

Study Guide and Intervention

The Counting Principle

Independent Events If the outcome of one event does not affect the outcome of another event and vice versa, the events are called **independent events**.

Fundamental Counting Principle

If event M can occur in m ways and is followed by event N that can occur in n ways, then the event M followed by the event N can occur in $m \cdot n$ ways.

Example

FOOD For the Breakfast Special at the Country Pantry, customers can choose their eggs scrambled, fried, or poached, whole wheat or white toast, and either orange, apple, tomato, or grapefruit juice. How many different Breakfast Specials can a customer order?

A customer's choice of eggs does not affect his or her choice of toast or juice, so the events are independent. There are 3 ways to choose eggs, 2 ways to choose toast, and 4 ways to choose juice. By the Fundamental Counting Principle, there are $3 \cdot 2 \cdot 4$ or 24 ways to choose the Breakfast Special.

Exercises

Solve each problem.

- The Palace of Pizza offers small, medium, or large pizzas with 14 different toppings available. How many different one-topping pizzas do they serve?
- The letters A, B, C, and D are used to form four-letter passwords for entering a computer file. How many passwords are possible if letters can be repeated?
- A restaurant serves 5 main dishes, 3 salads, and 4 desserts. How many different meals could be ordered if each has a main dish, a salad, and a dessert?
- Marissa brought 8 T-shirts and 6 pairs of shorts to summer camp. How many different outfits consisting of a T-shirt and a pair of shorts does she have?
- There are 6 different packages available for school pictures. The studio offers 5 different backgrounds and 2 different finishes. How many different options are available?
- How many 5-digit even numbers can be formed using the digits 4, 6, 7, 2, 8 if digits can be repeated?
- How many license plate numbers consisting of three letters followed by three numbers are possible when repetition is allowed?
- How many 4-digit positive even integers are there?

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Study Guide and Intervention *(continued)***The Counting Principle**

Dependent Events If the outcome of an event *does* affect the outcome of another event, the two events are said to be **dependent**. The Fundamental Counting Principle still applies.

Example **ENTERTAINMENT** The guests at a sleepover brought 8 videos. They decided they would only watch 3 videos. How many orders of 3 different videos are possible?

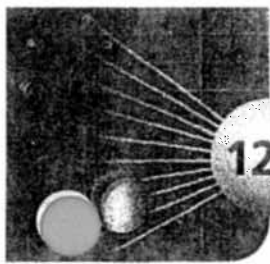
After the group chooses to watch a video, they will not choose to watch it again, so the choices of videos are dependent events.

There are 8 choices for the first video. That leaves 7 choices for the second. After they choose the first 2 videos, there are 6 remaining choices. Thus by the Fundamental Counting Principle, there are $8 \cdot 7 \cdot 6$ or 336 orders of 3 different videos.

Exercises

Solve each problem.

1. Three students are scheduled to give oral reports on Monday. In how many ways can their presentations be ordered?
2. In how many ways can the first five letters of the alphabet be arranged if each letter is used only once?
3. In how many different ways can 4 different books be arranged on the shelf?
4. How many license plates consisting of three letters followed by three numbers are possible when no repetition is allowed?
5. Sixteen teams are competing in a soccer match. Gold, silver, and bronze medals will be awarded to the top three finishers. In how many ways can the medals be awarded?
6. In a word-building game each player picks 7 letter tiles. If Julio's letters are all different, how many 3-letter combinations can he make out of his 7 letters?
7. The editor has accepted 6 articles for the news letter. In how many ways can the 6 articles be ordered?
8. There are 10 one-hour workshops scheduled for the open house at the greenhouse. There is only one conference room available. In how many ways can the workshops be ordered?
9. The top 5 runners at the cross-country meet will receive trophies. If there are 22 runners in the race, in how many ways can the trophies be awarded?



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Skills Practice

The Counting Principle

State whether the events are *independent* or *dependent*.

1. finishing in first, second, or third place in a ten-person race
2. choosing a pizza size and a topping for the pizza
3. Seventy-five raffle tickets are placed in a jar. Three tickets are then selected, one after the other, without replacing a ticket after it is chosen.
4. The 232 members of the freshman class all vote by secret ballot for the class representative to the Student Senate.

Solve each problem.

