

Name Key

Date _____

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?

$$(4)(2)(8) = 64$$

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?

$$26 \cdot 26 \cdot 26 \cdot 10 \cdot 10 \cdot 10 \cdot 10 = 175,760,000$$

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

$$26 \cdot 25 \cdot 24 \cdot 10 \cdot 10 \cdot 10 \cdot 10 = 15,600,000$$

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

$$\cancel{(10^5) = 252}$$

$$10^5 = 100,000$$

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

$$5! = 120$$

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

$$6! = 720$$

9. Evaluate (show all your work):

a. $6! = 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 = 720$

b. $9! = 9 \cdot 8 \cdot 7 \cdot 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 = 362,880$

c. $10! = 10 \cdot 9 \cdot 8 \cdot 7 \cdot 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 = 9! \cdot 10 = 3,628,800$

10. Rewrite $10!$ with a factor of $8!$ (Hint: $10 \cdot 9 \cdot 8!$)

11. $\frac{5!}{2!} = \frac{5 \cdot 4 \cdot 3 \cdot 2 \cdot 1}{2 \cdot 1} = 5 \cdot 4 \cdot 3 = 60$

12. $\frac{10!}{8!} = 10 \cdot 9 = 90$

13. $\frac{25!}{20!} = 25 \cdot 24 \cdot 23 \cdot 22 \cdot 21 = 6,375,600$

14. $\frac{12!}{(12-7)!} = 12 \cdot 11 \cdot 10 \cdot 9 \cdot 8 \cdot 7 \cdot 6 \cdot 5 \cdot 4 = 79,833,600$

15. $\frac{12!}{9!3!} = \frac{12 \cdot 11 \cdot 10}{3 \cdot 2 \cdot 1} = 220$

16. In how many ways can 7 different cards be laid out on a table in a row?

$7! = 5,040$

Name _____

Date _____

Worksheet B2 : Permutations

1. A lock contains 3 dials, each with ten digits. How many possible sequences of numbers exist?

$$10P_3 = 720$$

2. Four students are to be chosen from a group of 10 to fill the positions of president, vice-president, treasurer and secretary. In how many ways can this be accomplished?

$$10P_4 = 5,040$$

3. How many ways can the letters MATH be arranged?

$$4! = 24$$

4. A shelf can hold 7 trophies. How many ways can the trophies be arranged if there are 10 trophies available?

$$10P_7 = 604,800$$

5. Bill has three pairs of pants, 5 shirts and 2 pairs of shoes. How many outfits can he make?

$$3 \cdot 5 \cdot 2 = 30$$

Name _____

Date _____

Worksheet C2 : All Types of Permutations

1. How many 5-number license plates can be made using the digits 0, 1, 2, 3, 4, 5, if

a. repetitions ARE allowed

$$6^5 = 7776$$

b. repetitions are NOT allowed

$$6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 = 720$$

2. A teacher wants to write an ordered 4-question test from a pool of 12 questions. How many different forms of the test can the teacher write?

$${}_{12}P_4 = 11,880$$

3. How many 5-number license plates can be made using the digits 1, 2, 3, 4, 5, 6, 7, if an odd digit must come first and

a. repetitions ARE allowed

$$4 \cdot 7 \cdot 7 \cdot 7 \cdot 7 = 9,604$$

b. repetitions are NOT allowed

$$4 \cdot 6 \cdot 5 \cdot 4 \cdot 3 = 1,440$$

4. Assume the same situation as #3, but tell me how many EVEN license plates can be made if repetitions ARE allowed.

$$3 \cdot 7 \cdot 7 \cdot 7 \cdot 7 = 7,203$$

5. In how many ways can 4 blue, 3 red, and 2 green flags be arranged on a pole?

$$9! = 362,880$$

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

a. DEED

$$\frac{4!}{2!2!} = 6$$

b. COMMITTEE

$$\frac{9!}{2!2!2!} = 45360$$

c. CINCINNATI

$$\frac{10!}{2!3!3!} = 50400$$

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?

$$\frac{7!}{2!3!} = 420$$

8. Find the number of permutations of six colors on a spinner.

9. Find the number of ways 10 cheerleaders can make a circular formation.

Name _____

Date _____

Worksheet E2 : Combinations

Use the combinations formula to simplify each problem.

$$1. {}_9C_4 = \frac{9!}{5!4!} = 126$$

$$2. {}_4C_4 = 1$$

$$3. {}_9C_0 = 1$$

$$4. {}_{40}C_3 = 9,880$$

$$5. {}_{12}C_4 = 495$$

$$6. {}_{12}C_8 = 495$$

7. How many different 12-member juries be chosen from a pool of 32 people?

$${}_{32}C_{12} = 225,792,840$$

8. A test consists of 20 questions, but you are told to answer only 15. In how many different ways can you choose the 15 questions?

$${}_{20}C_{15} = 15,504$$

9. How many ways can nine starting players be chosen from a softball team of 15?

$${}_{15}C_9 = 5,005$$

10. Four seniors will speak at graduation. If 30 students audition to speak, how many different groups of 4 speakers can be selected?

$${}_{30}C_4 = 27,405$$

Name _____

Date _____

Worksheet F2 : More Combinations

Use the combinations formula to simplify each problem.

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

$$2. \binom{50}{2} = 1,225$$

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

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

~~$$5. \binom{n}{n-1} =$$~~

~~$$6. \binom{n+1}{n-1} =$$~~

- ~~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?

$$\binom{8}{6} \binom{7}{4} = 980$$

- ~~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?

$$\binom{10}{2} \binom{4}{2} \binom{6}{3} = 5400$$

Name _____

Date _____

Worksheet G2: Mixed Combinatorics

Decide if the problem is an example of a permutation or combination. Then evaluate each one. Show proper notation, and your work.

- Comb.* 1. How many teams of 4 horses would be made if there were 9 horses in the stable?

$${}^9C_4 = 126$$

- Perm.* 2. A lock manufacturer uses the numbers 1 - 30 in its combinations. How many different combinations for the lock are there if it uses 3-number combinations?

$$30^3 = 27,000$$

- Perm.* 3. Mike has nine baseball trophies to arrange on the shelf. How many different ways can they be arranged?

$$9! = 362,880$$

- Comb.* 4. In math class, there are 24 students. The teacher picks 4 students to help do a demonstration. How many different groups of 4 could she have chosen?

$${}_{24}C_4 = 19,626$$

- Perm.* 5. In how many ways can 10 people wait in line for concert tickets?

$$10! = 3,628,800$$

- Comb.* 6. The teacher has listed 30 books as book report options. You must read 5. How many different sets of 5 books could you have chosen to read?

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

- Comb.* 7. How many different ways are there to purchase 2 CD's, 3 DVD's and 1 set of headphones if there are 7 CD titles, 5 DVD titles, and 3 types of headphones available?

$$\binom{7}{2} \binom{5}{3} \binom{3}{1} = 630$$