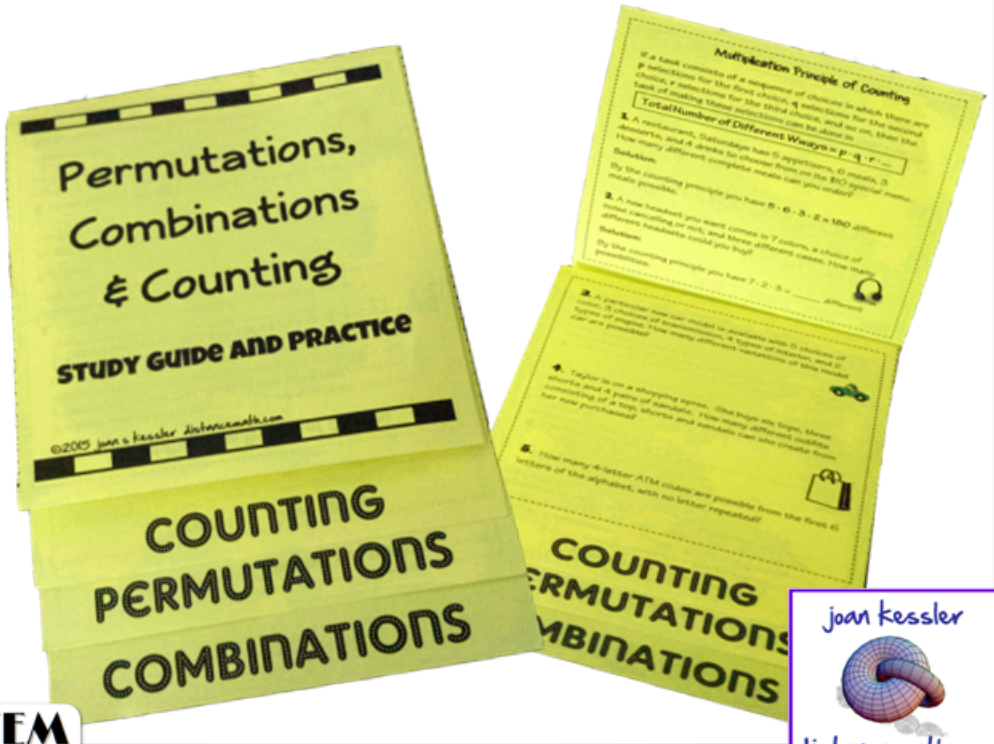
Combinations & Permutations

FLIP BOOK



STEM

joan kessler

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Product Description

This Flip Book includes Combinations, Permutations, and Counting Principles taught in most Algebra classes and in Statistics.

There are 19 problems for students to complete including a challenge problem on the back which is great for differentiation and early finishers. This makes a great study guide.

The Flip Book is a perfect size for traditional or Interactive Notebooks, or just to use for studying before a test. Final size 4 ¼" x 6½"

This is so easy to make, no glue, no mess. Print one page double-sided, make one cut, fold, staple – tah dah!! Even a caveman could do it.

Great practice and lots of fun!

Also included is a Flipbook with the solution key.

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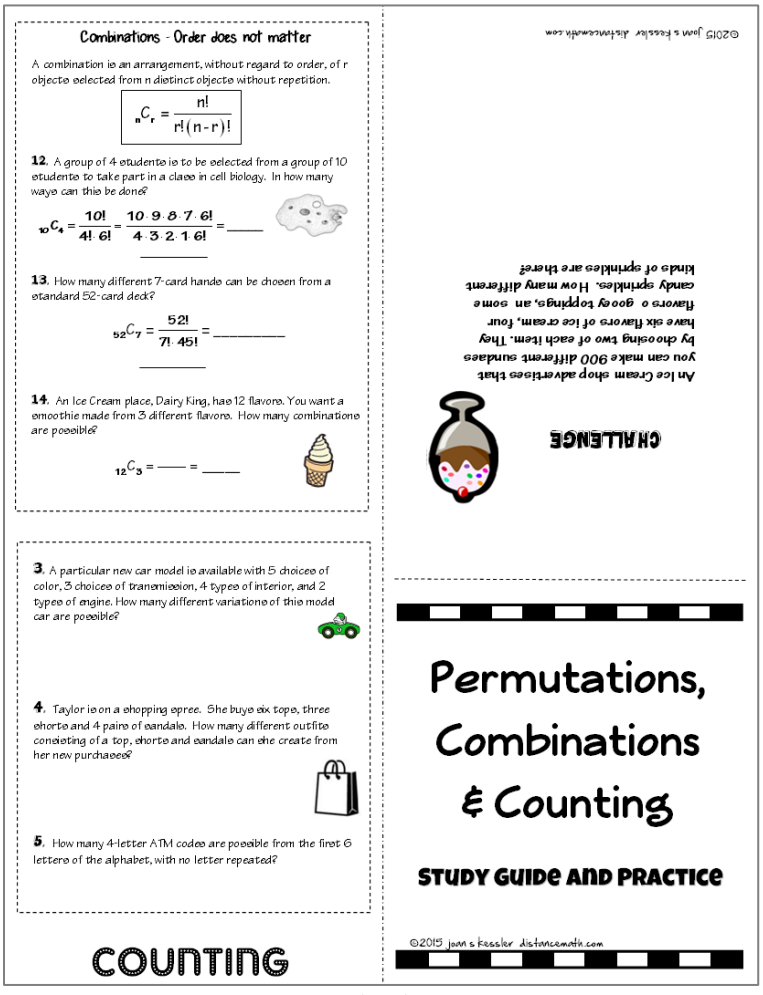
Directions