5. A surveying firm plans to buy a color printer for printing its maps. It has narrowed its choice to one of three models. Each of the models is available with either 32 megabytes of random access memory (RAM), 64 megabytes of RAM, or 128 megabytes of RAM. From how many combinations of models and RAM does the firm have to choose?
6. How many arrangements of three letters can be formed from the letters of the word *MATH* if any letter will not be used more than once?
7. Allan is playing the role of Oliver in his school's production of *Oliver Twist*. The wardrobe crew has presented Allan with 5 pairs of pants and 4 shirts that he can wear. How many possible costumes consisting of a pair of pants and a shirt does Allan have to choose from?
8. The 10-member steering committee that is preparing a study of the public transportation needs of its town will select a chairperson, vice-chairperson, and secretary from the committee. No person can serve in more than one position. In how many ways can the three positions be filled?
9. Jeanine has decided to buy a pickup truck. Her choices include either a V-6 engine or a V-8 engine, a standard cab or an extended cab, and 2-wheel drive or 4-wheel drive. How many possible models does she have to choose from?
10. A mail-order company that sells gardening tools offers rakes in two different lengths. Customers can also choose either a wooden, plastic, or fiberglass handle for the rake. How many different kinds of rakes can a customer buy?
11. A Mexican restaurant offers chicken, beef, or vegetarian fajitas wrapped with either corn or flour tortillas, and topped with either mild, medium, or hot salsa. How many different choices of fajitas does a customer have?

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Practice

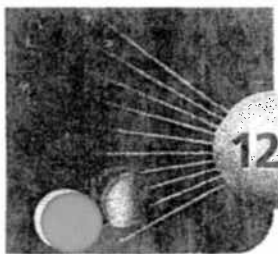
The Counting Principle

State whether the events are *independent* or *dependent*.

1. choosing an ice cream flavor and choosing a topping for the ice cream
2. choosing an offensive player of the game and a defensive player of the game in a professional football game
3. From 15 entries in an art contest, a camp counselor chooses first, second, and third place winners.
4. Jillian is selecting two more courses for her block schedule next semester. She must select one of three morning history classes and one of two afternoon math classes.

Solve each problem.

5. A briefcase lock has 3 rotating cylinders, each containing 10 digits. How many numerical codes are possible?
6. A golf club manufacturer makes irons with 7 different shaft lengths, 3 different grips, 5 different lies, and 2 different club head materials. How many different combinations are offered?
7. There are five different routes that a commuter can take from her home to the office. In how many ways can she make a round trip if she uses a different route coming than going?
8. In how many ways can the four call letters of a radio station be arranged if the first letter must be W or K and no letters repeat?
9. How many 7-digit phone numbers can be formed if the first digit cannot be 0 or 1, and any digit can be repeated?
10. How many 7-digit phone numbers can be formed if the first digit cannot be 0, and any digit can be repeated?
11. How many 7-digit phone numbers can be formed if the first digit cannot be 0 or 1, and if no digit can be repeated?
12. How many 7-digit phone numbers can be formed if the first digit cannot be 0, and if no digit can be repeated?
13. How many 6-character passwords can be formed if the first character is a digit and the remaining 5 characters are letters that can be repeated?
14. How many 6-character passwords can be formed if the first and last characters are digits and the remaining characters are letters? Assume that any character can be repeated.



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Study Guide and Intervention

Permutations and Combinations

Permutations When a group of objects or people are arranged in a certain order, the arrangement is called a **permutation**.

Permutations	The number of permutations of n distinct objects taken r at a time is given by $P(n, r) = \frac{n!}{(n-r)!}$.
Permutations with Repetitions	The number of permutations of n objects of which p are alike and q are alike is $\frac{n!}{p!q!}$.

The rule for permutations with repetitions can be extended to any number of objects that are repeated.

Example

From a list of 20 books, each student must choose 4 books for book reports. The first report is a traditional book report, the second a poster, the third a newspaper interview with one of the characters, and the fourth a timeline of the plot. How many different orderings of books can be chosen?

