Name: _____ Date: _____ Period: _____

Chapter 14: Probability & Statistics
Topic 1: Permutations & Combinations

New Term: Factorial. Expressed as **n!** means to multiply all consecutive integers from n down.

Example: 5! =

Fundamental Counting Principle:

- Purpose: Determine the number of ways an event can occur.
- Identify it: "How many ways can (an event) occur?"
- Use it: Multiply together the possibility for each.
- Example: Katrina plans on wearing one necklace, one bracelet, and one ring. If she owns 6 necklaces, 8 bracelets, and 5 rings, how many different jewelry combinations can she make?

  6*8*5 = 240

  Katrina has 240 options on how she can wear her jewelry

Permutations:

- Purpose: Determine how many groups of objects from the same set can be made
- Identify it: ORDER MATTERS
- Use it: $_nP_r = \frac{n!}{(n-r)!}$ Where n = Total r = Want
- Find it on your calculator: MATH → PRB →2: $_nP_r$
- Example: Kayla has 10 books in her room. She only has room for 5 of them on her shelf. Determine the number of ways that she can put the books on the shelf

  $_{10}P_5$=10!/(10-5)! = 30,240

  There are 30,240 ways she can arrange the books.

Combinations:

- Purpose: Determine how many groups of objects from the same set can be made
- Identify it: ORDER DOES NOT MATTER
- Use it: $_nC_r = \frac{n!}{r!(n-r)!}$ Where n = Total r = Want
- Find it on your calculator: MATH → PRB →3: $_nC_r$
- Example: Choosing 6 numbers, in any order, from the numbers 1 through 59 for a lottery game where the jackpot is won for all six numbers match the winning numbers.

  $_{59}C_6$=59!/6!(59!-6)! = 45,057,474

  There are 45,057,474 lottery jackpot combinations.

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Examples in your notebook: Identify FCP, PERMUTATION, OR COMBINATION first, then solve.

1. Selecting 5 students from a class of 25 to write solutions to a homework problem on the board. If it doesn't matter who does which question, how many ways can these 5 students be picked?

2. Twenty students are in the tennis tournament. Determine the number of ways that they can take 1st or 2nd place.

3. Laura is going out for lunch. The lunch menu has a choice of 5 soups, 6 salads, and 3 pasta dishes. If she can pick one soup, one salad, and one pasta dish, how many different combinations can she choose?

4. A math club has 25 boys and 15 girls. Which expression represents the total number of different 5-member teams, consisting of 4 boys and 1 girl, which can be formed?
   (Note: When we have different groups that need to be formed within the larger group, we multiply together the two probabilities. Figure out the boys first, then the girls, and then multiply your two separate answers for your total answer.)

5. A 10 person bowling team consists of juniors and seniors. There are 20 juniors and 30 seniors in the school. If the team is to consist of 4 juniors and 6 seniors, how many different teams can be formed?

6. How many 4 letter arrangements can be made using the letters of SPRITE? *(don't have to be real words)*

Permutations of Words:

- Permutations of words with NO REPEATS

  $n!$

  How many ways can the letters in the word **MATH** be arranged?
  Notice: No repeating letters

  n=4
  4! = 24

- Permutations of words WITH REPEATS

  How many ways can the letters in the word **APPLE** be arranged?
  Notice: A letters repeats!

  n=5
  repeating letters: "P" = 2
  $\frac{5!}{2!} = 60$

Examples in your notebook:

1. Determine how many different 12-letter combinations can be made by using the word **TRIGONOMETRY**.
   n=12
   Repeats: T=2 $\frac{12!}{2!\ 2!\ 2!}$=59,875,200
   R=2
   O=2

2. Determine the number of different 8-letter combinations can be made using the letters **GEOMETRY**.

3. How many different 11-letter words can be made from the letters in the word **MISSISSIPPI**?

4. How many different 7-letter words can be made from the letters in **RUNNING**?