Algebra II

Permutations verses Combinations

Name _____

Hour _____

1. Define the term "Permutation".

Arrangement of items in a particular order.

Number of available choices is reduced each time.

For problems 2 and 3, use the list given below of all the permutations of the letters R, S, T and N using three at a time.

RST	SRT	TRS	NSR
RTS	STR	TSR	NRS
RTN	SRN	TRN	NRT
RNT	SNR	TNR	NTR
RSN	STN	TSN	NTS
RNS	SNT	TNS	NST

2. Using the permutations listed above, put them into groups that contain the same three letters? See colors above

3. By definition a Combination is "**A collection of objects in which the order of objects does not matter**". How many groups (combinations) do you have in problem number **2**?

3) 4

For problems 4 and 5, use the list given below of all the permutations of the letters R, S, T, N and K using two at a time.

RS	SR	RT	TR	RN	NR	RK	KR
ST	TS	SN	NS	SK	KS	TN	NT
TK	KT	NK	KN				

4. Using the permutations listed above, put them into groups that contain the same two letters?

see colors above

5. By definition a Combination is "**A collection of objects in which the order of objects does not matter**". How many groups (combinations) do you have in problem number **4**?

5) 10

6. a) Try experimenting using factorials to write an expression to solve problem number **3.**

$$\frac{4!}{3!(4-3)!} = \frac{4\cdot 3\cdot 2\cdot 1}{3\cdot 2\cdot 1\cdot 1} = 4$$

b) Try experimenting using factorials to write an expression to solve problem number **5.**

$$\frac{5!}{2!(5-2)!} \qquad \frac{5\cdot 4\cdot 3\cdot 2\cdot 1}{2\cdot 1(3\cdot 2\cdot 1)} = \frac{20}{2} = 10$$

c) Using what you have learned in parts **a – b**, write an expression for a situation where you have 100 objects and wanted to know how many combinations using 29 of them at a time.

$$\frac{100!}{29!(100-29)!} = \frac{100!}{29!(71)!}$$

d) Write a formula for a combination of **n** objects taken **r** at a time using factorials.

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

7. Given the three letters W, H, and O:

a) List all the permutations of these three letters using two at a time.

WH HW OW
WO HO OH

b) List all the combinations of these three letters using two at a time.

WH
WO
HO

In problems 8 and 9 (a) state whether the following situations involve a permutation or a combination and (b) solve the situation

8. In a class of 25 students how many ways can three (3) students be picked, 1 to be a team leader, 1 to be a recorder, and 1 to be a reporter.

a) permutation

b) 13,800

9. There is a variety pack of a dozen different donuts sitting on the kitchen table. Stanley picks 4 donuts to take to work. How many ways can he do this?

a) combination

b) 495

10. Given the six letters A, S, D, F, G, and H. How many combinations of these letters can you make taking 4 at a time? Show how you would use the formula you developed in problem **6** to solve this.

$\frac{6!}{4!2!}$ $\frac{6\cdot5\cdot4\cdot3\cdot2\cdot1}{4\cdot3\cdot2\cdot1\cdot2\cdot1}$ $\frac{30}{2}=15$

11. Dr. Zweistein has 14 students in a physics class. Over the course of the year, Dr. Zweistein would like to arrange the lab groups so that every student has the opportunity to work with every other student in groups of two. How many different two-person lab groups are there?

11) 91

$_{14}C_2$

12. The Rails Club, a group of 25 train fanatics, is to choose four of their members to be on the Board of Directors.

a. How many different possible boards could the Rails choose?

$_{25}C_4$

a) 12,650

b. How many different possible boards could the Rails choose if there are to be a Chair, Vice Chair, Treasurer, and Secretary?

b) 303,600

$_{25}P_4$

13. At a burger specialty restaurant, the toppings options are catsup, mayonnaise, mustard, tomatoes, onions, lettuce, mushrooms, Swiss cheese, cheddar cheese, steak sauce, and guacamole. If you can choose between a 4-oz burger or a 6-oz burger and want a mix of 4 toppings, how many different burgers can you order?

13) 660

$2 \cdot {}_{11}C_4$

330 w/ a 4 oz burger
330 w/ a 6 oz burger