# **Section 1.5.** Set Operations

**Note.** In this section we define the familiar set operations of union, intersection, and complement.

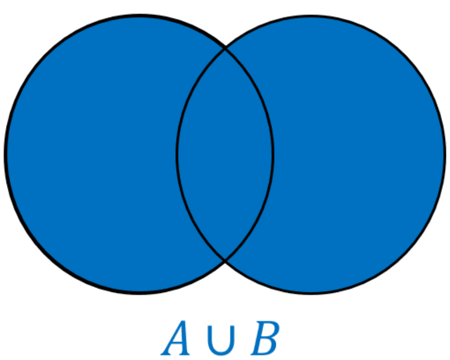
**Definition 1.5.1.** Let $A$ and $B$ be sets. The *union* of $A$ and $B$, denoted $A \cup B$, is the set that contains all elements that are either in $A$ or in $B$ (or both).

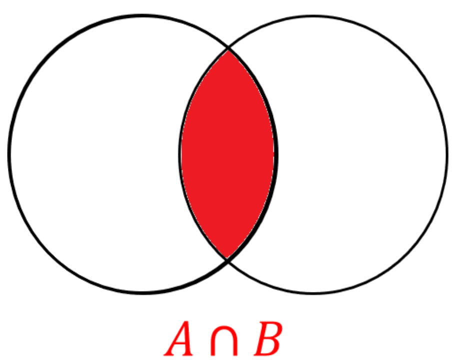
**Definition 1.5.2.** Let $A$ and $B$ be sets. The *intersection* of $A$ and $B$, denoted $A \cap B$, is the set of all elements that are in both $A$ and $B$.

**Note.** Is set builder notation

$$A \cup B = \{x \mid x \in A \vee x \in B\}$$

$$A \cap B = \{x \mid x \in A \wedge x \in B\}.$$



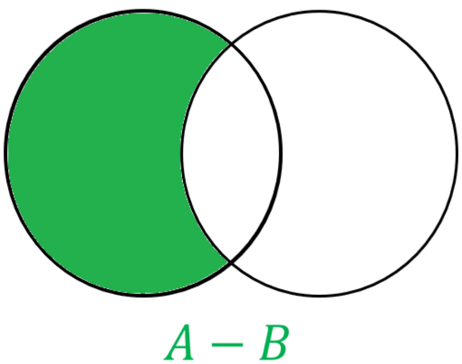




**Definition 1.5.3.** Two sets are *disjoint* if their intersection is empty.

**Note.** In general, for finite sets, $|A \cup B| = |A| + |B| - |A \cap B|$. If $A$ and $B$ are disjoint, $|A \cup B| = |A| + |B|$.

**Definition 1.5.4.** Let $A$ and $B$ be sets. The *difference* of $A$ and $B$, denoted $A - B$ (or often $A \setminus B$), is the set of all elements in $A$ that are not in $B$. $A - B$ is also called the *complement of $B$ with respect to $A$*.

**Note.** $A - B = \{x \mid x \in A \wedge x \notin B\}$. The Venn diagram for $A - B$ is:




**Definition 1.5.5.** Let $U$ be the universal set. The *complement* of $A$, denoted $\overline{A}$, is $U - A$.

**Note.** $\overline{A} = \{x \mid x \in U \wedge x \notin A\}$.

**Example.** Page 49 Number 10. Show $\overline{A \cap B} = \overline{A} \cup \overline{B}$. HINT: Show each is a subset of the other.

**Note.** On page 50, the text presents "membership tables" to prove set identities. This method is identical to the method of truth tables with propositions.

**Definition 1.5.6.** The *union* of a collection of sets is the set that contains those elements that are members of at least one set in the collection.

**Definition 1.5.7.** The *intersection* of a collection of sets is the set that contains the elements that are members of all the sets in the collection.

**Examples.** Page 55 Number 38, and Page 54 Numbers 12e, 36, and 34.

*Revised: 4/1/2019*