1. Print pages 6 and 7 back to back. Make sure you choose Flip on Short Edge from your printer settings.

(Also follow these directions for pages 8-9 for solution key.)

2. Cut on dotted vertical line.



Combinations - Order does not matter

A combination is an arrangement, without regard to order, of r objects selected from n distinct objects without repetition.

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

12. A group of 4 students is to be selected from a group of 10 students to take part in a class in cell biology. In how many ways can this be done?

$$ {}_{10}C_4 = \frac{10!}{4!\,6!} = \frac{10\cdot 9\cdot 8\cdot 7\cdot 6!}{4\cdot 3\cdot 2\cdot 1\cdot 6!} = \_\_\_\_ $$

13. How many different 7-card hands can be chosen from a standard 52-card deck?

$$ {}_{52}C_7 = \frac{52!}{7!\,45!} = \_\_\_\_\_ $$

14. An Ice Cream place, Dairy King, has 12 flavors. You want a smoothie made from 3 different flavors. How many combinations are possible?

$$ {}_{12}C_3 = \_\_\_\_ = \_\_\_\_ $$

3. A particular new car model is available with 5 choices of color, 3 choices of transmission, 4 types of interior, and 2 types of engine. How many different variations of this model car are possible?

4. Taylor is on a shopping spree. She buys six tops, three shorts and 4 pairs of sandals. How many different outfits consisting of a top, shorts and sandals can she create from her new purchases?

5. How many 4-letter ATM codes are possible from the first 6 letters of the alphabet, with no letter repeated?

COUNTING

CHALLENGE

An Ice Cream shop advertises that you can make 900 different sundaes by choosing two of each item. They have six flavors of ice cream, four flavors o gooey toppings, an some candy sprinkles. How many different kinds of sprinkles are there?

