Math 150

Section 8.1 Sets

A set is a collection of objects. The objects of a set are called elements and we use curly brackets to denote a set.

The empty set, or null set, is the set with no elements.

The universal set is a set that contains all of the objects being discussed.

Two sets are equal if they contain exactly the same elements (ordering doesn't matter in sets).

A set A is a subset of a set B (written $A \subseteq B$) provided that every element of A is also an element of B.

Example 1 For the given sets, decide whether each statement is true or false.

$$A = \{1, 2, 3, 4, 5\}, \quad B = \{1, \{2\}, 3\}, \quad C = \{1, 2, 3\}, \quad D = \{2, 4, 6\}$$

- $1 \in A$
- $1 \subseteq A$
- $D \subseteq A$
- $C \subseteq A$
- $\{2\} \subseteq B$
- $\emptyset \subseteq B$
- $C \subseteq C$
- $C \in A$
- $\{\emptyset\} \subseteq D$

Example 2 List all the possible subsets for each given set.

$$A = \{\triangle, \square\}, \quad B = \{2, 4, 5\}$$

A set of n distinct elements has 2^n subsets.

For any set A,

$$\emptyset \subseteq A \text{ and } A \subseteq A.$$

A set A is said to be a proper subset of a set B (written $A \subset B$) if every element of A is an element of B, but B contains at least one element that is not a member of A.

Operations on Sets

Given a set A and a universal set U, the set of all elements of U that do not belong to A is called the complement of A.

Notation $A' = \{x | x \notin A\}$

Given two sets A and B, the set of all elements belonging to both set A and set B is called the intersection of the two sets.

Notation $A \cap B = \{x | x \in A \text{ and } x \in B\}$

The set of all elements belonging to set A or to set B, or to both sets, is called the union of the two sets.

Notation $A \cup B = \{x | x \in A \text{ or } x \in B\}$

Example 3 Let $A = \{1, 2, 3, 4, 5\}$, $B = \{2, 4, 6, 8\}$, and $U = \mathbb{N}$. Find the following

- A'
- $A \cap B$
- $A \cup B$

Example 4 Let $U = \{x | x \text{ is a student at Winthrop }\}$, $A = \{$ students in Math 150 $\}$, and $B = \{$ students in some math class $\}$. Find the following

- B'
- $A \cap B$
- $A \cap B'$
- $A \cup B$
- $A \cap A'$

For any sets A and B, A and B are disjoint if $A \cap B = \emptyset$.