

Name: _____ Date: _____ Per: _____

Notes – Combinations

1. List all possible ways to pick *any three letters in any order* from the letters MATH

Combinations are the number of ways items can be selected - *NOT arranged*. The question you should be asking yourself is, "Will the outcome be different if I move things around?" If so - then you are dealing with permutations! If the order does NOT matter - then you are dealing with combinations.

2. How many ways can we make a taco pizza if we can only afford to buy three toppings out of 8 available toppings? Start like a permutations - make a "slot" for the number of items you are choosing.

$$\frac{\text{1st topping choice}}{\text{choice}} \cdot \frac{\text{2nd topping choice}}{\text{choice}} \cdot \frac{\text{3rd topping choice}}{\text{choice}} = \frac{\text{Total Permutations}}{\text{Total Permutations}}$$

BUT the pizzas will all taste the same no matter what order we assemble it, so we must divide our total permutations by the total number of ways we could assemble our pizza with any **three** different toppings:

$$\frac{\text{1st topping}}{\text{topping}} \cdot \frac{\text{2nd topping}}{\text{topping}} \cdot \frac{\text{3rd topping}}{\text{topping}} = \frac{\text{Total Permutations}}{\text{\# of Assemblies}}$$

The final number of Combinations = $\frac{\text{Total Permutations}}{\text{Total Assemblies}} =$

OR

Combination Formula: ${}_n C_k = C(n, k) = \frac{P(n, k)}{k!} = \frac{n!}{(n - k)!k!} =$

$n = \# \text{ Items choosing from}$ and $k = \# \text{ items you are selecting}$

3. How many ways can a link leader pick 3 of their 10 members to send a card to?
4. How many committees of six people can be formed out of a group of ten teachers?
5. How many 5 card poker hands are possible?
6. How many ways can you pick 4 students to work out a problem on the board if the class has 25 students?

Chris likes to do a variety of exercises everyday. 16 of Chris' favorite exercises include: 5 different abdominal moves, 3 leg moves, 4 arm moves, 2 back moves, and 2 cardio types. Out of these different exercises, 5 are beginner moves, 8 are middle level, and 3 are advanced. How many ways can Chris pick 6 exercises each day if they must include:

7. Only middle level moves
8. Only abdominal moves
9. 3 beginner moves **and** 3 advanced moves
10. Two arms, two abs, **and** two backs

Name: _____ Date: _____

Combinations

1. How many four person committees can be chosen from a group of seven people?	2. There are ten players on the basketball team. How many ways can a starting lineup of five players be chosen at random?
3. There are 4 things in a hat. How many ways can you pick 2 things from the hat at once?	4. How many combinations of two letters are possible from the letters Y, Z, A, and S?
5. How many three person teams can be made from a group of twelve people?	6. There are 4 names in a hat. How many ways can you pick 1 name from the hat at once?
7. You have a coupon that lets you buy a three topping pizza for \$10. How many pizzas are possible if they offer eleven toppings?	8. Micah and Pat have a set of ten colored pencils. They want to color all 50 states on the US map. Using only sets of 4 colors, how many different map colors are possible?
9. Crazy 8's starts off with each player being dealt 8 cards. How many different hands could be dealt out from a deck of 52 cards?	10. The English department has decided to make every student read five books over the summer. Students can pick from a list of ten books. How many different selections can students make?
11. Leadership has to select 5 students to help decorate the prom. If they have 12 students in the class, how many different groups can be chosen?	12. IB diploma students must take 3 higher level (HL) courses. If WHS offers HL Chem, HL Bio, HL Eng, and HL History, how many different schedules can be made?

Use the following information to answer questions 13 - 20. WHS has 17 students playing Varsity basketball. They have 9 boys and 8 girls. The same group is made up of 10 seniors, 5 juniors, and 2 sophomores. How many ways can they pick groups of 5 students to help coordinate a basketball clinic if they must have the following students in each group:

13. Only girls	14. Only sophomores
15. Only seniors	16. Four boys and one girl
17. Four seniors and one junior	18. Three boys and two girls
19. One sophomore, two juniors, and two seniors	20. One sophomore, one junior, and the rest seniors