1. What does "$\subseteq$" mean?

2. What does "$\subset$" mean?

Fill in the blanks.

3. {B, A, D} {B, C, D, F}

4. {B, C, D} {B, C, D}

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Section 2-3

Set Operations

$\cup$ $\cap$

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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) $\{2, 4, 6\} \cap \varnothing$

Solution

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

b) $\varnothing$

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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) $\{2, 4, 6\} \cup \varnothing$

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.

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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 ∪B, A∩B, A−B, B∪C, B∩C, A∪B∪C, A∩B∩C
B) T or F: A⊂U
C) T or F: B⊂A
D) T or F: B⊂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 coordiantes (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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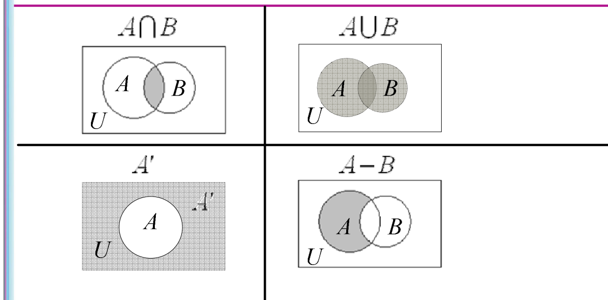
Venn Diagrams of Set Operations



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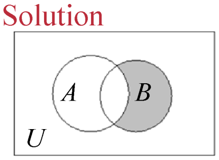
Example: Shading Venn Diagrams to Represent Sets

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

Solution



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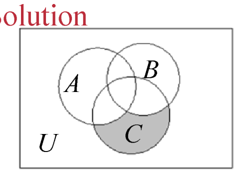
Example: Shading Venn Diagrams to Represent Sets

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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