We are continuing in 10-8. There is only one new goal to write down and you can continue writing notes on whatever page you were using yesterday.

Objectives

Solve problems involving the Fundamental Counting Principle.

Solve problems involving permutations and combinations.

New

perm comb

Feb 7-12:03 PM

Remember...

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

$0!$ 1

A voicemail system uses a password that is 1 letter and 4 numbers. how many different voicemail passwords are possible?

$26 \cdot 10 \cdot 10 \cdot 10 \cdot 10$

$260{,}000$

Jan 30-10:02 AM

A **permutation** is a selection of a group of objects in which order is important.

matters!

A family of 3 plans to sit in the same row at a movie theater. How many ways can the family be seated in 3 seats?

List all possible groupings.

A, B, C B, A, C C, A, B
A, C, B B, C, A C, B, A

There are six different ways the family can sit.

Feb 7-12:15 PM

Sometimes you may not want to order an entire set of items. Suppose that you want to select and order 3 people from a group of 7.

First Person	Second Person	Third Person
7 choices	6 choices	5 choices

$\cdot$ $\cdot$ =

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Another way to find the possible permutations is to use factorials. You can divide the total number of arrangements by the number of arrangements that are not used. In the previous slide, there are 7 total people and 4 whose arrangements do not matter.

$$\text{arrangements of 7} = \frac{7!}{4!} = \frac{7 \cdot 6 \cdot 5 \cdot \mathbf{4 \cdot 3 \cdot 2 \cdot 1}}{\mathbf{4 \cdot 3 \cdot 2 \cdot 1}} = 210$$
$$\text{arrangements of 4}$$

This can be generalized as a formula, which is useful for large numbers of items.

Feb 7-12:26 PM

Permutations

NUMBERS	ALGEBRA
The number of permutations of 7 items taken 3 at a time is $_7P_3 = \frac{7!}{(7-3)!} = \frac{7!}{4!}$.	The number of permutations of n items taken r at a time is $_nP_r = \frac{n!}{(n-r)!}$.

$_9P_3 = \frac{9!}{(9-3)!} = \frac{9!}{6!} = \frac{9 \cdot 8 \cdot 7 \cdot 6!}{6!} = 504$

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$_7P_2 = \frac{7!}{(7-2)!} = \frac{7!}{5!} = \frac{7\cdot6\cdot5!}{5!} = 42$

$_5P_5 = \frac{5!}{(5-5)!} = \frac{5!}{0!} = \frac{5\cdot4\cdot3\cdot2\cdot1}{1} = 120$

Jan 30-10:12 AM

How many ways can a student government select a president, vice president, secretary, and treasurer from a group of 6 people?

$_6P_4 = \frac{6!}{(6-4)!} = \frac{6\cdot5\cdot4\cdot3\cdot2\cdot1}{2\cdot1} = 360$

YOUR TURN !

Awards are given out at a costume party. How many ways can "most creative," "silliest," and "best" costume be awarded to 8 contestants if no one gets more than one award?

$_8P_3 = \frac{8!}{5!} = 8\cdot7\cdot6 = 336$

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A **combination** is a grouping of items in which order does not matter. There are generally fewer ways to select items when order does not matter. For example, there are 6 ways to order 3 items, but they are all the same combination:

6 permutations → {ABC, ACB, BAC, BCA, CAB, CBA}

1 combination → {ABC}

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To find the number of combinations, the formula for permutations can be modified.

$$\text{number of permutations} = \frac{\text{ways to arrange all items}}{\text{ways to arrange items not selected}}$$

Because order does not matter, divide the number of permutations by the number of ways to arrange the selected items.

$$\text{number of combinations} = \frac{\text{ways to arrange all items}}{(\text{ways to arrange selected items})(\text{ways to arrange items not selected})}$$

Feb 7-2:04 PM

Combinations

NUMBERS	ALGEBRA
The number of combinations of 7 items taken 3 at a time is $_7C_3 = \frac{7!}{3!(7-3)!}$.	The number of combinations of n items taken r at a time is $_nC_r = \frac{n!}{r!(n-r)!}$.

$_9C_4 = \frac{9!}{(9-4)!\cdot4!} = \frac{9!}{5!\cdot4!} = \frac{9\cdot8\cdot7\cdot6\cdot5!}{5!\cdot4\cdot3\cdot2\cdot1} = 126$

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$_6C_2 =$

The swim team has 8 swimmers. Two swimmers will be selected to swim in the first heat. How many ways can the swimmers be selected?

$_8C_2 = \frac{8!}{6!\cdot2!} = \frac{8\cdot7\cdot6!}{6!\cdot2\cdot1} = 28$

Jan 30-10:28 AM

When deciding whether to use permutations or combinations, first decide whether order is important. Use a permutation if order matters and a combination if order does not matter.

1. There are 12 different-colored cubes in a bag. How many ways can Randall draw a set of 4 cubes from the bag? permutation combination

2. Six different books will be displayed in the library window. How many different arrangements are there? permutation or combination

4. The three best essays in a contest will receive gold, silver, and bronze stars. There are 10 essays. In how many ways can the prizes be awarded? permutation or combination

Jan 30-11:01 AM

Assignment:

10-8 day 2 worksheet

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