

INTRODUCTION TO COMBINATIONS ALGEBRA 2 WITH TRIGONOMETRY

A permutation occurs when we arrange a subset of elements in a particular order. On the other hand, many times we are just interested in determining how many subsets of a particular size that we can make from an overall set. These subsets are known as **combinations**. The first exercise will introduce the idea and how we can count the combinations by first considering permutations.

Exercise #1: Consider the set created by the letters in the word MATH, i.e. in set notation $\{M, A, T, H\}$.

- (a) Determine the number of three-letter codes that can be made from the letters in this word. Express your answer as a permutation, a product, and an integer.
- (b) Consider only the letters in the subset $\{M, A, T\}$. How many ways can these three letters be arranged? Express your answer in factorial form and as an integer.
- (c) Write out all of the three letter codes that can be made with the letters in $\{M, A, T\}$. Verify that you list as many as you counted in part (b).
- (d) Using your answers to parts (a) and (b), calculate the number of three-letter subsets of the set $\{M, A, T, H\}$.

What you calculated in *Exercise #1(d)* was the number of combinations of four-elements, taken three at a time. The key difference between **combinations** and **permutations** is that in a permutation, the ordering of elements in the subset matters, whereas in a combination it doesn't. The calculation in #1(d) can be extended to:

COMBINATIONS – NOTATION AND FORMULA

The number of combinations of n elements taken r at a time is given by:

$${}_n C_r = \frac{{}_n P_r}{r!}$$

Exercise #2: Janine would like to select three DVD's to bring with her on a long plane flight. She has a collection of 22 DVD's to choose from. Calculate the number of unique sets of three DVD's she could choose.



Exercise #3: Mr. Weiler's math team must choose four of its competitors to compete in a group question. If the team has 12 members, how many different four-member groups could he form to compete?

Calculators typically have a function that calculates the numbers of permutations or combinations for a particular problem, but the formula from the previous page is important to understand, even if you stop using it.

Exercise #4: Use the combination command on your calculator to find each of the following.

(a) ${}_{10}C_4$ (b) ${}_5C_5$ (c) ${}_4C_2 \cdot {}_6C_5$ (d) $\frac{{}_6C_3}{{}_{10}C_3}$

Exercise #5: A bag contains twelve marbles, which includes seven red marbles and five blue marbles. Roja reaches into the bag and pulls out four marbles.

- (a) How many different sets of four marbles can be pulled from this bag? (By different we literally mean different marbles, regardless of the color.)
- (b) How many of these sets contain two red marbles and two blue marbles?
- (c) How many of these sets contain all red marbles?
- (d) How many of these sets contain all red marbles or all blue marbles?



Name: _____

Date: _____

INTRODUCTION TO COMBINATIONS
ALGEBRA 2 WITH TRIGONOMETRY - HOMEWORK

SKILLS

1. Use the combination formula to calculate each of the following. Show your calculations.

(a) ${}_5C_2$

(b) ${}_7C_3$

(c) ${}_4C_4$

(d) ${}_3C_1$

2. Use your calculator to find the value for each of the following. Express any non-integer answers in reduced fraction form.

(a) ${}_{20}C_6$

(b) ${}_7C_4 \cdot {}_5C_2$

(c) $\frac{{}_7C_3}{{}_{13}C_3}$

(d) $\frac{{}_6C_3 \cdot {}_8C_2}{{}_{14}C_5}$

3. Which of the following could be used to calculate ${}_6C_3$?

(1) $\frac{6 \cdot 3}{2}$

(3) $\frac{6 \cdot 5 \cdot 4}{3 \cdot 2 \cdot 1}$

(2) $\frac{6 \cdot 5 \cdot 4 \cdot 3}{3}$

(4) $\frac{6 \cdot 3}{3}$

4. Which of the following gives the number of three-element subsets of a set that contains 16 elements?

(1) 560

(3) 2730

(2) 48

(4) 65,536

5. Which of the following statements concerning combinations and permutations is incorrect?

(1) ${}_nC_r = \frac{{}_nP_r}{r!}$

(3) ${}_nC_r \leq {}_nP_r$

(2) ${}_nP_r = {}_nC_r \cdot r!$

(4) ${}_nP_r < {}_nC_r$



APPLICATIONS

6. Danny is selecting 4 shirts to take with him on a weekend visit to his grandparents. If he has a total of 14 shirts to choose from, which of the following gives the number of ways he can make his selection?
- (1) 18 (3) 24, 024
- (2) 1001 (4) 56
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7. Vien has made an mp3 playlist that contains eight songs. On his way to work, he places his mp3 player on random. If he only has time to listen to the first five songs of his playlist, how many different sets of five songs could he have listened to?
8. Mrs. Maples is creating a four-person debate team from her 9th grade English class, which contains 16 girls and 12 boys. Assume that the order that students are picked for the debate team does not matter.
- (a) How many different teams could Mrs. Maples create from her class? (b) How many of the teams from part (a) contain three girls and one boy?
- (c) How many of the teams from part (a) contain the same number of girls as boys? (d) How many of the teams from part (a) contain all girls or all boys?
9. A florist is creating bouquets out of red, yellow, and white roses. If there are five red roses, four yellow roses, and eight white roses to choose from, how many different arrangements can the florist make using two roses of each color?

