Algebra 2
Counting Principle, Permutations, and Combinations

Name: Key Date: _____ Period: _____

Use a calculator or the formula to solve the following.

Ex: $nPr = \frac{n!}{(n-r)!}$ $nCr = \frac{n!}{(n-r)!r!}$

1. $9P4$

$= \frac{9!}{(9-4)!} = \frac{9!}{5!} = \frac{9 \cdot 8 \cdot 7 \cdot 6 \cdot \cancel{5!}}{\cancel{5!}} = 3024$

2. $8P5$

$= \frac{8!}{8-5!} = \frac{8!}{3!} = \frac{8 \cdot 7 \cdot 6 \cdot 5 \cdot 4 \cdot \cancel{3!}}{\cancel{3!}} = 6720$

3. $6P6$

$= \frac{6!}{(6-6)!} = \frac{6!}{0!} = \frac{6!}{1} = 6! = 720$

"Fun" Fact: $0! = 1$

4. $8P0$

$= \frac{8!}{(8-0)!} = \frac{\cancel{8!}}{\cancel{8!}} = 1$

5. $9C5$

$= \frac{9!}{(9-5)!\,5!} = \frac{9 \cdot 8 \cdot 7 \cdot 6 \cdot \cancel{5!}}{4! \cdot \cancel{5!}} = 126$

6. $11C4$

$= 330$

7. $7C7$

$= 1$

8. $5C0$

$= 1$

State whether each of the following problems involves permutations or combinations. ***Give a brief explanation for your answer.***

9. A medical researcher needs 6 people to test the effectiveness of an experimental drug. If 13 people have volunteered for the test, in how many ways can 6 people be selected?

(Combination) / Permutation

Why? All people are taking the same drug test.

10. Fifty people purchase raffle tickets. Three winning tickets are selected at random. If first prize is $1000, second prize is $500, and third prize is $100, in how many different ways can the prizes be awarded?

Combination / (Permutation)

Why? order of selection determines prize money.

11. How many different four-letter passwords can be formed from the letters A, B, C, D, E, F, and G if no repetition of letters is allowed?

Combination / (Permutation)

Why? words change if the letters are swapped

Solve the following problems using the Counting Principle, nPr, or nCr.

12. A Club with ten members is to choose three officers – president, vice-president, and secretary-treasurer. If each office is to be held by one person and no person can hold more than one office, in how many ways can those offices be filled?

10 · 9 · 8 = 720

Different Positions

or $_{10}P_3 = \frac{10!}{10-3!} = \frac{10!}{7!} = \frac{10 \cdot 9 \cdot 8 \cdot \cancel{7!}}{\cancel{7!}}$

$= 720$

13. A popular brand of pen is available in three colors (red, green, or blue) and four writing tips (bold, medium, fine, or micro). How many different choices of pens do you have with this brand?

3 Color · 4 tips = 12

14. For a segment of a radio show, a DJ can play 7 songs. If there are 13 songs to select from, in how many ways can the program for this segment be arranged? (This is a problem in which the textbook claims that order matters) ... so permutation

$_{13}P_7 = \frac{13!}{(13-7)!} = \frac{13!}{6!} = \frac{13 \cdot 12 \cdot 11 \cdot 10 \cdot 9 \cdot 8 \cdot 7 \cdot \cancel{6!}}{\cancel{6!}} = 8648640$

15. An election ballot asks voters to select three city commissioners from a group of six candidates. In how many ways can this be done?

↳ Same job, order doesn't matter. Combination

$_6C_3 = 20$

16. You volunteer to help drive children at a charity event to the zoo, but you can fit only 8 of the 17 children present in your van. How many different groups of 8 children can you drive?

Combination ... $_{17}C_8 = 24310$

17. A book club offers a choice of 8 books from a list of 40. In how many ways can a member make a selection?

you end up w/ the same 8 books regardless of the order in which you select them.

Combination

$_{40}C_8 = 76904685$