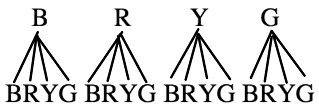
QUIZ B ANSWERS

1. a.



b. $4 \times 4 \times 4 = 64$

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2. a. 0, 1, 2, 3, 4, 5, 6, 7, 8, 9

b. $1/10 = 0.1$

c. $0 < 1/10 < 1$

$10(1/10) = 1$

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3. a. 8 outcomes!

b. 1/8 = 0.125

c. 4/8 = ½

CCC

ICC

CIC

CCI

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4. a. $2^{12} = 4096$

b. none wrong (or all right)

c. 4095/4096 = 0.99975586

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5. a. BBB, BGG, GBG, GGB, BBG, GBB, BGB, GGG

b. 1/8 = 0.125

c. .45 x .45 x .45 = 0.0911

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6. a. Whew – 32 outcomes…I'm not gonna list 'em all! (2^5)

b. 1/32 = 0.03125

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7. a. 4/52 = 0.0769

b. 13/52 = 0.25

c. 1/52 = 0.01923

d. *Yes, independent*

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BELLWORK

pile quiz B at your group

1. On a 13 question true/false test, what is the complement of getting at least 3 questions correct?

getting 0,1,2 correct

2. Michelle and Jim Bob Duggar from 19 Kids and Counting have 20 kids. If the have a 21st child, what would be the total number of possible outcomes for all of their kids?

$2^{21} = 2{,}097{,}152$

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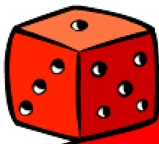
Permutation & Combination



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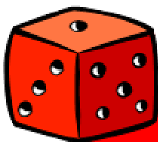
Fundamental Counting Principal

If an experiment is composed of *k* trials performed in a definite order, where the first trial has n_1 possible outcomes, the second trial has n_2 possible outcomes, and so on, then the number of possible outcomes for the experiment is:

$$n_1 \cdot n_2 \cdot n_3 \cdots\cdots n_k$$



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Example

How many different ways are there to create a license plate if the first three characters must be numbers from 0 - 9 and the next three characters must be letters A - Z?

#	#	#	a b c	a b c	a b c

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

$= 17{,}576{,}000$

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Example

Inside Box 1 are blue marbles #1-5
Box 2 contains red marbles #1-7
Box 3 has green marbles #1-6

How many outcomes are possible if you pick two blue, three red, and two green (in order) without returning the marbles?

$5 \cdot 4 \cdot 7 \cdot 6 \cdot 5 \cdot 6 \cdot 5$

$= 126000$

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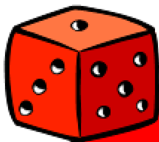
Example

If you had Amy, Beth, Carl, Dan, and Earl at a dinner party, how many different ways can you arrange them for dinner?

Example:

ABCDE ABCED ABDCE
ABDEC ACBDE ...

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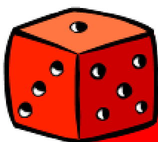
Example

If you had Amy, Beth, Carl, Dan, and Earl at a dinner party, how many different ways can you arrange them for dinner?

$5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 = 120$

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FACTORIAL

Factorial Notation - Used with the Fundamental Counting Rule as a shortcut if all items are used.

$$n! = n \cdot (n-1) \cdot (n-2) \cdot \ldots \cdot 2 \cdot 1$$

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Example

$5! = 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 = 120$

$10! = 10 \cdot 9 \cdots\cdots 2 \cdot 1 = 3{,}628{,}800$

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Example

In your P.E. class, there are 8 students. One of the activities is to race across the field. How many different outcomes could result from this race?

$8 \cdot 7 \cdot 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1$

$= 40320$

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Time to try some problems!!
Whoop whoop!

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BELLWORK

How many license plates are possible if you can have three letters followed by three non-zero digits?

$26 \cdot 26 \cdot 26 \cdot 9 \cdot 9 \cdot 9 = 12{,}812{,}904$

How many three letter words are possible where the first letter is a consonant followed by a vowel followed by a consonant that you did not already use?

$21 \cdot 5 \cdot 20 = 2100$

At Yogurtology, if you have 2 choices of bowl size, 7 choices of yogurt, and 22 choices of toppings, how many different yogurt combinations are there?

$2 \cdot 7 \cdot 22 = 308$

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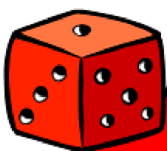
GOOD MORNING

Have out...

