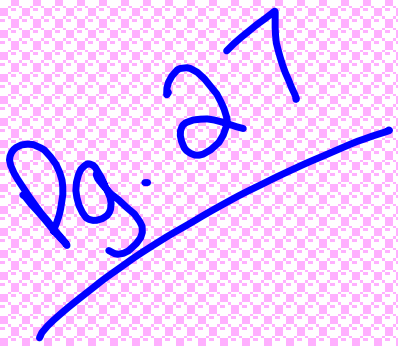
# Permutations Vs. Combinations



## Finishing a Race

"arrangements"

- Step 1: Permutations are the number of different ways you can arrange (order) a group of objects.
- Factorial starts with a number and multiplies by each smaller number down to 1.
- *n*!
- For example, how many ways can all 8 people finish a race? like phone #, license plate, PIN

  8 X 7 X 6 X 5 X 4 X 3 X 2 X 1

  8! = 8•7•6•5•4•3•2•1 = ~~5040~~ 40,320
- Note: your calculator has a factorial button. Find it! Math- Prob- 4: !

$_3P_3 = 3 \times 2 \times 1 = 6$ 1,2,3 1,3,2 2,1,3 2,3,1 3,1,2 3,2,1

## Finishing a Race (cont.)

arrangement

- For example, how many different ways are there for 8 runners to finish 1st, 2nd, and 3rd?
- First and Second and Third Place

$$\underset{1st}{8} \times \underset{2nd}{7} \times \underset{3rd}{6} = 336$$

- That is, we want the "permutations of 8 things taken 3 at a time."
- We write it this way: $_8P_3$ — arrange 3 of them; to choose from

Math - Prob - 2:nPr

## Finishing a Race (cont.)

- And to solve this, we need just need to count 8•7•6 = 336.
- Factorial notation works well and will chop off the part we don't need.
- Our formula works like this:

$$_8P_3 = \frac{8!}{5!} = \frac{8 \cdot 7 \cdot 6 \cdot \cancel{5} \cdot \cancel{4} \cdot \cancel{3} \cdot \cancel{2} \cdot \cancel{1}}{\cancel{5} \cdot \cancel{4} \cdot \cancel{3} \cdot \cancel{2} \cdot \cancel{1}} = 8 \cdot 7 \cdot 6 = 336$$

## Finishing a Race (cont.)

- We call the number of ways to *arrange* any *r* items from a group of *n* different items permutations of *n* objects *r* at a time.

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

don't need to know

- ORDER MATTERS!!!
- And guess what? Your calculator probably has a permutations button, too!

Math- Prob- 2: nPr

# Kuta Software - Permutations vs. Combinations

**State if each scenario involves a permutation or a combination. Then find the number of possibilities.**

5) Castel and Joe are planning trips to three countries this year. There are 7 countries they would like to visit. One trip will be one week long, another two days, and the other two weeks. P

$_7P_3 = 210$

$7 \times 6 \times 5$

7) You are setting the combination on a three-digit lock. ~~You want to use the numbers 123 but don't care what order they are in.~~ order matters

$_3P_3 = 6$

$3 \times 2 \times 1$

## Choosing a Group Of Items

- Step 2: Combinations are the number of different ways you can ~~arrange~~ choose a group of objects, BUT
- When you don't care about what order the things are in.
- For example, when you order a triple scoop ice cream ~~cone~~ bowl, you probably don't care what order the delicious flavors are in on the ~~cone~~ bowl.
- How many ways can 3 people be chosen from 8 people to represent the class? Order doesn't matter.

## Choosing a Group Of Items(cont.)

- We call the number of ways to *select* any *r* items from a group of *n* different items combinations of *n* objects chosen *r* at a time.

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

don't need to know

- Since there are *r* choices, we can rearrange them *r*! different ways. So we divide by this amount.
- And guess what? Your calculator probably has a combinations button, too!

math- Prob- nCr

**State if each scenario involves a permutation or a combination. Then find the number of possibilities.**

6) There are 110 people at a meeting. They each shake hands with everyone else. How many handshakes were there?

8) A group of 25 people are going to run a race. The top 8 finishers advance to the finals. order doesn't matter

$_{25}C_8 = 1,081,575$

Kuta Software - Infinite Algebra 2

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# Permutations vs Combinations

**State if each scenario involves a permutation or a combination.**

1) A team of 8 basketball players needs to choose a captain and ~~co-~~ captain.

1st.

Permutation order matters

2) Rob and Mary are planning trips to nine countries this year. There are 13 countries they would like to visit. They are deciding which countries to skip.

Combination order doesn't matter

3) The batting order for seven players on a 12 person team.

order matters

Permutation

4) There are 45 applicants for three Computer Programmer positions.

order doesn't matter

Combination

**State if each scenario involves a permutation or a combination. Then find the number of possibilities.**

choose
↳ positions, places, ores

9) A team of 17 softball players needs to choose three players to refill the water cooler.

$_{17}C_3 = 680$

10) 5 out of 13 students will ride in a car instead of a van

$_{13}C_5 = 1287$

11) The student body of 10 students wants to elect a president, vice president, secretary, and treasurer.

$_{10}P_4 = 5040$

12) Selecting which seven players will be in the batting order on a 11 person team.

$_{11}C_7 = 330$ (not arranging the batting order)

13) There are 15 applicants for four jobs: Computer Programmer, Software Tester, Manager, and Systems Engineer.

$_{15}P_4 = 32,760$

14) A group of 45 people are going to run a race. The top three runners earn gold, silver, and bronze medals.

$_{45}P_3 = 85,140$

## Homework:

Permutations and Combinations
Worksheet - Multiples of 3

(3, 6, 9, 12, 15, 18, 21, 24, 27, 30)

calculate | P or C (don't calculate)

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