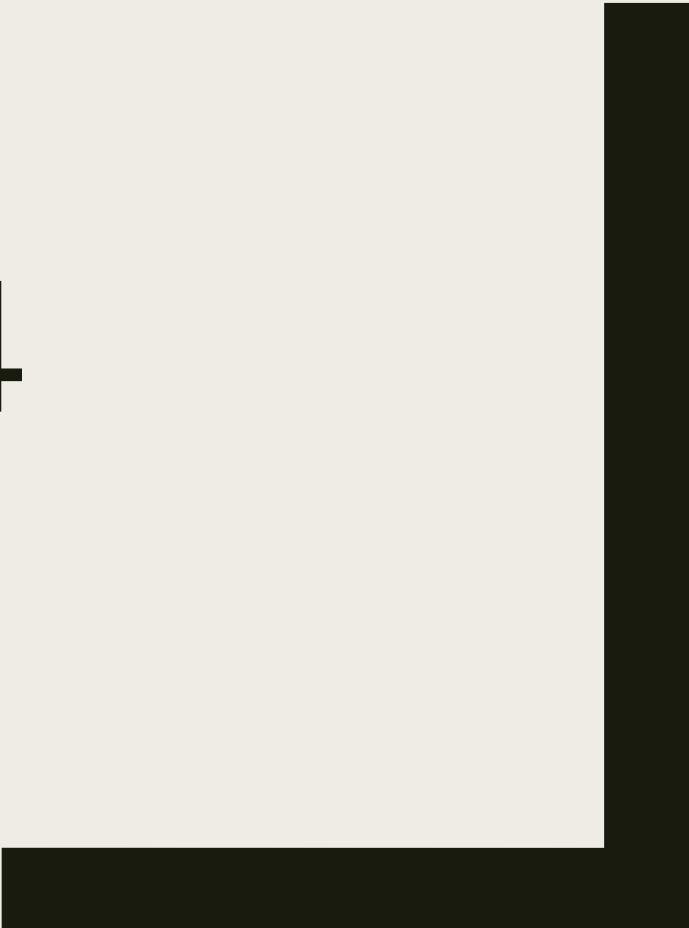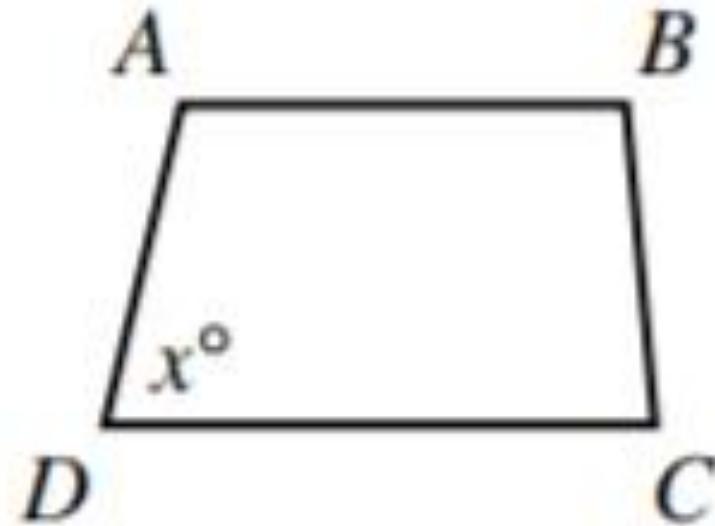# ALGEBRA 4

Day 53

Bell Work

For trapezoid *ABCD* shown below, $\overline{AB} \parallel \overline{DC}$, the measures of the interior angles are distinct, and the measure of $\angle D$ is $x°$. What is the degree measure of $\angle A$ in terms of x ?

