Name _____ Date _____ Class _____

LESSON 11-1

Practice B

Permutations and Combinations

Use the Fundamental Counting Principle.

1. The soccer team is silk-screening T-shirts. They have 4 different colors of T-shirts and 2 different colors of ink. How many different T-shirts can be made using one ink color on a T-shirt? _____

2. A travel agent is offering a vacation package. Participants choose the type of tour, a meal plan, and a hotel class from the table below.

Tour	Meal	Hotel
Walking	Restaurant	4-Star
Boat	Picnic	3-Star
Bicycle		2-Star
		1-Star

How many different vacation packages are offered? _____

Evaluate.

3. $\frac{3!6!}{3!}$ _____

4. $\frac{10!}{7!}$ _____

5. $\frac{9! - 6!}{(9 - 6)!}$ _____

Solve.

6. In how many ways can the debate team choose a president and a secretary if there are 10 people on the team? _____

7. A teacher is passing out first-, second-, and third-place prizes for the best student actor in a production of *Hamlet*. If there are 14 students in the class, in how many different ways can the awards be presented? _____

Evaluate.

8. ${}_5P_4$ _____

9. ${}_3C_2$ _____

10. ${}_8P_3$ _____

Solve.

11. Mrs. Marshall has 11 boys and 14 girls in her kindergarten class this year.

a. In how many ways can she select 2 girls to pass out a snack? _____

b. In how many ways can she select 5 boys to pass out new books? _____

c. In how many ways can she select 3 students to carry papers to the office? _____

LESSON 11-1

Practice A

Permutations and Combinations

Use the Fundamental Counting Principle.

1. For her aquarium, Susan can choose from 4 types of fish and 3 types of plants. If she chooses one type of fish and one type of plant, how many different aquariums can Susan set up? **12**

2. Lottery numbers in a particular state consist of 6 digits. Each lottery ball that is drawn has six sides, numbered 1–6. How many different lottery numbers are possible? **46,656**

Evaluate.

3. $5!$ **120**

4. $\frac{6!}{2!}$ **360**

5. $\frac{2!3!}{4!}$ **$\frac{1}{2}$**

Solve.

6. For an art exhibit, Craig has to choose 3 ceramic mugs out of the 7 that he made over the summer. In how many ways can he arrange these 3 mugs in a row? **210 ways**

7. The members of a track team want to choose a team captain and someone to organize their equipment. In how many ways can 2 people be chosen from a team of 10 girls? **90 ways**

Evaluate.

8. ${}_4P_3$ **24**

9. ${}_3C_2$ **3**

10. ${}_5P_2$ **20**

11. ${}_5C_2$ **10**

12. ${}_8P_4$ **1680**

13. ${}_6C_1$ **6**

Solve.

14. While on vacation, Sandra wants to buy 2 wallets. There are 7 different patterns she can choose from. In how many ways can Sandra choose 2 different wallets? **21 ways**

15. Vince chooses 3 side dishes from a total of 10 side dishes offered on the menu. In how many different ways can he choose his side dishes? **120 ways**

LESSON 11-1

Practice B

Permutations and Combinations

Use the Fundamental Counting Principle.

1. The soccer team is silk-screening T-shirts. They have 4 different colors of T-shirts and 2 different colors of ink. How many different T-shirts can be made using one ink color on a T-shirt? **8 T-shirts**

2. A travel agent is offering a vacation package. Participants choose the type of tour, a meal plan, and a hotel class from the table below.

Tour	Meal	Hotel
Walking	Restaurant	4-Star
Boat	Picnic	3-Star
Bicycle		2-Star
		1-Star

How many different vacation packages are offered? **24 packages**

Evaluate.

3. $\frac{3!6!}{3!}$ **720**

4. $\frac{10!}{7!}$ **720**

5. $\frac{9! - 6!}{(9 - 6)!}$ **60,360**

Solve.

6. In how many ways can the debate team choose a president and a secretary if there are 10 people on the team? **90 ways**

7. A teacher is passing out first-, second-, and third-place prizes for the best student actor in a production of *Hamlet*. If there are 14 students in the class, in how many different ways can the awards be presented? **2184 ways**

Evaluate.

8. ${}_5P_4$ **120**

9. ${}_3C_2$ **3**

10. ${}_8P_3$ **336**

Solve.

