NAME _____ DATE _____ PERIOD _____

Study Guide

Permutations and Combinations

Use the **Basic Counting Principle** to determine different possibilities for the arrangement of objects. The arrangement of objects in a certain order is called a **permutation**. A **combination** is an arrangement in which order is *not* a consideration.

Example 1 **Eight students on a student council are assigned 8 seats around a U-shaped table.**

a. How many different ways can the students be assigned seats at the table?

Since order is important, this situation is a permutation. The eight students are taken all at once, so the situation can be represented as $P(8, 8)$.

$P(8, 8) = 8!$ $\qquad P(n, n) = n!$

$= 8 \cdot 7 \cdot 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1$ or 40,320

There are 40,320 ways the students can be seated.

b. How many ways can a president and a vice-president be elected from the eight students?

This is a permutation of 8 students being chosen 2 at a time.

$P(8, 2) = \frac{8!}{(8-2)!}$ $\qquad P(n, r) = \frac{n!}{(n-r)!}$

$= \frac{8 \cdot 7 \cdot 6!}{6!}$ or 56

There are 56 ways a president and vice-president can be chosen.

Example 2 **The Outdoor Environmental Club consists of 20 members, of which 9 are male and 11 are female. Seven members will be selected to form an event-planning committee. How many committees of 4 females and 3 males can be formed?**

Order is not important. There are three questions to consider.

How many ways can 3 males be chosen from 9?
How many ways can 4 females be chosen from 11?
How many ways can 3 males and 4 females be chosen together?

The answer is the product of the combinations $C(9, 3)$ and $C(11, 4)$.

$C(9, 3) \cdot C(11, 4) = \frac{9!}{(9-3)!3!} \cdot \frac{11!}{(11-4)!4!}$ $\qquad C(n, r) = \frac{n!}{(n-r)!r!}$

$= \frac{9!}{6!3!} \cdot \frac{11!}{7!4!}$

$= 84 \cdot 330$ or 27,720

There are 27,720 possible committees.