Algebra of Set Operations

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Not an Element

Proposition 1 (:B$_{\text{proposition}}$:)

Let A and B be sets and let x be any object. Then:

1. $x \notin A \cup B$ iff $x \notin A$ and $x \notin B$.
2. $x \notin A \cap B$ iff $x \notin A$ or $x \notin B$.
3. $x \notin A \backslash B$ iff $x \notin A$ or $x \in B$.

De Morgan's Laws for Sets

Theorem 1 (De Morgan's Laws for Sets)

Let S, A, and B be sets. Then:

1. $S \backslash (A \cup B) = (S \backslash A) \cap (S \backslash B)$.
2. $S \backslash (A \cap B) = (S \backslash A) \cup (S \backslash B)$.

Distributive Laws for Unions and Intersections

Theorem 2 (Distributive Laws for Unions and Intersections)

Let S, A, and B be sets. Then:

1. $S \cap (A \cup B) = (S \cap A) \cup (S \cap B)$.
2. $S \cup (A \cap B) = (S \cup A) \cap (S \cup B)$.

Associative Laws for Unions and Intersections

Proposition 2 (Associative Laws for Unions and Intersections)

Let A, B, and C be sets. Then:

1. $(A \cup B) \cup C = A \cup (B \cup C)$
2. $(A \cap B) \cap C = A \cap (B \cap C)$

Commutative Laws for Unions and Intersections

Proposition 3 (Commutative Laws for Unions and Intersections)

Let A and B be sets. Then:

1. $A \cup B = B \cup A$
2. $A \cap B = B \cap A$