Name_____Date_____

PERMUTATIONS

Permutations are the different ways to arrange a given set of objects. The word ***arrange*** or ***order*** found in a story problem are key words which mean permutation.

Permutations are often confused with combinations. Order is important with permutations. With combinations, order is not important. For example, if a pizza has 3 toppings it is considered one combination. If you rearrange the toppings on the pizza, it is the same combination. If you were asked how many different orders can you place the toppings on top when making the pizza, it then becomes a permutation because the problem wanted to know the ORDER.

When a problem asks you to find ALL possible arrangements of the entire set of objects, perform a factorial on the number of objects. Example: How many ways can you arrange the letters MATH?

There are 4 letters in the word math so solve by finding 4 factorial which is expressed as 4!.

4! = 4 x 3 x 2 x 1 ----------> 4! = 24 arrangements

When you have to arrange ***some*** of all objects, you must perform the nPr function. nPr means to arrange some of all. ***n =*** all objects available. P = permutations(arrangements) r = amount you choose.

$_7P_3$ means you want to see how many arrangements you can make when choosing 3 objects out of 7.

Start out like a normal factorial starting with 7, but only multiply the first three terms in the factorial.

7 x 6 x 5 and then solve. 7 x 6 x 5 = 210 ways to choose 3 out of 7 items.

Solve

1) 5!

5 x 4 x 3 x 2 x 1

120

2) 7!

7 x 6 x 5 x 4 x 3 x 2 x 1

5,040

3) 4!

4 x 3 x 2 x 1

24

4) 3!

3 x 2 x 1

6

5) 8!

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

40,320

6) How many ways can you arrange the letters F R I E N D ?

6! = 720 ways

7) How many different 5 digit zip codes can be made by using the digits 1 3 5 7 and 9? Assume that each digit is used only one time for each mailbox number.

5! = 120 ways

8) Grace has 7 flavors of jelly beans. How many different orders can Grace eat 4 of the jelly beans?

$_7P_4$ =7 x 6 x 5 x 4 = 840

9) Kevin, Jake, Bianca and Janine ran a race. How many possible orders can they finish the race?

4! = 4 x 3 x 2 x 1 = 24 possible orders

10) Eric works at the local art museum. He has 10 pieces of art to choose from, but he can only hang 3 of the frames. How many possible ways can Eric choose and then arrange three frames?

$_{10}P_3$ = 10 x 9 x 8 = 720 possibilities

11) If Gabrielle rented four movies and she watches two of them tonight, in how many orders can she watch two movies?

$_4P_2$ = 4 x 3 = 12 different orders.

12) Kendrick rented 8 horror movies. How many possible orders can Kendrick watch all 8 movies?

8! = 8 x 7 x 6 x 5 x 4 x 3 x 2 x 1 = 40,320 orders.

13) How many permutations can you make with the letters A through F?

6! = 6 x 5 x 4 x 3 x 2 x 1 = 720 permutations

14) How many permutations can you use create choosing three letters from V W X Y and Z?

$_5P_3$ = 5 x 4 x 3 = 60 permutations

15) If there are 9 players on a baseball team, how many ways can you pick someone to bat first and second?

$_9P_2$ = 9 x 8 = 72 possible arrangements.

16) How many ways can Morgan, Justin and Blake stand in line?

3! = 3 x 2 x1 = 6 ways