Math 4 Honors Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Lesson 5-2: *Order & Repetition I* Date \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Learning Goals:**

* *I can determine when order and repetition involved in counting situations.*
* *I can apply the appropriate strategies and formulas in counting situations, not involving repetitions, where order is important and where order is not important.*
* *I can identify similarities and differences between permutations and combinations.*

1 a. It makes a difference whether or not the *order* of the side dishes matters and whether or not *repetition*

 of sides dishes is possible. In this case, it (*does/does not*) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ matter in which order

 the side dishes are chosen and that repetition (*is/is not*) \_\_\_\_\_\_\_\_\_\_\_\_\_\_ possible for the side dishes.

 b. Show how it could have been **incorrectly** calculated:

 c. Most likely, the different orderings of side dishes were counted as different arrangements. However,

 the order in which the side dishes are chosen (*does/does not*) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ matter. For example,

 choosing mashed potatoes, corn, and beans should be the same as corn, mashed potatoes, and beans.

What *two* questions should be considered when studying permutations and combinations?

* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2. These questions require some thought. Make sure to discuss with your group members and compare.

 a. Yes or No? \_\_\_\_\_\_\_ Yes or No? \_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_ different choices

 b. Yes or No? \_\_\_\_\_\_\_ Yes or No? \_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_ different choices

 c. Yes or No? \_\_\_\_\_\_\_ Yes or No? \_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_ different choices

 d. Yes or No? \_\_\_\_\_\_\_ Yes or No? \_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_ different choices

 e. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ has the most choices and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ has the fewest. This makes sense

 because allowing repetition and having order matter will always give the greatest # of possibilities.

 f. Share your strategies with each other.

3. Make sure to read about the information to put into the table below.

|  |  |  |
| --- | --- | --- |
|  | No Repetitions | Repetitions OK |
| Different Orders Count as Different Possibilities |  |  |
| Different Orderings Do Not Count as Different Possibilities |  |  |

4 a. Enter P-VP-T in the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ row and \_\_\_\_\_\_\_\_\_\_\_\_\_ column of the table since there is no

 repetition and the order counts.

 b. \_\_\_\_\_\_\_\_\_\_\_ different 3-person groups. Show calculations.

5. a. Yes or No? \_\_\_\_\_\_\_\_\_\_

 b. \_\_\_\_\_\_\_\_\_\_\_\_\_\_ different 3-person groups from 20 people. Show calculations.

 c. \_\_\_\_\_\_\_\_\_\_\_\_\_\_ different 4-person groups from 15 people. Show calculations. OVER🡪

6. **Factorial**: 5! = 5 × 4 × 3 × 2 × 1 (5! is “five factorial”) **or** *n*! *= n* × (*n* − 1) × (*n* − 2) × … × 2 × 1.

 a. The calculation in activity 5 used the beginning part of 15!, but the multiplications stops after the first

 three factors.

 b. You would multiply the first \_\_\_\_\_\_\_\_\_\_\_\_\_ factors of 30!: \_\_\_\_\_ × \_\_\_\_\_ × \_\_\_\_\_ × \_\_\_\_\_

7 a. In the counting problem in Part b of Problem 5, *n* = 20, *k* = 3, and *n* – *k* + 1 = 18, so the answer is

 20 × 19 × 18 = 6,840. In the counting problem in Part c of Problem 5, *n* = 15 and *k* = 4, so the answer is

 15 × 14 × 13 × 12 = 32,760. These answers should match the ones obtained in Problem 5.

 b. This formula is a generalization of the method in Problem 5 because you do the same kind of

 factorial-type multiplication, but with general *n* and *k*. In particular, you use the first *k* factors of *n*!,

 just as in Problem 5 you used the first 3 factors of 15!.

 c. There are *k* factors in this product.

 d. By using the distributive property, you can see that *n* – (*k* – 1) = *n* – *k* + 1.

8 a. Use the formula:  for part A. Show your calculations and make sure you match #5 b and c.

 #5 part b: #5 part c:

 b. = 

 = *n*(*n* – 1)(*n* – 2)…(*n* – (*k* – 1))

 = *n*(*n* – 1)(*n* – 2)…(*n – k* + 1)

 c. There are *n* choices for the first officer, then (*n* – 1) choices for the second officer, and so on. So, *n*! is

 a good way to start this computation. But you want the computation to stop after *k* factors since there

 are *k* officers. Thus, the last factor you want is (*n* – *k* + 1). This can be achieved by dividing *n*! by

 (*n – k*)!.

9 a. Explain:

 b. \_\_\_\_\_\_\_\_\_\_\_\_\_\_ permutations. Show calculations.

10 a. The number of 3-person committees is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ the number of 3-person P-VP-T groups.

 b. In both the French Club and Ski Club elections, repetition (*is/is not*) \_\_\_\_\_\_\_\_\_\_\_\_ allowed.

 However, in the French Club election, order (*does/does not*) \_\_\_\_\_\_\_\_\_\_\_\_\_\_ matter, but in the Ski

 Club election, order (*does/does not*) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ matter.

 c. Enter “committee” in the \_\_\_\_\_\_\_\_\_\_\_\_\_\_ row and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ column cell in the table.

 d. \_\_\_\_\_\_\_\_\_\_\_\_ different ski club committees. Show calculations.

11. Read the paragraph before part A. This should help to clarify some things in question #10.

 a. Orderings: \_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_ or \_\_\_\_ × \_\_\_\_ × \_\_\_\_

 b. Yes or No? \_\_\_\_\_\_\_\_\_ -- If no, go back and correct your work in question #10 d.

 c. \_\_\_\_\_\_\_\_\_\_\_\_\_ different committees of 3 from 24. Show calculations.

 d. i. \_\_\_\_\_\_\_\_\_\_\_\_\_ different committees of 4 from 15. Show calculations.

 ii. You divided by \_\_\_\_\_\_\_\_. This came from \_\_\_\_ × \_\_\_\_ × \_\_\_\_ × \_\_\_\_ or \_\_\_\_!

 e. i. Just complete the equation: = \_\_\_\_\_\_\_\_\_\_\_ committees of 3 from 15.

 ii. Just complete the equation:  = \_\_\_\_\_\_\_\_ committees of 5 from 30.

12 a. Dividing each of the two general formulas for the ranked-officer problem by *k*! will give general

 formulas for the committee problem.

  and 

 b. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ committees of 5 from 30. Check your result with #11e. Show calculations.

 c. = 

 = 

 = 

13. Explain:

**Permutations**: Arrangements where there is no repetition and *order* ***does*** *matter*. (French Club)

**Combinations**: Arrangements where there is no repetition and *order* ***does not*** *matter*. (Ski Club)

**Check Your Understanding**

a. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ different collections of 4 from 10 (order not important). Show calculations.

b. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ different concert programs of 4 from 10 (order important). Show calculations.

**Lesson 5-2 Homework** *Please do your work on another sheet of paper.*