Since each book report has a different format, order is important. You must find the number of permutations of 20 objects taken 4 at a time.

$$\begin{aligned}
 P(n, r) &= \frac{n!}{(n-r)!} && \text{Permutation formula} \\
 P(20, 4) &= \frac{20!}{(20-4)!} && n = 20, r = 4 \\
 &= \frac{20!}{16!} && \text{Simplify.} \\
 &= \frac{20 \cdot 19 \cdot 18 \cdot 17 \cdot \overset{1}{\cancel{16}} \cdot \overset{1}{\cancel{15}} \cdot \dots \cdot \overset{1}{\cancel{1}}}{\underset{1}{\cancel{16}} \cdot \underset{1}{\cancel{15}} \cdot \dots \cdot \underset{1}{\cancel{1}}} && \text{Divide by common factors.} \\
 &= 116,280
 \end{aligned}$$

Books for the book reports can be chosen 116,280 ways.

Exercises

Evaluate each expression.

1. $P(6, 3)$

2. $P(8, 5)$

3. $P(9, 4)$

4. $P(11, 6)$

How many different ways can the letters of each word be arranged?

5. MOM

6. MONDAY

7. STEREO

8. **SCHOOL** The high school chorus has been practicing 12 songs, but there is time for only 5 of them at the spring concert. How many different orderings of 5 songs are possible?

Study Guide and Intervention (continued)**Permutations and Combinations**

Combinations An arrangement or selection of objects in which order is *not* important is called a combination.

Combinations	The number of combinations of n distinct objects taken r at a time is given by $C(n, r) = \frac{n!}{(n-r)!r!}$.
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Example 1

SCHOOL How many groups of 4 students can be selected from a class of 20?

Since the order of choosing the students is not important, you must find the number of combinations of 20 students taken 4 at a time.

$$C(n, r) = \frac{n!}{(n-r)!r!} \quad \text{Combination formula}$$

$$\begin{aligned} C(20, 4) &= \frac{20!}{(20-4)!4!} & n = 20, r = 4 \\ &= \frac{20!}{16!4!} \text{ or } 4845 \end{aligned}$$

There are 4845 possible ways to choose 4 students.

Example 2

In how many ways can you choose 1 vowel and 2 consonants from a set of 26 letter tiles? (Assume there are 5 vowels and 21 consonants.)

By the Fundamental Counting Principle, you can multiply the number of ways to select one vowel and the number of ways to select 2 consonants. Only the letters chosen matter, not the order in which they were chosen, so use combinations.

$C(5, 1)$ One of 5 vowels are drawn.

$C(21, 2)$ Two of 21 consonants are drawn.

$$\begin{aligned} C(5, 1) \cdot C(21, 2) &= \frac{5!}{(5-1)!1!} \cdot \frac{21!}{(21-2)!2!} & \text{Combination formula} \\ &= \frac{5!}{4!} \cdot \frac{21!}{19!2!} & \text{Simplify.} \\ &= 5 \cdot 210 \text{ or } 1050 & \text{Simplify.} \end{aligned}$$

There are 1050 combinations of 1 vowel and 2 consonants.

Exercises

Evaluate each expression.

1. $C(5, 3)$

2. $C(7, 4)$

3. $C(15, 7)$

4. $C(10, 5)$

5. PLAYING CARDS From a standard deck of 52 cards, in how many ways can 5 cards be drawn?

6. HOCKEY How many hockey teams of 6 players can be formed from 14 players without regard to position played?

7. COMMITTEES From a group of 10 men and 12 women, how many committees of 5 men and 6 women can be formed?

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Skills Practice

Permutations and Combinations

Evaluate each expression.

1. $P(6, 3)$
2. $P(8, 2)$
3. $P(2, 1)$
4. $P(3, 2)$
5. $P(10, 4)$
6. $P(5, 5)$
7. $C(2, 2)$
8. $C(5, 3)$
9. $C(4, 1)$
10. $C(8, 7)$
11. $C(3, 2)$
12. $C(7, 4)$

Determine whether each situation involves a *permutation* or a *combination*. Then find the number of possibilities.

13. seating 8 students in 8 seats in the front row of the school auditorium
14. introducing the 5 starting players on the Woodsville High School basketball team at the beginning of the next basketball game
15. checking out 3 library books from a list of 8 books for a research paper
16. choosing 2 movies to rent from 5 movies
17. the first-, second-, and third-place finishers in a race with 10 contestants
18. electing 4 candidates to a municipal planning board from a field of 7 candidates
19. choosing 2 vegetables from a menu that offers 6 vegetable choices
20. an arrangement of the letters in the word *rhombus*
21. selecting 2 of 8 choices of orange juice at a store
22. placing a red rose bush, a yellow rose bush, a white rose bush, and a pink rose bush in a row in a planter
23. selecting 2 of 9 kittens at an animal rescue shelter
24. an arrangement of the letters in the word *isosceles*

12-2

Practice

Permutations and Combinations

Evaluate each expression.

