Name_____Date_____Per_____

Algebra 2H Extra Notes 7-1: Counting and Permutations

Fundamental Counting Principle

If there are n items and m_1 ways to choose a first item, m_2 ways to choose a second item after the first item has been chosen, and so on, then there are $m_1 \cdot m_2 \cdot \ldots \cdot m_n$ ways to choose n items.

Example 1: California license plates have 1 digit, 3 letters, and 3 digits.
a) How many license plates are possible if there are no restrictions on digits and letters and repeated letters or digits are allowed?

b) How many license plates beginning with an "8" are possible if no letter can be repeated?

Example 2: You are taking a five-question multiple choice quiz, with A,B,C,D as answer choices. How many ways can the quiz be answered?

Permutations
A *permutation* is a selection or arrangement of objects where order is important.

Example 3: You have homework in 5 classes tonight.
a) In how many ways can you complete all of the homework?

permutations of n objects taken n at a time is $_nP_n = n!$

b) In how many ways can you complete the homework for only 3 of the classes?

permutations of n objects taken r at a time is $_nP_r = \frac{n!}{(n-r)!}$

Example 4: Evaluate each expression.

a) $_{10}P_4$

b) $\dfrac{(n+2)!}{n!}$

Example 5: How many distinct permutations of the letters in the word WOW?

permutations of *n* objects with numbers of repeated objects $r_1, r_2, r_3, \ldots$

$$\frac{n!}{r_1! \cdot r_2! \cdot r_3! \ldots}$$

Example 6: A dog has a litter of 8 puppies, 5 males and 3 females. One possible birth order is MMMMMFFF. How many distinguishable birth orders are possible?