ALGEBRA 2 Name:_____ Date:_____

10.4 The Fundamental Counting Principal and Permutations

Tree Diagrams:

At Chubby's Ice Cream Parlor, you can choose from 3 different ice cream flavors (chocolate, vanilla, or strawberry), served in a cone or dish, and one of 2 toppings (whipped cream or sprinkles). How many options do you have to choose from?

The Fundamental Counting Principle:

- Used to count the number of possibilities of an event occurring
- Shortcut to using tree diagrams
- Suppose an event can be chosen (occur) in **p** different ways and another independent event can be chosen in **q** different way, then the two events can occur in **p • q** ways.
- Multiply the number of options in each event to find the total number of outcomes

Examples:

1. Alan is eating at Chik-Fil-A. He can choose between 4 types of sandwiches and have either an iced tea or lemonade with each one. How many different combinations could he choose from? List them.

2. Dana can choose from four different gym classes to take next year and three different art classes. How many different combinations of a gym class and art class can she choose? List them.

3. When eating a salad at Outback, Sam can choose between Ranch, French, or Balsamic dressing and can have his salad with or without cheese? How many different salads could he choose from? List them.

4. When buying a "value meal" at Wendy's, there are 9 different sandwiches and 7 different sides. How many different meals consisting of one sandwich and one side could someone buy?

5. Fred wants to buy either a Toyota Camry or a Honda Accord. Both cars come in three different interior colors and four different exterior colors. How many different options can Fred choose from?

6. Mr. Dalmati has 26 dress shirts, 43 ties, 7 pairs of pants, and 2 pairs of dress shoes. How many different outfits consisting of a shirt, tie, pair of pants, and pair of shoes does he have?

7. How many different 7-digit phone numbers begin with 893?

8. How many different 7-digit phone numbers are possible if the first digit cannot be 0 or 1?

9. A license plate in a certain state consists of three digits followed by three letters. How many different license plates are possible if…

   (a) There can be repeats? (b) Letters cannot be repeated?

   (c) Digits cannot be repeated and the letters C and F cannot be used?

   (d) Letters are not repeated and only even numbers that are not repeated are used?

10. Given the word "FRIEND", how many different ways can the letters of the word be arranged if…

   (a) The first letter must be an "N"?

   (b) The first letter must be a vowel?

   (c) The word letters begin with "R" and end with "E"?

11. How many different 7-letter passwords can be created if…

   (a) Letters can be repeated?

   (b) Letters cannot be repeated?

Factorials: **n!** (pronounced "n factorial") **= n·(n–1) ·(n–2)·… ·3·2·1**

12. 5! = 13. 7! =

Permutations:

- An ordering of a set of objects – ORDER MATTERS!
- Objects **CANNOT** be repeated

$${}_nP_r$$

Examples:

14. How many ways can three students line up in front of their class? How about 4 students?

15. Seven students are going to present a speech. How many different orders can they present?

16. In how many ways can 6 different pictures be lined up on a wall?

17. Eight skiers are competing in a moguls (snow bumps) competition.
    (a) In how many different orders can the skiers finish the competition?

    (b) In how many different ways can 3 of the skiers finish 1st through 3rd?

18. Of 6 friends on the track team, how many ways can 4 of them be used to run the 400-meter relay?

19. Six swimmers are competing in a race. How many different ways can three of them finish in first, second, and third place.

20. Four boys and four girls are going to stand in a straight line. If a girl is first and a boy is last, how many different ways could the children line up?

21. You have 8 text messages on your cell phone. In how many orders can you reply to 5 of the messages?

22. There are 12 snowboarders in a competition. Assuming there are no ties…
    a) In how many different orders can all of them finish the competition?

    b) In how many ways can the gold, silver, and bronze trophies be awarded?