1. $P(8, 6)$
2. $P(9, 7)$
3. $P(3, 3)$
4. $P(4, 3)$
5. $P(4, 1)$
6. $P(7, 2)$
7. $C(8, 2)$
8. $C(11, 3)$
9. $C(20, 18)$
10. $C(9, 9)$
11. $C(3, 1)$
12. $C(9, 3) \cdot C(6, 2)$

Determine whether each situation involves a *permutation* or a *combination*. Then find the number of possibilities.

13. selecting a 4-person bobsled team from a group of 9 athletes
14. an arrangement of the letters in the word *Canada*
15. arranging 4 charms on a bracelet that has a clasp, a front, and a back
16. selecting 3 desserts from 10 desserts that are displayed on a dessert cart in a restaurant
17. an arrangement of the letters in the word *annually*
18. forming a 2-person sales team from a group of 12 salespeople
19. making 5-sided polygons by choosing any 5 of 11 points located on a circle to be the vertices
20. seating 5 men and 5 women alternately in a row, beginning with a woman
21. **STUDENT GROUPS** Farmington High is planning its academic festival. All math classes will send 2 representatives to compete in the math bowl. How many different groups of students can be chosen from a class of 16 students?
22. **PHOTOGRAPHY** A photographer is taking pictures of a bride and groom and their 6 attendants. If she takes photographs of 3 people in a group, how many different groups can she photograph?
23. **AIRLINES** An airline is hiring 5 flight attendants. If 8 people apply for the job, how many different groups of 5 attendants can the airline hire?
24. **SUBSCRIPTIONS** A school librarian would like to buy subscriptions to 7 new magazines. Her budget, however, will allow her to buy only 4 new subscriptions. How many different groups of 4 magazines can she choose from the 7 magazines?

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12-1 Study Guide and Intervention

The Counting Principle

Independent Events If the outcome of one event does not affect the outcome of another event and vice versa, the events are called **independent events**.

Fundamental Counting Principle If event M can occur in m ways and is followed by event N that can occur in n ways, then the event M followed by the event N can occur in $m \cdot n$ ways.

Example **FOOD** For the Breakfast Special at the Country Pantry, customers can choose their eggs scrambled, fried, or poached, whole wheat or white toast, and either orange, apple, tomato, or grapefruit juice. How many different Breakfast Specials can a customer order?

A customer's choice of eggs does not affect his or her choice of toast or juice, so the events are independent. There are 3 ways to choose eggs, 2 ways to choose toast, and 4 ways to choose juice. By the Fundamental Counting Principle, there are $3 \cdot 2 \cdot 4$ or 24 ways to choose the Breakfast Special.

Exercises

Solve each problem.

- The Palace of Pizza offers small, medium, or large pizzas with 14 different toppings available. How many different one-topping pizzas do they serve? 42
- The letters A, B, C, and D are used to form four-letter passwords for entering a computer file. How many passwords are possible if letters can be repeated? 256
- A restaurant serves 5 main dishes, 3 salads, and 4 desserts. How many different meals could be ordered if each has a main dish, a salad, and a dessert? 60
- Marissa brought 8 T-shirts and 6 pairs of shorts to summer camp. How many different outfits consisting of a T-shirt and a pair of shorts does she have? 48
- There are 6 different packages available for school pictures. The studio offers 5 different backgrounds and 2 different finishes. How many different options are available? 60
- How many 5-digit even numbers can be formed using the digits 4, 6, 7, 2, 8 if digits can be repeated? 2500
- How many license plate numbers consisting of three letters followed by three numbers are possible when repetition is allowed? 17,576,000
- How many 4-digit positive even integers are there? 4500

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12-1 Study Guide and Intervention

The Counting Principle

Dependent Events If the outcome of an event *does* affect the outcome of another event, the two events are said to be **dependent**. The Fundamental Counting Principle still applies.

Example **ENTERTAINMENT** The guests at a sleepover brought 8 videos. They decided they would only watch 3 videos. How many orders of 3 different videos are possible?