11. Mrs. Marshall has 11 boys and 14 girls in her kindergarten class this year.

   a. In how many ways can she select 2 girls to pass out a snack? **91 ways**

   b. In how many ways can she select 5 boys to pass out new books? **462 ways**

   c. In how many ways can she select 3 students to carry papers to the office? **2300 ways**

LESSON 11-1

Practice C

Permutations and Combinations

Evaluate.

1. $\frac{7! - 4!}{(6 - 3)!}$ **836**

2. $\frac{6!}{3!(8 - 5)!}$ **20**

3. $\frac{5!4!}{9!}$ **$\frac{1}{126}$**

4. ${}_{10}C_5$ **252**

5. ${}_7P_4$ **840**

6. ${}_{10}C_9$ **10**

Compare. Write >, <, or =.

7. ${}_8P_3 \square {}_6C_3$ **>**

8. ${}_{12}C_9 \square {}_{12}C_7$ **<**

9. ${}_9P_5 \square {}_{10}P_5$ **<**

Solve.

10. The door code to get into a top-secret laboratory is 6 digits. The first 3 digits of the code are all odd and the last 3 digits are all even. Digits can be used more than once. How many possible codes are there to gain access to this laboratory? **8000 codes**

11. In how many ways can a 3-digit number be formed using the numbers 0–9, if each digit is used only one time? **720 ways**

12. The principal of the high school selects 4 Merit Scholars to attend a Town Council meeting. If there are a total of 12 Merit Scholars at the school, in how many ways can the students be selected? **495 ways**

13. A board of trustees is made up of 10 people. The board is choosing a chairperson, a secretary, and a publicist. If they have already decided upon a chairperson, in how many ways can they choose a secretary and a publicist? **72 ways**

14. There are 8 marbles in a bag. If they are all different colors, in how many ways can 4 marbles be chosen? **70 ways**

15. A student in a biology laboratory has 7 plants to use in an experiment. One plant will act as the control, 3 will be subjected to Environment A, and 3 will be subjected to Environment B. In how many ways can the student choose the plants that will be subjected to Environment B? **35 ways**

16. Holly wants to choose 5 different decorative tiles out of 8. If she plans to place the 5 tiles in a row, end to end, in how many different ways can she arrange them, from left to right? **6720 ways**

LESSON 11-1

Reteach

Permutations and Combinations

A **permutation** is a selection of items from a group in which the order is important. In a permutation, *AB* is NOT the same as *BA*.

The number of permutations of n items taken r at a time is shown by the following formula.

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

The value of r must be less than or equal to the value of n.

How many ways can club members select a president, a vice president, a secretary, and a treasurer from a group of 10 members? Order matters since each office is different.

To find the number of permutations of 10 items taken 4 at a time, use $n = 10$ and $r = 4$ in the permutation rule. Then evaluate.

$$ {}_{10}P_4 = \frac{10!}{(10 - 4)!} = \frac{10!}{6!} = \frac{10 \cdot 9 \cdot 8 \cdot 7 \cdot \cancel{6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1}}{\cancel{6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1}} = 10 \cdot 9 \cdot 8 \cdot 7 = 5040 $$

Remember that $n!$ or "n factorial" means to find the product of the whole numbers from 1 to n.

There are 5040 ways to select the officers.

Evaluate.

1. $8!$ **40,320**

2. $5!$ **120**

3. $10!$ **3,628,800**

4. $\frac{6!}{3!}$ **120**

5. $\frac{9!}{4!}$ **15,120**

6. $\frac{15!}{14!}$ **15**

Solve.

7. How many ways can the letters from *A* through *H* be used to create 5-letter passwords is there are no repeated letters in a password?

   a. Does the order of the letters matter in the password? **Yes**

   b. How many letters are there from *A* through *H*? **8**

   c. Find the number of permutations of 8 letters taken 5 at a time.
   ${}_8P_5 = \frac{8!}{(8 - 5)!} =$ **6720**

8. An editor has 4 different spaces to arrange articles in a magazine. He must choose from 6 articles. How many different arrangements are possible?

   Write and evaluate the permutation rule to solve.

   $$ {}_6P_4 = \frac{6!}{(6 - 4)!} = 360 $$