2.3

Venn Diagrams and Set Operations
Venn Diagrams

- A Venn diagram is a technique used for picturing set relationships.
- A rectangle usually represents the universal set, $U$.
  - The items inside the rectangle are divided into subsets of $U$ and are represented by circles.
Disjoint Sets

- Two sets which have *no* elements in common are said to be *disjoint*.
- The intersection of disjoint sets is the empty set.
- Disjoint sets $A$ and $B$ are drawn in this figure. There are no elements in common since there is no overlapping area of the two circles.
Overlapping Sets

For sets $A$ and $B$ drawn in this figure, notice the overlapping area shared by the two circles.

This section represents the elements are in the intersection of set $A$ and set $B$.

See Example 2, page 58 in the textbook
Complement of a Set

- The set known as the complement contains all the elements of the universal set, which are not listed in the given subset.

- Symbol: $A'$

- See Examples 3,4,5 in p. 59-60 of the textbook
Intersection

- The intersection of two given sets contains only those elements common to those sets.

- Symbol: $A \cap B$

- The word “and” is used for intersection of sets. For example $\{1,2,3\}$ and $\{3,4\}$ is the set $\{3\}$ since 3 is the only number common to both sets.

- The word “and” has a different meaning in math than it does in everyday English.

- See Examples 3,4,5 in p. 59-60 of the textbook
Union

- The union of two given sets contains all of the elements for those sets.
- The union “unites” that is, it brings together everything into one set.
- The word “or” is used for union of sets. For example \{1,2,3\} or \{3,4\} is the set \{1,2,3,4\} since that is the union of the two sets.

- Symbol: \( A \cup B \)
- See Examples 3,4,5 in p. 59-60 of the textbook
Subsets

- When $B \subseteq A$, every element of $B$ is also an element of $A$.
- Circle $B$ is completely inside circle $A$. 

Diagram: 
- $U$
- $A$
- $B$
Equal Sets

- When set $A$ is equal to set $B$, all the elements of $A$ are elements of $B$, and all the elements of $B$ are elements of $A$.
- Both sets are drawn as one circle.
Number of elements in a union of sets

Let A and B be two sets with a finite number of elements each. Then

\[ n(A \cup B) = n(A) + n(B) - n(A \cap B) \]

We need the minus sign since we want to subtract the number of elements which appear in both A and B.

Study Example 7 in page 61
Next Steps

- Study Examples 1-7 in Section 2.3
- Work problems 15, 16; 21-26, all; 33-40, all; 49-57, odds from the textbook, p. 62
- Do online homework
- Do online quiz 2.1-2.3