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Math Connects

Course 2

Chapter 9 Resource Masters

Includes:

Chapter Resources
- Student-Built Glossary
- Family Letter
- Family Activity
- Anticipation Guide

Leveled Lesson Resources
- Lesson Reading Guide
- Study Guide and Intervention
- Skills Practice
- Practice
- Word Problem Practice
- Enrichment

Assessment Resources
- Student Recording Sheet
- Extended-Response Scoring Rubric
- 4 Quizzes
- Mid-Chapter Test
- Vocabulary Test
- Leveled Chapter 9 Tests
- Chapter Extended-Response Test
- Standardized Test Practice
- Chapter 9 Assessment Line-up Answer Keys
- Unit 4 Test

All Answers Included

Consumable Workbooks Many of the worksheets contained in the Chapter Resource Masters booklets are available as consumable workbooks in both English and Spanish.

	MHID	ISBN
Study Guide and Intervention Workbook	0-07-881054-X	978-0-07-881054-1
Skills Practice Workbook	0-07-881053-1	978-0-07-881053-4
Practice Workbook	0-07-881056-6	978-0-07-881056-5
Word Problem Practice Workbook	0-07-881055-8	978-0-07-881055-8

Spanish Versions

Study Guide and Intervention Workbook	0-07-881058-2	978-0-07-881058-9
Skills Practice Workbook	0-07-881057-4	978-0-07-881057-2
Practice Workbook	0-07-881060-4	978-0-07-881060-2
Word Problem Practice Workbook	0-07-881059-0	978-0-07-881059-6

Answers for Workbooks The answers for Chapter 9 of these workbooks can be found in the back of this Chapter Resource Masters booklet.

StudentWorks Plus™ This CD-ROM includes the entire Student Edition test along with the English workbooks listed above.

TeacherWorks Plus™ All of the materials found in this booklet are included for viewing, printing, and editing in this CD-ROM.

Spanish Assessment Masters MHID: 0-07-881061-2 ISBN: 978-0-07-881061-9
These masters contain a Spanish version of Chapter 9 Test Form 2A and Form 2C.

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Contents

Teacher's Guide to Using the *Chapter 9 Resource Masters*

The *Chapter 9 Resource Masters* includes the core materials needed for Chapter 9. These materials include worksheets, extensions, and assessment options. The answers for these pages appear at the back of this booklet.

All of the materials found in this booklet are included for viewing and printing on the *TeacherWorks Plus*™ CD-ROM.

Chapter Resources

Student-Built Glossary (pages 1–2) These masters are a student study tool that presents up to twenty of the key vocabulary terms from the chapter. Students are to record definitions and/or examples for each term. You may suggest that students highlight or star the terms with which they are not familiar. Give this to students before beginning Lesson 9-1. Encourage them to add these pages to their mathematics study notebooks. Remind them to complete the appropriate words as they study each lesson.

Family Letter and Family Activity (pages 3–6) The letter informs your students' families of the mathematics they will be learning in this chapter. The family activity helps them to practice problems that are similar to those on the state test. A full solution for each problem is included. Spanish versions of these pages are also included. Give these to students to take home before beginning the chapter.

Anticipation Guide (pages 7–8) This master, presented in both English and Spanish, is a survey used before beginning the chapter to pinpoint what students may or may not know about the concepts in the chapter. Students will revisit this survey after they complete the chapter to see if their perceptions have changed.

Lesson Resources

Lesson Reading Guide Get Ready for the Lesson reiterates the questions from the beginning of the Student Edition lesson. Read the Lesson asks students to interpret the context of and relationships among terms in the lesson. Finally, Remember What You Learned asks students to summarize what they have learned using various representation techniques. Use as a study tool for note taking or as an informal reading assignment. It is also a helpful tool for ELL (English Language Learners).

Study Guide and Intervention This master provides vocabulary, key concepts, additional worked-out examples and Check Your Progress exercises to use as a reteaching activity. It can also be used in conjunction with the Student Edition as an instructional tool for students who have been absent.

Skills Practice This master focuses more on the computational nature of the lesson. Use as an additional practice option or as homework for second-day teaching of the lesson.

