

1. What does " \subseteq " mean?

2. What does " \subset " mean?

Fill in the blanks.

3. $\{B, A, D\} \subseteq \{B, C, D, F\}$

4. $\{B, C, D\} \subseteq \{B, C, D\}$

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Section 2-3

Set Operations

\cup \cap

This slide features a decorative header with red and green horizontal lines and a central title 'Section 2-3' in purple. Below the title, the text 'Set Operations' is displayed in purple, followed by the symbols for union (\cup) and intersection (\cap) in red. A small red and white icon is located in the bottom right corner.

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Intersection of Sets

The _____ of sets A and B , written $A \cap B$, is the set of elements common to both A and B , or where there is overlap.

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Intersections

Find each intersection.

a) $\{1, 3, 5, 7, 9\} \cap \{1, 2, 3, 4, 5, 6\}$

b) $\{2, 4, 6\} \cap \emptyset$

Solution

a) $\{1, 3, 5\}$

b) \emptyset

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Union of Sets

The **union** of sets A and B , written $A \cup B$, is the set of elements belonging to either of the sets, or throwing every element into one big set.

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Unions

Find each union.

a) $\{1, 3, 5, 7, 9\} \cup \{1, 2, 3, 4, 5, 6\}$

b) $\{2, 4, 6\} \cup \emptyset$

Solution

a) $\{1, 2, 3, 4, 5, 6, 7, 9\}$

b) $\{2, 4, 6\}$

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Difference of Sets

The **difference** of sets A and B , written $A - B$, is the set of elements belonging to set A and not to set B . This is not the complement, complements are compared to a universal set.

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

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

$$B = \{2, 3, 6\}$$

$$C = \{3, 5, 7\}$$

- A) Find $A', B', C', A \cup B, A \cap B, A - B, B \cup C, B \cap C, A \cup B \cup C, A \cap B \cap C$
B) T or F: $A \subset U$
C) T or F: $B \subset A$
D) T or F: $B \subset C$

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Ordered Pairs

In the **ordered pair** (a, b) , a is called the **first component** and b is called the **second component**. In general $(a, b) \neq (b, a)$.

Two ordered pairs are **equal** provided $a = b$.

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Cartesian Product of Sets

The **Cartesian product** of sets A and B can be written, $A \times B$, which represents all possible sets of coordinates (A, B) .

$$A = \{1, 5, 8, 12, 13\}$$

$$B = \{1, 4, 11, 15\}$$

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Example: Finding Cartesian Products

Let $A = \{a, b\}$, $B = \{1, 2, 3\}$

Find each set.

- a) $A \times B$
b) $B \times B$

Solution

- a) $\{(a, 1), (a, 2), (a, 3), (b, 1), (b, 2), (b, 3)\}$
b) $\{(1, 1), (1, 2), (1, 3), (2, 1), (2, 2), (2, 3), (3, 1), (3, 2), (3, 3)\}$

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Cardinal Number of a Cartesian Product

If $K(A) = a$ and $K(B) = b$, then the number of possible coordinates is $ab = ba$.

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Example: Finding Cardinal Numbers of Cartesian Products

If $K(A) = 12$ and $K(B) = 7$, then find $n(A \times B)$ and $n(B \times A)$.

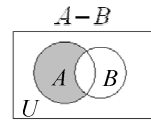
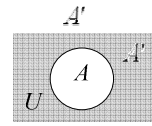
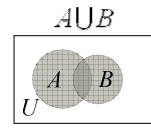
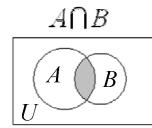
Solution

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Venn Diagrams of Set Operations



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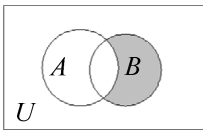
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Example: Shading Venn Diagrams to Represent Sets

Draw a Venn Diagram to represent the set $A' \cap B$.

Solution



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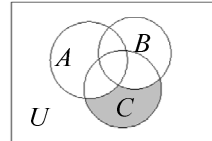
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Example: Shading Venn Diagrams to Represent Sets

Draw a Venn Diagram to represent the set $(A' \cap B') \cap C$.

Solution



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De Morgan's Laws

For any sets A and B ,

$$(A \cap B)' = A' \cup B' \text{ and } (A \cup B)' = A' \cap B'$$

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