Worksheet 1.2 Name:______________________________

Permutations Date:________ Per.:_____

1. Think back to the toppings for the "candy pizza." On a separate piece of paper, create a tree diagram showing all the ways the toppings for the pizza can be arranged. Use the same format from problems 8 and 9 from yesterday so that the same toppings in different orders are considered a different pizza but don't allow toppings of the same type on one pizza. How many different ways are there to put toppings onto the pizza? _____

2. Looking at the available options for toppings, fill in each blank space:

   How many types of first toppings are there? _____

   How many types of second toppings are there? _____

   How many types of third toppings are there? _____

   How many types of fourth toppings are there? _____

3. What pattern is occurring in the number of available toppings from problems 1 and 2? ____

4. A factorial is the product of all the positive numbers less than and equal to the number. The notation is an exclamation point (!). For example, 4! = 4*3*2*1. With that in mind find each of the following:

   5! = _______________

   3! = _______________

   2! = _______________

   *note: 0! = 1 by definition

5. The way n objects can be arranged in a specific order is called a permutation. All the possible arrangements are the total number of permutations of a group. Using

your new notation, on a separate sheet of paper, show how many total permutations of 4 pizza toppings there are?

_____

6. Suppose there is a special on two topping pizzas. On a separate sheet of paper create a tree diagram showing the ways 2 toppings can be chosen from 4 possible toppings. Again, allow toppings the same two toppings in a different order to be a different pizza. How many permutations of 2 toppings from 4 possible toppings can be made? _____

7. Looking at the available options for toppings, fill in each blank space:

   How many types of first toppings are there? _____

   How many types of second toppings are there? _____

8. What pattern is occurring in the number of available toppings from problems 6 and 7? ____

9. There is a formula for the number of permutations of n objects taken r at a time (noted as nPr), it is: $^{n!}/_{(n-r)!}$. Use this formula to calculate the number of permutations for each of the following:

   5P2 = _______________

   8P3 = _______________

   Suppose there are 8 swimmers in an Olympic race. On a separate sheet of paper show how many ways can a gold, a silver, and a bronze medal be awarded? _______________

10. Consider the letters in the word MOM. On a separate sheet of paper, create a tree diagram showing the number of different ways the letters in the word MOM

can be rearranged. Why doesn't the formula for permutations work for

this?____

____

11. There is a slightly different formula for permutations where the objects have been repeated: $^{n!}/_{p!q!\ldots}$. In this formula p, q, … each represent the number of repeated objects. For example, Tennessee has 9 letters so there are 9! permutations. However, the n is repeated twice, the s is repeated twice, and the e is repeated 4 times. So we divide out these repeated objects and end up with : $^{9!}/_{(2!2!4!)} = 3780$. Examine each of the following words and calculate how many different ways the letters can be rearranged.

Pizza	_______________
Candy	_______________
Arkansas	_______________
Mississippi	_______________