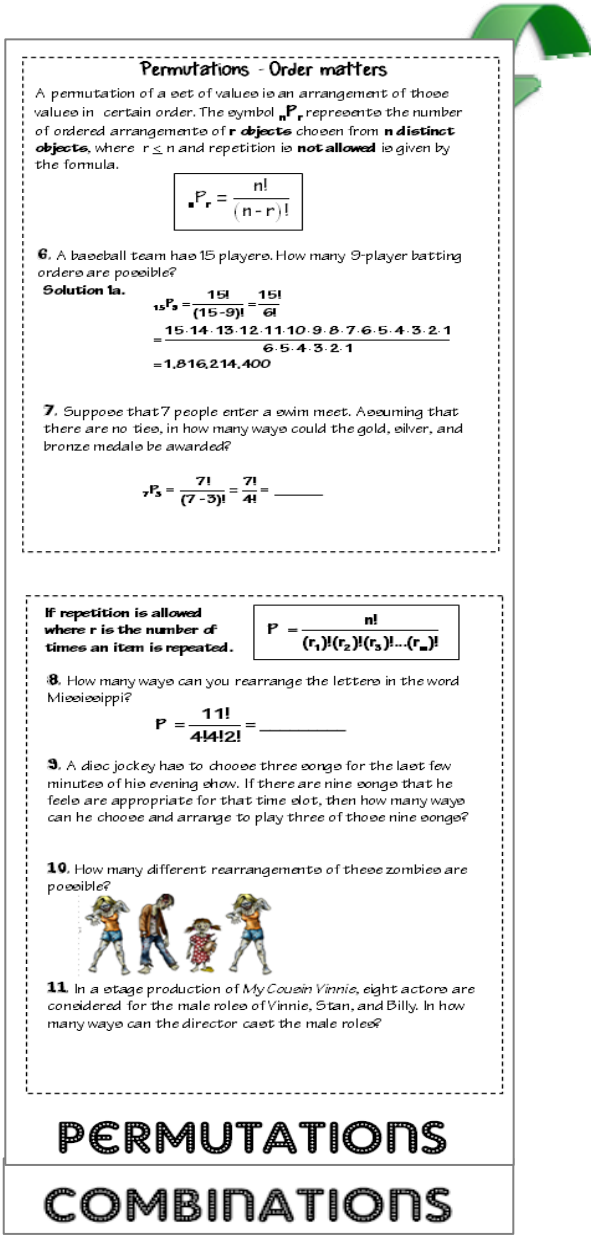
Permutations, Combinations & Counting

STUDY GUIDE AND PRACTICE

3. Arrange strips as shown on next page

Directions

3. Arrange strips as shown below.



Permutations - Order matters

A permutation of a set of values is an arrangement of those values in certain order. The symbol ${}_nP_r$ represents the number of ordered arrangements of **r objects** chosen from **n distinct objects**, where $r \leq n$ and repetition is **not allowed** is given by the formula.

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

6. A baseball team has 15 players. How many 9-player batting orders are possible?

Solution 1a.

$${}_{15}P_9 = \frac{15!}{(15-9)!} = \frac{15!}{6!}$$

$$= \frac{15 \cdot 14 \cdot 13 \cdot 12 \cdot 11 \cdot 10 \cdot 9 \cdot 8 \cdot 7 \cdot 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1}{6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1}$$

$$= 1,816,214,400$$

7. Suppose that 7 people enter a swim meet. Assuming that there are no ties, in how many ways could the gold, silver, and bronze medals be awarded?

$${}_7P_3 = \frac{7!}{(7-3)!} = \frac{7!}{4!} = \_\_\_\_\_$$

If repetition is allowed where r is the number of times an item is repeated.

$$P = \frac{n!}{(r_1)!(r_2)!(r_3)!\ldots(r_n)!}$$

8. How many ways can you rearrange the letters in the word Mississippi?

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9. A disc jockey has to choose three songs for the last few minutes of his evening show. If there are nine songs that he feels are appropriate for that time slot, then how many ways can he choose and arrange to play three of those nine songs?

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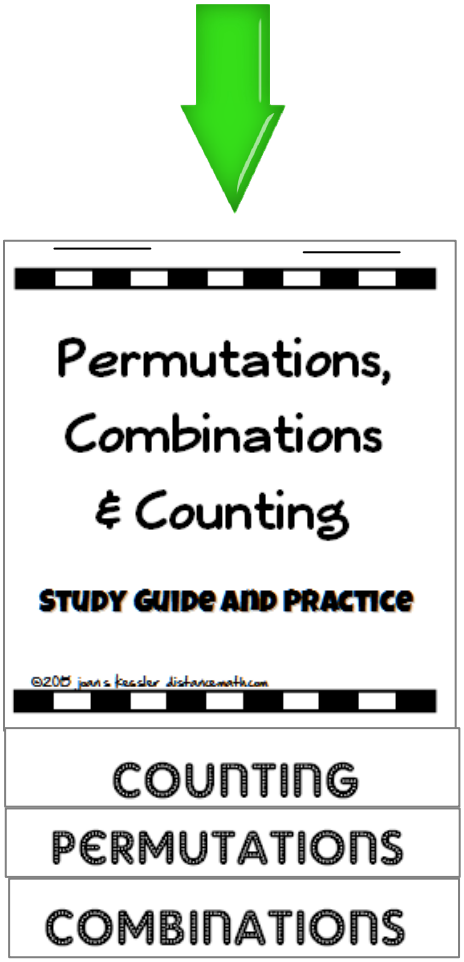
11. In a stage production of *My Cousin Vinnie*, eight actors are considered for the male roles of Vinnie, Stan, and Billy. In how many ways can the director cast the male roles?

PERMUTATIONS

COMBINATIONS

4. Flip the top over. Staple.



Permutations, Combinations & Counting

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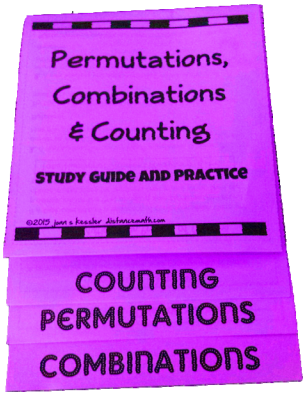
COUNTING

PERMUTATIONS

COMBINATIONS

HAVE FUN WITH COLORED PAPER.



