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

- Multiplication 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: \( n \, nCr \, r \).