F. $(180 - x)°$
G. $(180 - 0.5x)°$
H. $(180 + 0.5x)°$
J. $(180 + x)°$
K. $x°$

Go over Test

11.1 Permutations and Combinations

Objective: To count permutations and combinations

- _Scenario: You go to a deli. There are 4 types of meat (Turkey, Ham, Roast Beef, and Pastrami) and 3 types of bread (White, Wheat, and Rye). How many different sandwich combinations do you have to choose from?_

-

Method 1, **Tree Diagram**: charting every possible combination of multiple sets of data as a web

Count the number of options on the final column (12 combination)
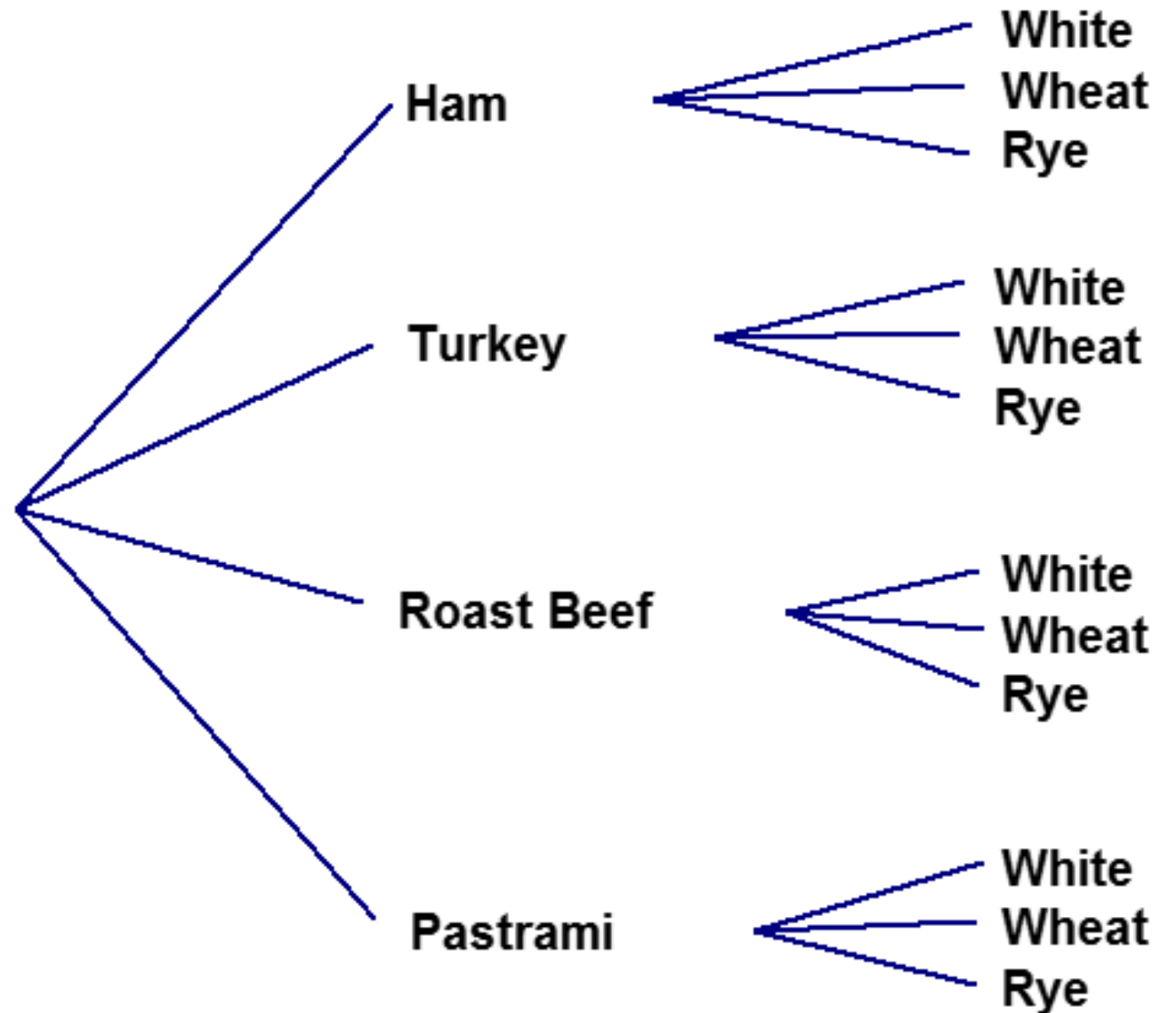
Method 2, Fundamental Counting Principle;

Two Events: If one event can occur in m ways and another event can occur in n ways, then the number of ways that both events can occur is **m*n**

Example: 4 meat choices, 3 bread choices; (4)(3)=12 combinations

Which method would be better if we added...