After the group chooses to watch a video, they will not choose to watch it again, so the choices of videos are dependent events.

There are 8 choices for the first video. That leaves 7 choices for the second. After they choose the first 2 videos, there are 6 remaining choices. Thus by the Fundamental Counting Principle, there are $8 \cdot 7 \cdot 6$ or 336 orders of 3 different videos.

Exercises

Solve each problem.

- Three students are scheduled to give oral reports on Monday. In how many ways can their presentations be ordered? 6
- In how many ways can the first five letters of the alphabet be arranged if each letter is used only once? 120
- In how many different ways can 4 different books be arranged on the shelf? 24
- How many license plates consisting of three letters followed by three numbers are possible when no repetition is allowed? 11,232,000
- Sixteen teams are competing in a soccer match. Gold, silver, and bronze medals will be awarded to the top three finishers. In how many ways can the medals be awarded? 3360
- In a word-building game each player picks 7 letter tiles. If Julio's letters are all different, how many 3-letter combinations can he make out of his 7 letters? 210
- The editor has accepted 6 articles for the news letter. In how many ways can the 6 articles be ordered? 720
- There are 10 one-hour workshops scheduled for the open house at the greenhouse. There is only one conference room available. In how many ways can the workshops be ordered? 3,628,800
- The top 5 runners at the cross-country meet will receive trophies. If there are 22 runners in the race, in how many ways can the trophies be awarded? 3,150,080

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Skills Practice

The Counting Principle

State whether the events are *independent* or *dependent*.

1. finishing in first, second, or third place in a ten-person race *dependent*
2. choosing a pizza size and a topping for the pizza *independent*
3. Seventy-five raffle tickets are placed in a jar. Three tickets are then selected, one after the other, without replacing a ticket after it is chosen. *dependent*
4. The 232 members of the freshman class all vote by secret ballot for the class representative to the Student Senate. *independent*

Solve each problem.

5. A surveying firm plans to buy a color printer for printing its maps. It has narrowed its choice to one of three models. Each of the models is available with either 32 megabytes of random access memory (RAM), 64 megabytes of RAM, or 128 megabytes of RAM. From how many combinations of models and RAM does the firm have to choose? 9
6. How many arrangements of three letters can be formed from the letters of the word **MATH** if any letter will not be used more than once? 24
7. Allan is playing the role of Oliver in his school's production of *Oliver Twist*. The wardrobe crew has presented Allan with 5 pairs of pants and 4 shirts that he can wear. How many possible costumes consisting of a pair of pants and a shirt does Allan have to choose from? 20
8. The 10-member steering committee that is preparing a study of the public transportation needs of its town will select a chairperson, vice-chairperson, and secretary from the committee. No person can serve in more than one position. In how many ways can the three positions be filled? 720
9. Jeanine has decided to buy a pickup truck. Her choices include either a V-6 engine or a V-8 engine, a standard cab or an extended cab, and 2-wheel drive or 4-wheel drive. How many possible models does she have to choose from? 8
10. A mail-order company that sells gardening tools offers rakes in two different lengths. Customers can also choose either a wooden, plastic, or fiberglass handle for the rake. How many different kinds of rakes can a customer buy? 6
11. A Mexican restaurant offers chicken, beef, or vegetarian fajitas wrapped with either corn or flour tortillas, and topped with either mild, medium, or hot salsa. How many different choices of fajitas does a customer have? 18

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Practice (Average)

The Counting Principle

State whether the events are *independent* or *dependent*.

1. choosing an ice cream flavor and choosing a topping for the ice cream *independent*
2. choosing an offensive player of the game and a defensive player of the game in a professional football game *independent*
3. From 15 entries in an art contest, a camp counselor chooses first, second, and third place winners. *dependent*
4. Jillian is selecting two more courses for her block schedule next semester. She must select one of three morning history classes and one of two afternoon math classes. *independent*

Solve each problem.

