Algebra 2B Notes Name: _____

11-1 Permutations and Combinations Date: _____ Hr: _____

Objective:

- To count permutations
- To count combinations

Common Core Content Standard:

S.CP.9 Use permutations and combinations to compute probabilities of compound events and solve problems.

When counting is impractical, the _____ using multiplication can be used instead.

Make note

Key Concept **Fundamental Counting Principle**

If event M can occur in m ways and is followed by event N that can occur in n ways, then event M followed by event N can occur in $m \cdot n$ ways.

Example 3 pants and 2 shirts give $3 \cdot 2 = 6$ possible outfits.

Example 1: Using the Fundamental Counting Principle

An old website requires a four-character password consisting of three numbers and one letter, A new website requires a six-character password consisting of three numbers and three letters. How many more passwords can be made for the new website?

A _____ is an arrangement of items in a particular order.

For any positive integer n, _____ is $n! = n(n-1) \cdot \ldots \cdot 3 \cdot 2 \cdot 1$. Zero factorial is $0! = 1$.

Example 2: Finding the Number of Permutations of n Items

In how many ways can you arrange nine CDs one after another on a shelf?

Sometimes you are interested in the number of permutations possible using all of the objects from a set, but just a few at a time. You can still use the Fundamental Counting Principle or factorial notation.

Take Note **Key Concept** Number of Permutations

The number of permutations of n items of a set arranged r items at a time is

$${}_nP_r = \frac{n!}{(n-r)!} \text{ for } 0 \le r \le n.$$

Example ${}_{10}P_4 = \frac{10!}{(10-4)!} = \frac{10!}{6!} = 5040$

Example 3: Finding ${}_nP_r$

In how many ways can a first, second, and third baseman be selected from eight players?

A selection in which order does not matter is a _____.

Take Note **Key Concept** Number of Combinations

The number of combinations of n items of a set chosen r items at a time is

$${}_nC_r = \frac{n!}{r!(n-r)!} \text{ for } 0 \le r \le n.$$

Example ${}_5C_3 = \frac{5!}{3!(5-3)!} = \frac{5!}{3! \cdot 2!} = \frac{120}{6 \cdot 2} = 10$

Example 4: **Finding ${}_nC_r$**

What is ${}_{15}C_6$, the number of combinations of 15 items taken six at a time?

Example 5: **Identifying Whether Order is Important**

For each situation, determine whether you should use a permutation or combination. What is the answer to each question?

a. You have 20 songs on your MP3 player. You have time to listen to four of the songs. In how many different ways can you select four songs if order doesn't matter?

b. A raffle at a school carnival awards prizes of $100, $50, $25, and $10. If 25 raffle tickets are sold, how many different ways can the prizes be distributed?