{x \mid x \text{ is a letter in the word 'TEA'}\}$. Find $A \cup B$.
7. If $A = \{1, 2, 3, 4\}$, $B = \{3, 4, 5, 6\}$, and $C = \{1, 6\}$, find $(A \cup B) \cap C$.
8. Let $A = \{a, e, i, o, u\}$ and $B = \{a, b, c\}$. Find $A - B$.
9. If the universal set $U = \{1, 2, 3, 4, 5, 6\}$, $A = \{2, 4, 6\}$, and $B = \{1, 2, 3\}$, find $(A \cup B)'$.
10. Given $A = \{1, 3, 5, 7\}$ and $B = \{2, 3, 6, 7\}$, find $A \cup B$ and $A \cap B$.

Key

1. $A \cup B = \{1, 2, 3, 4, 5, 7\}$
2. $A \cap B = \{c, d\}$
3. $A - B = \{4, 6, 8\}$
4. $A' = \{1, 4, 5\}$
5. $A \cap B = \{3\}$
6. $A \cup B = \{a, e, i, o, u, t\}$
7. $(A \cup B) \cap C = \{1, 6\}$
8. $A - B = \{e, i, o, u\}$
9. $(A \cup B)' = \{5\}$
10. $A \cup B = \{1, 2, 3, 5, 6, 7\}$ and $A \cap B = \{3, 7\}$