5. A briefcase lock has 3 rotating cylinders, each containing 10 digits. How many numerical codes are possible? 1000
6. A golf club manufacturer makes irons with 7 different shaft lengths, 3 different grips, 5 different lies, and 2 different club head materials. How many different combinations are offered? 210
7. There are five different routes that a commuter can take from her home to the office. In how many ways can she make a round trip if she uses a different route coming than going? 20
8. In how many ways can the four call letters of a radio station be arranged if the first letter must be W or K and no letters repeat? 27,600
9. How many 7-digit phone numbers can be formed if the first digit cannot be 0 or 1, and any digit can be repeated? 8,000,000
10. How many 7-digit phone numbers can be formed if the first digit cannot be 0, and any digit can be repeated? 9,000,000
11. How many 7-digit phone numbers can be formed if the first digit cannot be 0 or 1, and if no digit can be repeated? 483,840
12. How many 7-digit phone numbers can be formed if the first digit cannot be 0, and if no digit can be repeated? 544,320
13. How many 6-character passwords can be formed if the first character is a digit and the remaining 5 characters are letters that can be repeated? 118,813,760
14. How many 6-character passwords can be formed if the first and last characters are digits and the remaining characters are letters? Assume that any character can be repeated. 45,697,600

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Study Guide and Intervention (continued)

Permutations and Combinations

Combinations An arrangement or selection of objects in which order is *not* important is called a combination.

Combinations The number of combinations of n distinct objects taken r at a time is given by $C(n, r) = \frac{n!}{(n-r)!r!}$.

Example 1 SCHOOL How many groups of 4 students can be selected from a class of 20?

Since the order of choosing the students is not important, you must find the number of combinations of 20 students taken 4 at a time.

$$C(n, r) = \frac{n!}{(n-r)!r!} \quad \text{Combination formula}$$

$$C(20, 4) = \frac{20!}{(20-4)!4!} \quad n = 20, r = 4$$

$$= \frac{20!}{16!4!} \quad \text{or } 4845$$

There are 4845 possible ways to choose 4 students.

Example 2 In how many ways can you choose 1 vowel and 2 consonants from a set of 26 letter tiles? (Assume there are 5 vowels and 21 consonants.)

By the Fundamental Counting Principle, you can multiply the number of ways to select one vowel and the number of ways to select 2 consonants. Only the letters chosen matter, not the order in which they were chosen, so use combinations.

$$C(5, 1) \cdot C(21, 2) = \frac{5!}{(5-1)!1!} \cdot \frac{21!}{(21-2)!2!} \quad \text{Combination formula}$$

$$= \frac{5!}{4!} \cdot \frac{21!}{19!2!} \quad \text{Simplify.}$$

$$= 5 \cdot 210 \text{ or } 1050$$

There are 1050 combinations of 1 vowel and 2 consonants.

Exercises

Evaluate each expression.

- $C(5, 3)$ 10 2. $C(7, 4)$ 35 3. $C(15, 7)$ 6435 4. $C(10, 5)$ 252
- PLAYING CARDS** From a standard deck of 52 cards, in how many ways can 5 cards be drawn? 2,598,960
- HOCKEY** How many hockey teams of 6 players can be formed from 14 players without regard to position played? 3003
- COMMITTEES** From a group of 10 men and 12 women, how many committees of 5 men and 6 women can be formed? 232,848

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Study Guide and Intervention

Permutations and Combinations

Permutations When a group of objects or people are arranged in a certain order, the arrangement is called a permutation.

Permutations with Repetitions The number of permutations of n distinct objects taken r at a time is given by $P(n, r) = \frac{n!}{(n-r)!}$.

The number of permutations of n objects of which p are alike and q are alike is $\frac{n!}{p!q!}$.

The rule for permutations with repetitions can be extended to any number of objects that are repeated.

Example From a list of 20 books, each student must choose 4 books for book reports. The first report is a traditional book report, the second a poster, the third a newspaper interview with one of the characters, and the fourth a timeline of the plot. How many different orderings of books can be chosen?

Since each book report has a different format, order is important. You must find the number of permutations of 20 objects taken 4 at a time.

$$P(n, r) = \frac{n!}{(n-r)!} \quad \text{Permutation formula}$$

$$P(20, 4) = \frac{20!}{(20-4)!} \quad n = 20, r = 4$$

$$= \frac{20!}{16!}$$

$$= 20 \cdot 19 \cdot 18 \cdot 17 \cdot 16 \cdot 15 \cdot \dots \cdot 1 \quad \text{Simplify.}$$

$$= 116,280 \quad \text{Divide by common factors.}$$

Books for the book reports can be chosen 116,280 ways.