- 5 Cheeses
- 8 Vegetables
- 6 Dressings
- Etc...

How would this change the outcome if we could select more than one of each item?

The standard configuration for a New York license plate is 3 digits followed by 3 letters.

1) How many different license plates are possible if digits and letters can be repeated?

2) How many different license plates are possible if digits and letters cannot be repeated?

The standard configuration for a New York license plate is 3 digits followed by 3 letters.

1) How many different license plates are possible if digits and letters can be repeated?

(10)(10)(10)(26)(26)(26) = _____

2) How many different license plates are possible if digits and letters cannot be repeated?

(10)(9)(8)(26)(25)(24) = _____

Factorial: the product of all integers from 1 to n denoted by ! (ex: 3! = 3*2*1 = 6)

- ■ Examples: Evaluate the factorial:

4!   6!   0!

3! x 4!   1! $\dfrac{8!}{5!}$

Permutation: an ordering of n objects (Each different order is a new permutation)

Example: How many permutations are there for the letters A, B, and C?

Number of Permutations of n Distinct Objects;
n! = n*(n – 1)*(n – 2)*...*3*2*1

Example: *Twelve skiers are competing in the final round of the Olympic freestyle skiing aerial competition*

a) In how many different ways can the skiers finish the competition?

b) In how many different ways can 3 of the skiers finish first, second, and third to win gold, silver, and bronze?

Permutations of n Objects Taken r at a Time;

The number of permutations of r objects taken from a group of n distinct objects is denoted by $_nP_r$ and is given by:

$$_nP_r = \frac{n!}{(n-r)!}$$

Note: n is the total number of objects, and r is the number of objects selected from the total

Examples

Find the number of permutations:

$_{10}P_6$ $_5P_1$

Permutations with Repetition;

The number of distinguishable permutations of n objects where one object is repeated q_1 times, another is repeated q_2 times, and so on is:

$$\frac{n!}{q_1! \cdot q_2! \cdot \ldots \cdot q_k!}$$

<u>*Example*</u>*:*

Find the number of distinguishable permutations of the letters in the word.

a) PENCIL   b) LETTER

Combination: a selection of r objects from a group of n objects where the <u>order is not important</u> (ex: hand of cards)

<u>Combinations of n Objects Taken r at a Time</u>;

The number of combinations of r objects taken from a group of n distinct objects is denoted by $_nC_r$ and is given by:

$$_nC_r = \frac{n!}{(n-r)! \cdot r!}$$

Note: n is the total number of objects, and r is the number of objects selected from the total

Example

Find the number of combinations:

$_{10}C_6$ $_5C_1$

Permutation or Combination?

Example: You are considering 10 different colleges. Before you decide to apply to the colleges, you want to visit some of them. In how many ways can you visit,

6 of the colleges?   *4 of the colleges?*

Multiple Events:

Event A <u>and</u> Event B $\rightarrow$ <u>Multiply</u>

Event A <u>or</u> Event B $\rightarrow$ <u>Add</u>

Example:
A restaurant serves omelets that can be ordered with any of the ingredients shown.

- *Vegetarian*   Meat
- *Green Pepper*   Ham
- *Red Pepper*   Bacon
- *Onion*   Sausage
- *Mushroom*   Steak
- *Tomato*
- *Cheese*

- a) Suppose you want exactly 2 vegetarian ingredients and 1 meat ingredient in your omelet. How many different types of omelets can you order?

- b) Suppose you can afford at most 3 ingredients in your omelet. How many different omelets can you order?

For Next Time

- Page 678 #1-6, 9-11, 13-19 (odd), 20, 21-37 (odd), 38-41