Permutations, Combinations & Counting

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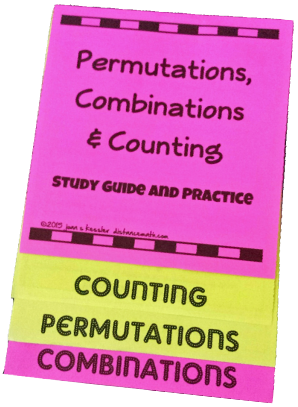

Permutations, Combinations & Counting

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STUDY GUIDE AND PRACTICE

CHALLENGE

An Ice Cream shop advertises that you can make 900 different sundaes by choosing two of each item. They have six flavors of ice cream, four flavors o gooey toppings, an some candy sprinkles. How many different kinds of sprinkles are there?

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4. Taylor is on a shopping spree. She buys six tops, three shorts and 4 pairs of sandals. How many different outfits consisting of a top, shorts and sandals can she create from her new purchases?

5. How many 4-letter ATM codes are possible from the first 6 letters of the alphabet, with no letter repeated?

COUNTING

Combinations - Order does not matter

A combination is an arrangement, without regard to order, of r objects selected from n distinct objects without repetition.

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

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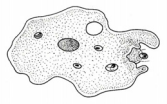

$$ {}_{10}C_4 = \frac{10!}{4!\cdot 6!} = \frac{10\cdot 9\cdot 8\cdot 7\cdot 6!}{4\cdot 3\cdot 2\cdot 1\cdot 6!} = \underline{\quad} $$

13. How many different 7-card hands can be chosen from a standard 52-card deck?

$$ {}_{52}C_7 = \frac{52!}{7!\cdot 45!} = \underline{\quad} $$

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$$ {}_{12}C_3 = \underline{\quad} = \underline{\quad} $$

Permutations - Order matters

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

6. A baseball team has 15 players. How many 9-player batting orders are possible?

Solution 1a.

$$ {}_{15}P_9 = \frac{15!}{(15-9)!} = \frac{15!}{6!} $$
$$ = \frac{15 \cdot 14 \cdot 13 \cdot 12 \cdot 11 \cdot 10 \cdot 9 \cdot 8 \cdot 7 \cdot 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1}{6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1} $$
$$ = 1{,}816{,}214{,}400 $$

7. Suppose that 7 people enter a swim meet. Assuming that there are no ties, in how many ways could the gold, silver, and bronze medals be awarded?

$$ {}_7P_3 = \frac{7!}{(7-3)!} = \frac{7!}{4!} = \_\_\_\_\_ $$

If repetition is allowed where r is the number of times an item is repeated.

$$ P = \frac{n!}{(r_1)!(r_2)!(r_3)!\ldots(r_m)!} $$

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11. In a stage production of *My Cousin Vinnie*, eight actors are considered for the male roles of Vinnie, Stan, and Billy. In how many ways can the director cast the male roles?

Multiplication Principle of Counting

If a task consists of a sequence of choices in which there are **p** selections for the first choice, **q** selections for the second choice, **r** selections for the third choice, and so on, then the task of making these selections can be done in

Total Number of Different Ways = $p \cdot q \cdot \ldots$

1. A restaurant, Saturdays has 5 appetizers, 6 meals, 3 desserts, and 2 drinks to choose from on its $10 special menu. How many different complete meals can you order?

Solution:

By the counting principle you have $5 \cdot 6 \cdot 3 \cdot 2 = 180$ different meals possible.

2. A new headset you want comes in 7 colors, a choice of noise canceling or not, and three different cases. How many different headsets could you buy?

Solution:

By the counting principle you have $7 \cdot 2 \cdot 3 =$ _____ different possibilities.

15. There are 25 students in the school chorus. Five students are to be selected to perform in the Mayor's Parade. How many ways can they choose this team of five students?

16. A movie theater has 17 new release movie posters. How many ways can the manager choose 8 for a promotion?

17. How many games will be played in a 10-team league if each team plays every other team exactly once?

18. How many three topping pizzas can be ordered given the topping menu on the right? (3 different toppings)

Toppings		
onion	zucchini	red peppers
green peppers	mushrooms	french fries
broccoli	olives	green beans
cheese	pineapple	pickles

PERMUTATIONS

COMBINATIONS

Permutations, Combinations & Counting

STUDY GUIDE AND PRACTICE

CHALLENGE

An Ice Cream shop advertises that you can make 900 different sundaes by choosing two of each item. They have six flavors of ice cream, four flavors o gooey toppings, an some candy sprinkles. How many different kinds of sprinkles are there?

