Apply Set Theory

TEKS *a.1, a.2*

GOAL Define the concepts of sets, operations on sets, and subsets.

Key Vocabulary
- **set**
- **union**
- **intersection**
- **complement**
- **subset**

A **set** is a collection of distinct objects. Each object in a set is called an **element** or **member** of the set. A set is denoted by enclosing its elements in braces. For example, if A is the set of positive integers less than 5, then $A = \{1, 2, 3, 4\}$.

There are two special sets that are often used. The set with no elements is called the **empty set** and is denoted by $\varnothing$. The set of all elements under consideration is called the **universal set** and is denoted by U.
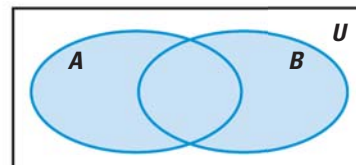

KEY CONCEPT   *For Your Notebook*
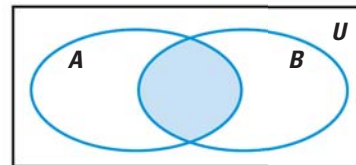
Operations on Sets

The **union** of two sets A and B is written as $A \cup B$ and is the set of all elements in *either A or B*.
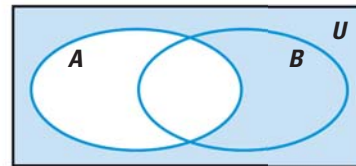
$A \cup B$

The **intersection** of two sets A and B is written as $A \cap B$ and is the set of all elements in *both A and B*.

$A \cap B$

The **complement** of a set A is written as $\overline{A}$ and is the set of all elements in the universal set U that are *not* in A.

$\overline{A}$

EXAMPLE 1   **Perform operations on sets**

Let U be the set of all integers from 1 to 10. Let $A = \{1, 2, 4, 8\}$ and let $B = \{2, 4, 6, 8, 10\}$. Find the indicated set.

  a. $A \cup B$ **b.** $A \cap B$ **c.** $\overline{A}$ **d.** $\overline{A \cup B}$

Solution

  a. $A \cup B = \{1, 2, 4, 8\} \cup \{2, 4, 6, 8, 10\} = \{1, 2, 4, 6, 8, 10\}$

  b. $A \cap B = \{1, 2, 4, 8\} \cap \{2, 4, 6, 8, 10\} = \{2, 4, 8\}$

  c. $\overline{A} = \overline{\{1, 2, 4, 8\}} = \{3, 5, 6, 7, 9, 10\}$

  d. $\overline{A \cup B} = \overline{\{1, 2, 4, 8\} \cup \{2, 4, 6, 8, 10\}} = \overline{\{1, 2, 4, 6, 8, 10\}} = \{3, 5, 7, 9\}$