Practice This master closely follows the types of problems found in the Exercises section of the Student Edition and includes word problems. Use as an additional practice option or as homework for second-day teaching of the lesson.

Word Problem Practice This master includes additional practice in solving word problems that apply the concepts of the lesson. Use as an additional practice or as homework for second-day teaching of the lesson.

Enrichment These activities may extend the concepts of the lesson, offer an historical or multicultural look at the concepts, or widen students' perspectives on the mathematics they are learning. They are written for use with all levels of students.

Graphing Calculator, Scientific Calculator,* or *Spreadsheet Activities These activities present ways in which technology can be used with the concepts in some lessons of this chapter. Use as an alternative approach to some concepts or as an integral part of your lesson presentation.

Assessment Options

The assessment masters in the *Chapter 9 Resource Masters* offer a wide range of assessment tools for formative (monitoring) assessment and summative (final) assessment.

Student Recording Sheet This master corresponds with the Test Practice at the end of the chapter.

Extended-Response Rubric This master provides information for teachers and students on how to assess performance on open-ended questions.

Quizzes Four free-response quizzes offer assessment at appropriate intervals in the chapter.

Mid-Chapter Test This 1-page test provides an option to assess the first half of the chapter. It parallels the timing of the Mid-Chapter Quiz in the Student Edition and includes both multiple-choice and free-response questions.

Vocabulary Test This test is suitable for all students. It includes a list of vocabulary words and 10 questions to assess students' knowledge of those words. This can also be used in conjunction with one of the leveled chapter tests.

Leveled Chapter Tests

- *Form 1* contains multiple-choice questions and is intended for use with below grade level students.
- *Forms 2A and 2B* contain multiple-choice questions aimed at on grade level students. These tests are similar in format to offer comparable testing situations.
- *Forms 2C and 2D* contain free-response questions aimed at on grade level students. These tests are similar in format to offer comparable testing situations.
- *Form 3* is a free-response test for use with above grade level students.

All of the above mentioned tests include a free-response Bonus question.

Extended-Response Test Performance assessment tasks are suitable for all students. Sample answers and a scoring rubric are included for evaluation.

Standardized Test Practice These three pages are cumulative in nature. It includes two parts: multiple-choice questions with bubble-in answer format and short-answer free-response questions.

Answers

- The answers for the Anticipation Guide and Lesson Resources are provided as reduced pages with answers appearing in red.
- Full-size answer keys are provided for the assessment masters.

NAME _____ DATE _____ PERIOD _____

9 Student-Built Glossary

This is an alphabetical list of new vocabulary terms you will learn in Chapter 9. As you study the chapter, complete each term's definition or description. Remember to add the page number where you found the term. Add this page to your math study notebook to review vocabulary at the end of the chapter.

Vocabulary Term	Found on Page	Definition/Description/Example
combination		
complementary event		
composite event		
dependent events		
disjoint events		
experimental probability		
Fundamental Counting Principle		
independent events		

NAME _____ DATE _____ PERIOD _____

9 Student-Built Glossary

Vocabulary Term	Found on Page	Definition/Description/Example
outcome		
permutation		
probability		
random		
sample space		
simple event		
theoretical probability		
tree diagram		

NAME _____ DATE _____ PERIOD _____

9 Family Letter

Dear Parent or Guardian:

Probability is used in such diverse areas as weather forecasting, business, and genetics. We use combinations and permutations to determine the number of possible outcomes in a given situation. This type of information helps us to decide how to spend our money or to predict the color of a puppy's fur.

In **Chapter 9, Probability,** your child will learn probability, simple events, sample spaces, the fundamental counting principle, permutations, combinations, theoretical and experimental probability, and independent events. Your child will also learn the problem solving strategy of acting it out. In the study of this chapter, your child will complete a variety of daily classroom assignments and activities and possibly produce a chapter project.

By signing this letter and returning it with your child, you agree to encourage your child by getting involved. Enclosed is an activity you can do with your child that practices how the math we will be learning in Chapter 9 might be tested. You may also wish to log on to **glencoe.com** for self-check quizzes and other study help. If you have any questions or comments, feel free to contact me at school.