Answer is 5 different kinds of candy sprinkles.

$${}_6C_2 \cdot {}_4C_2 \cdot {}_xC_2 = 10$$

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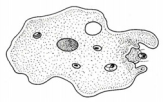

$${}_{10}C_4 = \frac{10!}{4!\cdot 6!} = \frac{10\cdot 9\cdot 8\cdot 7\cdot 6!}{4\cdot 3\cdot 2\cdot 1\cdot 6!} = 210$$

13. How many different 7-card hands can be chosen from a standard 52-card deck?

$${}_{52}C_7 = \frac{52!}{7!\cdot 45!} = 133{,}784{,}560$$

14. An Ice Cream place, Dairy King, has 12 flavors. You want a smoothie made from 3 different flavors. How many combinations are possible?

$${}_{12}C_3 = \frac{12!}{3!\cdot 4!} = 220$$

3. A particular new car model is available with 5 choices of color, 3 choices of transmission, 4 types of interior, and 2 types of engine. How many different variations of this model car are possible?

$$5\times 3\times 4\times 2 = 120$$

4. Taylor is on a shopping spree. She buys six tops, three shorts and 4 pairs of sandals. How many different outfits consisting of a top, shorts and sandals can she create from her new purchases?

$$6\times 3\times 4 = 72$$

5. How many 4-letter ATM codes are possible from the first 6 letters of the alphabet, with no letter repeated?

$$6\times 5\times 4\times 3 = 360$$

COUNTING

Permutations - Order matters

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Solution 1a.

$$ {}_{15}P_9 = \frac{15!}{(15-9)!} = \frac{15!}{6!} $$
$$ = \frac{15\cdot14\cdot13\cdot12\cdot11\cdot10\cdot9\cdot8\cdot7\cdot6\cdot5\cdot4\cdot3\cdot2\cdot1}{6\cdot5\cdot4\cdot3\cdot2\cdot1} $$
$$ = 1{,}816{,}214{,}400 $$

7. Suppose that 7 people enter a swim meet. Assuming that there are no ties, in how many ways could the gold, silver, and bronze medals be awarded?

$$ {}_7P_3 = \frac{7!}{(7-3)!} = \frac{7!}{4!} = 210 $$

If repetition is allowed where r is the number of times an item is repeated.

$$ P = \frac{n!}{(r_1)!(r_2)!(r_3)!\ldots(r_m)!} $$

8. How many ways can you rearrange the letters in the word Mississippi?

$$ P = \frac{11!}{4!4!2!} = 34{,}650 $$

9. A disc jockey has to choose three songs for the last few minutes of his evening show. If there are nine songs that he feels are appropriate for that time slot, then how many ways can he choose and arrange to play three of those nine songs?

$$ {}_9P_3 = 504 $$

10. How many different rearrangements of these zombies are possible?

$$ P = \frac{4!}{2!} = 12 $$

11. In a stage production of *My Cousin Vinnie*, eight actors are considered for the male roles of Vinnie, Stan, and Billy. In how many ways can the director cast the male roles?

$$ {}_8P_3 = \frac{8!}{(8-3)!} = \frac{8!}{5!} = 336 $$

Multiplication Principle of Counting

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Total Number of Different Ways = p · q · r ...

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Solution.

By the counting principle you have $5 \cdot 6 \cdot 3 \cdot 2 = 180$ different meals possible.

2. A new headset you want comes in 7 colors, a choice of noise canceling or not, and three different cases. How many different headsets could you buy?

Solution.

By the counting principle you have $7 \cdot 2 \cdot 3 = 42$ different possibilities.

15. There are 25 students in the school chorus. Five students are to be selected to perform in the Mayor's Parade. How many ways can they choose this team of five students?

$$ {}_{25}C_5 = \frac{25!}{5!\cdot20!} = 53{,}130 $$

16. A movie theater has 17 new release movie posters. How many ways can the manager choose 8 for a promotion?

$$ {}_{17}C_8 = \frac{17!}{8!9!} = 24{,}310 $$

17. How many games will be played in a 10-team league if each team plays every other team exactly once?

$$ {}_{10}C_2 = \frac{10!}{2!8!} = 45 $$

18. How many three topping pizzas can be ordered given the topping menu on the right? (3 different toppings)

$$ {}_{12}C_3 = \frac{12!}{3!9!} = 220 $$

Toppings		
onion	zucchini	red peppers
green peppers	mushrooms	french fries
broccoli	olives	green beans
cheese	pineapple	pickles

PERMUTATIONS

COMBINATIONS