Math 141 Key Topics: 6.1-6.4

Section 6.1

- A **set** is just a collection of objects. The objects of a set are called the **elements** of the set. If an element a is in a set A, we say $a \in A$.
- **Roster notation** is where a set is written by just listing the elements of the set.
- **Set-builder notation** is where a set is written by giving a rule or property that describes all the elements in the set.
- Two sets A and B are equal ($A = B$) if they have exactly the same elements.
- A set A is a **subset** of a set B ($A \subseteq B$) if every element of A is also in B.
- A is a **proper subset** of B ($A \subset B$) if A is a strictly smaller subset of B. In other words, A is a subset of B but is not equal to B.
- The **empty set**, $\emptyset$, is the set with no elements. $\emptyset$ is a subset of every set.
- A **universal set** is the set of elements of interest in a particular problem.
- The **union** of two sets A and B ($A \cup B$) is the set that consists of the elements in A OR B OR both.
- The **intersection** of two sets A and B ($A \cap B$) is the set that consists of the elements that are in BOTH A AND B. (What these sets have in common.)
- The **complement** of a set A, (A^c), is the set of elements that are NOT in A (within a universal set U).
- Two sets A and B are **disjoint** if they have no elements in common: $A \cap B = \emptyset$.
- Be able to draw Venn diagrams to illustrate sets and set operations.
- De Morgan's Laws:
  $(A \cup B)^c = A^c \cap B^c$
  $(A \cap B)^c = A^c \cup B^c$

Section 6.2

- $n(A)$ means the number of elements in A.
- $n(A \cup B) = n(A) + n(B) - n(A \cap B)$
- Be able to find the number of elements in each region of a Venn diagram.

Section 6.3

- Mutliplication Principle: The total number of ways to do a series of tasks is the PRODUCT of the number of ways to do each task.

Section 6.4

- A **permutation** is an arrangement of objects in a certain order. ORDER MATTERS. If there are n distinct objects and you want the number of ways to arrange r of them at a time, the number of permutations is $P(n,r) = \frac{n!}{(n-r)!}$. This can also be done on the calculator using the command: $n\ nPr\ r$.
- $n!$ is the number of ways to arrange n distinct objects (the number of permutations of n distinct objects).
- If some of the objects you are permuting are identical (not distinct), you must use a special type of permutation: $\frac{n!}{n_1!n_2!\cdots n_r!}$, where each n_i in the denominator is how many objects are alike of each kind.
- A **combination** is just a selection of objects from a set. ORDER DOES NOT MATTER. A combination is just a subset. If there are n distinct objects and you want the number of ways to select a subset of r objects, the number of combinations is $C(n,r) = \frac{n!}{r!(n-r)!}$. This can also be done on the calculator using the command: $n\ nCr\ r$.