Wednesday, May 20, 2020

Begin: Outcomes, Probability, and Statistics

Multiplication Counting Principle:

Stated simply, it is the idea that if there are M ways of doing something and N ways of doing another thing, then there are M•N ways of performing both things.

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

Factorial is usually used if you are arranging ALL of the available items.

Permutation:

An arrangement of items when order DOES matter.

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

n= total # items

r = # arranging at a time

You want to order a custom paint that is a mixture of 2 colors. If there are only 4 colors to choose from, how many different custom 2 color mixtures are possible?

Colors:

- Red
- Blue
- Green
- Purple

RB RG RP

BG BP GP

There are 6 different custom colors.

Does order matter in this situation? → NO, because you are going to mix them together.

The previous problem introduces a new concept.

Combination:

Selecting a number of items when order DOESN'T matter.

Combination Formula: When order DOESN'T matter

Number of ways to choose **r** items from a total of **n** items.

$$ {}_nC_r = \frac{n!}{r!\,(n-r)!} $$

n= total # items

r = # selecting at a time

${}_9C_2 = 36$

There are 36 ways to choose 2 things when there are 9 total to pick from and the oder you select them doesn't mattet.

Many scientific and most graphing calculators can do Combinations. Look through your User's Guide.

I've also put a link to an online Combination calculator on my blog in the "Helpful Math Resources and Math Links" page.

You want to order a custom paint that is a mixture of 2 colors. If there are only 4 colors to choose from, how many different custom 2 color mixtures are possible?

Colors:

- Red
- Blue
- Green
- Purple

Because the order you choose the colors doesn't matter, they will be mixed together, you can answer this using a Combination:

$_4C_2 = 6$

You order a shake at an ice cream shop. There are 7 ingrediants to choose from. You buy a shake that contains 4 ingredients. How many different shakes are possible?

- Does this situation represent a Combination or a Permuation?
- Combination - because the ingredients are going to be blended together it doesn't matter in what order they were put into the blender.
- $_7C_4 = 35$

You are taking a test with 10 problems but you only have to choose 5 of them to complete. All problems are worth the same amount of points and are of the same degree of difficulty. How may ways can you choose 5 of these problems to do?

- Combination or Permutation?
- Combination: Since they are all worth the same it doesn't matter the order you select them.
- $_{10}C_5 = 252$

There are 24 students in the class.

How many ways could President, Vice-President, and Secretary be assigned?

Permutation. $_{24}P_3 = 12{,}144$ ways

How many ways could a committee of 3 students be picked to meet with the principal?

Combination. $_{24}C_3 = 2024$ ways

This "combination" lock has the numbers from 0 to 39.

Let's assume a "combo" to this lock is 3 different numbers.

Why is the phrase Combination Lock not a good name?

Because the order you input the #'s is important!

It should actually be called a Permuation Lock.

Find all possible "combos".

$${}_{40}P_3 = 59{,}280$$

There are 10 swimmers in a race. How many ways can the gold, silver, and bronze medals be awarded?

Combination or Permutation?

Permutation: the order in which you finish is important.

${}_{10}P_3 = 720$ ways

There are 10 swimmers on a team. How many ways can three co-captains be selected?

Combination or Permutation?

Combination: the order in which Co-Captains are picked ISN'T important.

${}_{10}C_3 = 120$ ways

You have to reshelve 8 books at the library.

a. How many ways can you arrange all of these books on a shelf?

${}_8P_8$ or $8! = 40{,}320$ ways

b. How many ways can you arrange 5 of these books on a shelf?

${}_8P_5 = 6720$ ways

or: $8 \times 7 \times 6 \times 5 \times 4 = 6720$

There are 8 books from the library that you want to read but you can only check out a maximum of three books at a time. How many ways can you check out three of these books?

This is a COMBINATION because when you check them out of the library it doesn't matter in what order you do this.

$_8C_3 = 56$

You can now finish Practice #28.

Practice #28 will be due on Thursday, May 21 by 10:00 pm.