Permutations and Combinations

Permutation - The number of permutations of *n* items at a time.

$$_nP_r \qquad \frac{n!}{(n-r)!} \qquad _{12}P_3 \qquad \frac{12!}{(12-3)!} = \frac{12!}{9!} \quad \text{(order matters)}$$

$$\frac{12 \times 11 \times 10 \times 9!}{9!} = 1320$$

Combinations - The number of combinations of *n* items of a set chosen *r* items at a time is: (order does not matter)

$$_nC_r \qquad \frac{n!}{r!(n-r)!} \qquad _{12}C_3 \qquad \frac{12!}{3!(12-3!)} = \frac{12 \times 11 \times 10 \times 9!}{3!(9!)} = \frac{12 \times 11 \times 10}{3 \times 2 \times 1}$$

$$= 220$$

Fundamental Counting Principal - If event M can occur in *m* ways and is followed by even N that can occur in *n* ways, then even M followed by even N can occur *m(n)* ways.

Factorial - an arrangement of items in a particular order. (!)

$$9! = 9 \times 8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1$$

Permutations and Combinations

1) How many 2-letter pairs of 1 vowel and 1 consonant can you make from the English alphabet? Consider "y" to be a consonant.

$$\left( {}_5P_1 \right)\left( {}_{21}P_1 \right)$$
$$5(21) = 105$$

2) A contest winner gets to choose 1 of 8 possible vacations and bring 1 of 10 friends with her. How many different ways could the contest winner select her prize?

$$\left( {}_8P_1 \right)\left( {}_{10}P_1 \right)$$
$$8(10) = 80$$

**Evaluate each expression.**

3) $8!$

$40,320$

4) $\dfrac{11!}{9!} = 110$

5) $6! \, 4! = 17,280$

Find the number of permutations in the following problems.

6) $_{12}P_{10}$ = 239,500,800

7) $_{12}P_5$ = 95040

8) In how many ways can four distinct positions for a relay race be assigned from a team of nine runners?

$_9P_4$ = 3024

**Evaluate each expression.**

9) $_{12}C_{10}$

66

10) $_{12}C_1 = 12$

11) $4(_7C_3)$

$4(35)$

$= 140$

12) $_5C_4 + _5C_3$

$5 + 10 = 15$

13) You draw the names of 5 raffle winners from a basket of 50 names. Each person wins the same prize. How many different groups of winners could you draw?

$$_nC_r \qquad _{50}C_5 = 2,118,760$$

14) How many different 5-letter codes can you make from the letters in the word *cipher*?

$$_nP_r = \ _6P_5 = 720$$