

6.7 Permutations and Combinations

Vocabulary

factorial
permutation
combination

The **factorial** of a number is the product of all the whole numbers from the number down to 1.

The factorial of 0 is defined to be 1.

$$5! = 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1$$

Reading

Read $5!$ as "five factorial."

Evaluate the expression. No Calculator!

A. $\frac{9!}{(8-2)!}$

Hint:

$$\frac{9 \cdot 8 \cdot 7 \cdot 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1}{6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1}$$

Step 1: :

$$\begin{array}{r} 72 \\ \times 7 \\ \hline 504 \end{array}$$

Step 2:

Evaluate the expression. No calculator!

B. $\frac{9!}{7! 2!}$

$$\frac{9 \cdot 8}{2 \cdot 1}$$

Hint:

$$\frac{72}{2} = 36$$

$$\frac{9 \cdot 8 \cdot \cancel{7} \cdot \cancel{6} \cdot \cancel{5} \cdot \cancel{4} \cdot \cancel{3} \cdot \cancel{2} \cdot \cancel{1}}{\cancel{7} \cdot \cancel{6} \cdot \cancel{5} \cdot \cancel{4} \cdot \cancel{3} \cdot \cancel{2} \cdot \cancel{1} \cdot 2 \cdot 1}$$

Start cancelling!

A **permutation** is an arrangement of things in a certain order.

1) For example: How many different ways can three people line up in front of the classroom?

first

?

choices

3

second

?

• choices

2

third

?

• choice

1

The product can be written as a factorial.

$$3 \cdot 2 \cdot 1 = 3! = 6$$

Solve the problem.

2) The starting line up of 5 players for the EHS basketball team must line up to enter the gym. How many different orders can coach arrange the players?

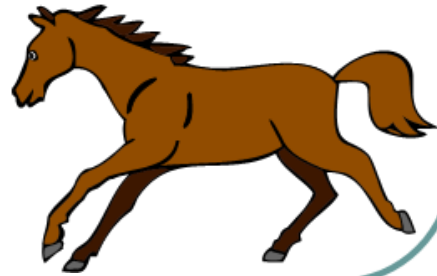


$$\begin{array}{cccccc} 5 & 4 & 3 & 2 & 1 & \\ \hline & & & & & \\ 20 \cdot 3 & = & 60 \cdot 2 & = & 120 & \end{array}$$

Solve the problem.

3) Ten horses are entered in a race. You have no idea how to bet, so you figure you'll just randomly bet on which horses will come in first, second and third (this is called a trifecta box...by the way). How many different bets can you make?

$$\underline{10} \cdot \underline{9} \cdot \underline{8}$$



Calculator only!

Permutations - order matters

$${}_n P_r \quad \text{Math} \bullet \rightarrow \text{PRB} \bullet \rightarrow \#2$$

Solve the problem.

4) If 6 students are running for president, vice-president and treasurer of their class, how many different ways can you vote for these three positions?

The number of students is 6.

$${}^6P_3 = 120$$

The students are arranged 3 at a time.

There are 120 permutations.

A **combination** is a selection of things in any order.

5) Looking at the last problem, what if 6 students are running for a position as class representative and your class can have 3 reps. Will you get the same answer as before?

How many different groups of 3 can be chosen?

combination

$${}_n C_r \quad \text{Math} \bullet \rightarrow \text{PRB} \bullet \rightarrow \#3$$

Looking back at example #5

$${}_6 C_3 = \text{●}$$

There are ____ combinations

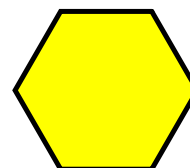
6) There are 19 people in an Algebra II class, but only 15 computers in the computer lab, so each student must take turns going to the lab. How many different groups of 15 can the teacher send to the lab?

19 people

$${}_{19}C_{15} =$$

15 chosen at a time

3876



7) The California state lottery is called the "6/53", meaning a winner must select six different correct numbers from the numbers 1 through 53. How many different ways can six numbers be selected?

$${}_{53}C_6$$

22,957,480



Permutation or Combination?

8) From a deck of 52 cards, how many 5 card hands can be drawn for a poker game?

9) How many different seating charts can I make for my Algebra II class of 25 students?

10) If a locker combination must have 3 different numbers using the numbers from 1 to 10, how many possible locker combinations are possible?

11) For AP English, you are required to read 3 books from a list of 12 novels over summer vacation. How many different groups of books can you select?

Kahoot



Homework 6.7

NON Calculator:

p. 348 #5, 8, 9

WITH Calculator:

p. 348 # 10, 15, 18, 19, 21, 22, 29,
30, 46-49, 56

