Worksheet A2 : Fundamental Counting Principle, Factorials, Permutations Intro

1. A restaurant offers four sizes of pizza, two types of crust, and eight toppings. How many possible combinations of pizza with one topping are there?

$$4 \cdot 2 \cdot 8 = 64$$

2. How many ways can 5 paintings be line up on a wall?

$$5! = 120$$

3. Rob has 4 shirts, 3 pairs of pants, and 2 pairs of shoes that all coordinate. How many outfits can you put together?

$$4 \cdot 3 \cdot 2 = 24$$

4. Grace loves to eat salad! How many salads can she put together if she can pick out one type of lettuce from 2 choices, one vegetable from 4 choices and one dressing from 7 choices?

$$2 \cdot 4 \cdot 7 = 56$$

5. PA license plates have 3 letters followed by 4 numbers.

    a. If the same letter or number can be repeated, how many can be made?

$$26 \cdot 26 \cdot 26 \cdot 10 \cdot 10 \cdot 10 \cdot 10 = 175760000$$

    b. If the same letter CANNOT be repeated, how many can be made?

$$26 \cdot 25 \cdot 24 \cdot 10 \cdot 10 \cdot 10 \cdot 10 = 156000000$$

6. How many 5-digit numbers can be formed (using 0 – 9)?

$$10 \cdot 10 \cdot 10 \cdot 10 \cdot 10 = 10^5 = 100000$$

7. How many 5-digit numbers can be formed if each one uses all the digits 0, 1, 2, 3, 4 without repetition?

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

8. In how many ways can 6 bicycles be parked in a row?

$$6! = 720$$

6. Find the number of permutations of the letters of these words:

   a. DEED $\quad=\quad \dfrac{4!}{2!\,2!} = \boxed{6}$

   b. COMMITTEE $\quad \dfrac{9!}{2!\,2!\,2!} = 45360$

   c. CINCINNATI $\quad \dfrac{10!}{2!\,3!\,3!} = 50\,400$

7. A player in a word game has the letters E, E, B, D, G, G, G. In how many ways can these letters be arranged?
   $$\dfrac{7!}{2!\,3!} = 420$$

8. Find the number of permutations of six colors on a spinner.
   $$(6 \div 1)! = 5! = 120$$

9. Find the number of ways 10 cheerleaders and make a circular formation.
   $$(10 - 1)! = 9! = 362,880$$

Worksheet F2 : More Combinations

Use the combinations formula to simplify each problem.

1. $\binom{9}{5} =$ 126

2. $\binom{50}{2} =$ 1225

3. $\binom{12}{8} =$ 495

4. $\binom{n}{n} =$ 1

$$\boxed{\dfrac{n^2 + n}{2}}$$

5. $\binom{n}{n-1} = \dfrac{n!}{(n-r)! \, r!} = \dfrac{n!}{[n-(n-1)]! \,(n-1)!}$

$\dfrac{n!}{1! \,(n-1)!} = \dfrac{n!}{(n-1)!} = \boxed{n}$

6. $\binom{n+1}{n-1} \to n \atop \to r$ $\dfrac{(n+1)!}{[(n+1)-(n-1)]! \,(n-1)!}$

$\dfrac{(n+1)!}{2! \,(n-1)!} = \dfrac{(n+1)(n)(n-1)}{2 \cdot 1 \,(n-1)}$

7. How many basketball games are played in a 10-team league if each team plays all other teams TWICE?

8. Of the first 8 questions on a test, a student must answer 6. Of the next 7 questions, 4 must be answered. In how many ways can this be done?

$$(8 \, C \, 6)(7 \, C \, 4) = 980$$

9. Irene's Ice Cream serves 10 flavors of ice cream, 4 kinds of syrup, and 6 varieties of toppings. How many different Sundaes can you make if each has 2 flavors of ice cream, 2 kinds of syrup, and 3 toppings?

$$(10 \, C \, 2)(4 \, C \, 2)(6 \, C \, 3) = 5400$$