Exercises

Evaluate each expression.

- $P(6, 3)$ 120 2. $P(8, 5)$ 6720 3. $P(9, 4)$ 3024 4. $P(11, 6)$ 332,640
- MOM** 3 6. MONDAY 720 7. STEREO 360

How many different ways can the letters of each word be arranged?

- SCHOOL** The high school chorus has been practicing 12 songs, but there is time for only 5 of them at the spring concert. How many different orderings of 5 songs are possible? 95,040

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12-2 Skills Practice

Permutations and Combinations

Evaluate each expression.

1. $P(6, 3)$ 120
2. $P(8, 2)$ 56
3. $P(2, 1)$ 2
4. $P(3, 2)$ 6
5. $P(10, 4)$ 5040
6. $P(5, 5)$ 120
7. $C(2, 2)$ 1
8. $C(5, 3)$ 10
9. $C(4, 1)$ 4
10. $C(8, 7)$ 8
11. $C(3, 2)$ 3
12. $C(7, 4)$ 35

Determine whether each situation involves a *permutation* or a *combination*. Then find the number of possibilities.

13. seating 8 students in 8 seats in the front row of the school auditorium
permutation; 40,320
14. introducing the 5 starting players on the Woodsville High School basketball team at the beginning of the next basketball game
permutation; 120
15. checking out 3 library books from a list of 8 books for a research paper
combination; 56
16. choosing 2 movies to rent from 5 movies
combination; 10
17. the first-, second-, and third-place finishers in a race with 10 contestants
permutation; 720
18. electing 4 candidates to a municipal planning board from a field of 7 candidates
combination; 35
19. choosing 2 vegetables from a menu that offers 6 vegetable choices
combination; 15
20. an arrangement of the letters in the word *rhombus*
permutation; 5040
21. selecting 2 of 8 choices of orange juice at a store
combination; 28
22. placing a red rose bush, a yellow rose bush, a white rose bush, and a pink rose bush in a row in a planter
permutation; 24
23. selecting 2 of 9 kittens at an animal rescue shelter
combination; 36
24. an arrangement of the letters in the word *isosceles*
permutation; 30,240

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Glencoe Algebra 2

NAME _____

DATE _____

PERIOD _____

12-2 Practice (Average)

Permutations and Combinations

Evaluate each expression.

1. $P(8, 6)$ 20,160
2. $P(9, 7)$ 181,440
3. $P(3, 3)$ 6
4. $P(4, 3)$ 24
5. $P(4, 1)$ 4
6. $P(7, 2)$ 42
7. $C(8, 2)$ 28
8. $C(11, 3)$ 165
9. $C(20, 18)$ 190
10. $C(9, 9)$ 1
11. $C(3, 1)$ 3
12. $C(9, 3) \cdot C(6, 2)$ 1260

Determine whether each situation involves a *permutation* or a *combination*. Then find the number of possibilities.

13. selecting a 4-person bobbed team from a group of 9 athletes
combination; 126
14. an arrangement of the letters in the word *Canada*
permutation; 120
15. arranging 4 charms on a bracelet that has a clasp, a front, and a back
permutation; 24
16. selecting 3 desserts from 10 desserts that are displayed on a dessert cart in a restaurant
combination; 120
17. an arrangement of the letters in the word *annually*
permutation; 5040
18. forming a 2-person sales team from a group of 12 salespeople
combination; 66
19. making 5-sided polygons by choosing any 5 of 11 points located on a circle to be the vertices
combination; 462
20. seating 5 men and 5 women alternately in a row, beginning with a woman
permutation; 14,400
21. **STUDENT GROUPS** Farmington High is planning its academic festival. All math classes will send 2 representatives to compete in the math bowl. How many different groups of students can be chosen from a class of 16 students? 120
22. **PHOTOGRAPHY** A photographer is taking pictures of a bride and groom and their 6 attendants. If she takes photographs of 3 people in a group, how many different groups can she photograph? 56
23. **AIRLINES** An airline is hiring 5 flight attendants. If 8 people apply for the job, how many different groups of 5 attendants can the airline hire? 56
24. **SUBSCRIPTIONS** A school librarian would like to buy subscriptions to 7 new magazines. Her budget, however, will allow her to buy only 4 new subscriptions. How many different groups of 4 magazines can she choose from the 7 magazines? 35

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