- Notebook
- ~~Homework~~
- ~~Bellwork~~
- Calculator



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In your P.E. class, there are 8 students. One of the activities is to race across the field. How many different 1st, 2nd, and 3rd place finishers could result from this race?

How many racers could come in first? 8

How many racers could come in second? 7

How many racers could come in third? 6

$$\frac{8\cdot7\cdot6\cdot\cancel{5}\cdot\cancel{4}\cdot\cancel{3}\cdot\cancel{2}\cdot\cancel{1}}{\cancel{5}\cdot\cancel{4}\cdot\cancel{3}\cdot\cancel{2}\cdot\cancel{1}} = 8\cdot7\cdot6$$

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In your P.E. class, there are 8 students. One of the activities is to race across the field. How many different 1st, 2nd, and 3rd place finishers could result from this race?

In other words... we don't care about 4th - 8th place finishers. How can we eliminate them from our factorial formula?

$$8\bullet7\bullet6\bullet5\bullet4\bullet3\bullet2\bullet1$$

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PERMUTATION

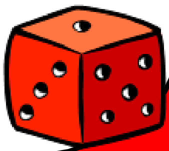
Permutations - Use the fundamental counting rule (in factorial form) then eliminate the factors we don't want.

- the number of ways to arrange in order **n** distinct objects, taking them **r** at a time. Order is important!!!

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

P.O.M.

Perm Order Matters



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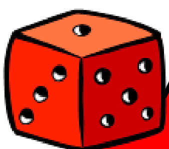
Example

What would happen if you had $\frac{10!}{3!}$?

$$\frac{10\cdot9\cdot8\cdot7\cdot6\cdot5\cdot4\cdot\cancel{3}\cdot\cancel{2}\cdot\cancel{1}}{\cancel{3}\cdot\cancel{2}\cdot\cancel{1}}$$

What if you had $\frac{12!}{10!}$?

$$\frac{12\cdot11\cdot\cancel{10}\cdot\cancel{9}\cdots}{\cancel{10}\cdot\cancel{9}\cdot\cancel{8}\cdots}$$



Pretty sweet huh?!?

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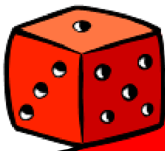
Example

Calculate the number of ordered seating arrangements we have for eight people in 5 chairs.

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

$$_8P_5 = \frac{8\cdot 7\cdot 6\cdot 5\cdot 4\cdot \cancel{3\cdot 2\cdot 1}}{\cancel{3\cdot 2\cdot 1}}$$

$$= \boxed{6{,}720}$$



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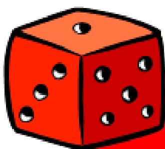
Example

If you had Amy, Beth, Carl, Dan, and Earl at a dinner party, but you only have enough food for 3, who can be served?

Ex: ~~BCA~~

ABC	ABD	ABE
ACD	ACE	...



What's different?

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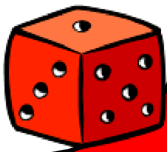
COMBINATIONS

<u>Combinations-</u> if order is not important, then use combinations.

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



C.O.D.

order doesn't matter

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Example

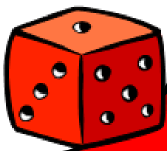
Calculate the combinations of choosing 3 people from 5 to eat dinner.

$$ {}_{n}C_{r} = \frac{n!}{r!(n-r)!} \quad (n=5,\ r=3) = \frac{5!}{3!\,2!} $$

$$ = \frac{5\cdot\cancel{4}^{2}\cdot\cancel{3\cdot 2\cdot 1}}{\cancel{3\cdot 2\cdot 1}\cdot\cancel{2}\cdot 1} = \boxed{10} $$

calc:

$5!/(3!(5-3)!)$



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CALCULATOR!!

MATH --> PRB --> $_nC_r$ and $_nP_r$

Calculators rule the world!

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Example

A department has 30 members and a committee of 5 people is needed to carry out a task. How many different committees are possible?

Does order matter? no C

$_{30}C_5 = 142{,}506$

[redacted]

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Example

A department has 30 members and a committee of 5 people is needed to carry out a task. There will be a chairperson, vice chairperson, treasurer, secretary, and technician. How many different committees are possible?

Does order matter? yes P

$${}_{30}P_5 = 17,100,720$$

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Example

A department has 30 members and a committee of 5 people is needed to carry out a task. There will be a chairperson and 4 members. How many different committees are possible?

Does order matter?

$$\frac{30}{C.P.}\left({}_{29}C_4\right) = 712,530$$

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Review

Fundamental Counting Principal

$n_1 \cdot n_2 \cdot n_3 \cdot .... \cdot n_k$

Factorial Notation

$n! = n \cdot (n-1) \cdot (n-2) \cdot ... \cdot 2 \cdot 1$

Permutation

order matters (POM)

Combination

order doesn't matter (COD)

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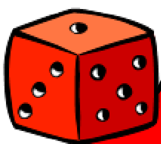
TRY IT!!

So I have 4 people - Amy, Beth, Carl, and Dan - and I want to pick 3 of them to go on a vacation with me, how many ways can I do this?



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TRY IT!!

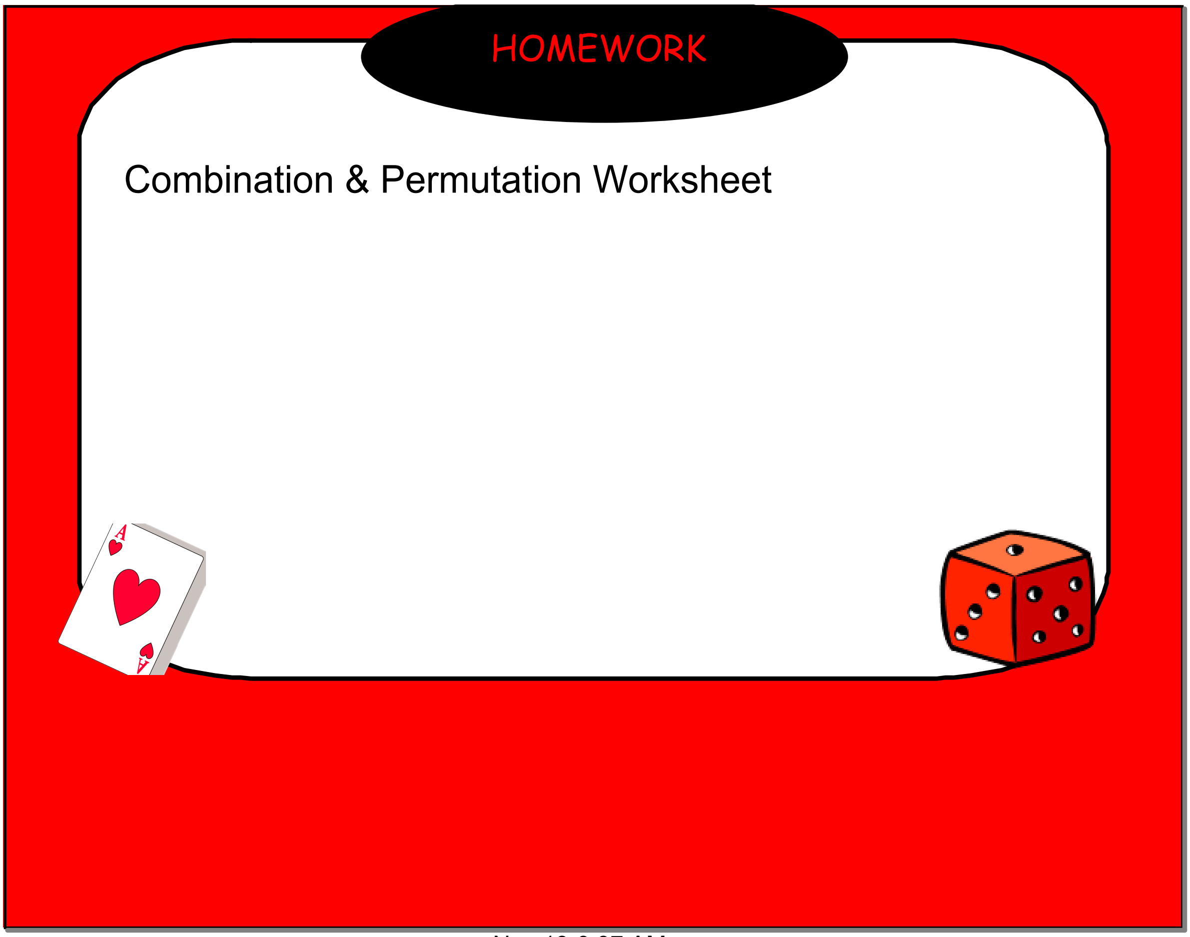
How is this different than their seating arrangement on the airplane on our way to that vacation?

TRY IT!!

1. How many ways can you arrange 4 people for a photograph in a straight line?

2. What if I only want 2 of them?

3. What if I just need 2 of the 4 for a picture?



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