Sincerely,

Signature of Parent or Guardian _____ Date _____

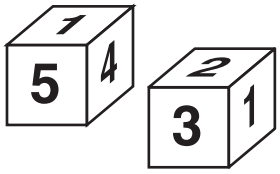
NAME _____ DATE _____ PERIOD _____

9 Family Activity

State Test Practice

Fold the page along the dashed line. Work each problem on another piece of paper. Then unfold the page to check your work.

1. Joshua is playing a game with his friends. The object of the game is to get a sum of 9 when two standard number cubes are rolled.



How many possible ways are there for rolling two number cubes? How many of these ways have a sum of 9?

A 36 ways; 4 with a sum of 9
B 36 ways; 8 with a sum of 9
C 16 ways; 4 with a sum of 9
D 16 ways; 8 with a sum of 9

2. Justine is designing a probability experiment in which she can simulate finding the probability of getting snow overnight if the weatherman said that there is a 25% chance that the precipitation overnight will be rain, a 50% chance that the precipitation will be snow, and a 25% chance that there will be no precipitation at all.

Which of the following would best simulate what might happen overnight?

A toss a coin
B spin a spinner with four equal sections
C roll a standard number cube
D pick from 25 marbles in a bag

Fold here.

Solution

1. Since there are 6 possible outcomes for each number cube, there are 6×6 or 36 possible rolls.

In order for the sum of the number cubes to be 9, we can have the following combinations:

Cube 1	Cube 2
3	6
6	3
4	5
5	4

There are 4 possible combinations that will result in a sum of 9.

The answer is **A.**

Solution

2. *Hint: Consider the number of outcomes possible and consider their probabilities as fractions of a whole.*

The probabilities can all be expressed in terms of $\frac{1}{4}$. Choice B is the only option that represents fourths.

The answer is **B.**

NOMBRE _____ FECHA _____ PERÍODO ___

9 Carta a la familia

Estimado padre o apoderado:

La probabilidad se usa en áreas tan diversas como el pronóstico del tiempo, los negocios y la genética. Usamos combinaciones y permutaciones para determinar el número de posibles resultados en una situación dada. Este tipo de información nos ayuda a decidir cómo gastar nuestro dinero o predecir el color del pelaje de un cachorro.

En el **Capítulo 9, Probabilidad,** su hijo(a) aprenderá sobre probabilidad, eventos simples, espacios muestrales, el principio fundamental de conteo, permutaciones, combinaciones, probabilidad teórica y experimental y eventos independientes. Su hijo(a) también aprenderá la estrategia de solución de problemas mediante simulacros. En el estudio de este capítulo, su hijo(a) completará una variedad de tareas y actividades diarias y es posible que trabaje en un proyecto del capítulo.

Al firmar esta carta y devolverla con su hijo(a), usted se compromete a ayudarlo(a) a participar en su aprendizaje. Junto con esta carta, va incluida una actividad que puede realizar con él(ella) y la cual practica lo que podrían encontrar en las pruebas de los conceptos matemáticos que aprenderán en el Capítulo 9. Además, visiten **glencoe.com** para ver autocontroles y otras ayudas para el estudio. Si tiene cualquier pregunta o comentario, por favor contácteme en la escuela.

Cordialmente,

Firma del padre o apoderado _____ Fecha _____

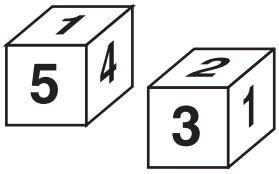
NOMBRE _____ FECHA _____ PERÍODO ___

9 Actividad en familia

Práctica para la prueba estatal

Doblen la página a lo largo de las líneas punteadas. Resuelvan cada problema en otra hoja de papel. Luego, desdoblen la página y revisen las respuestas.

1. Joshua está jugando con sus amigos. El objeto del juego es obtener una suma de 9 al lanzar dos cubos numerados estándares.



¿Cuántas maneras posibles hay de lanzar dos cubos numerados? ¿Cuántas de éstas suman 9?

A 36 maneras; 4 suman 9
B 36 maneras; 8 suman 9
C 16 maneras; 4 suman 9
D 16 maneras; 8 suman 9

2. Justine diseña un experimento de probabilidades en donde puede simular la búsqueda de la probabilidad de que nieve durante la noche, si el meteorólogo dijo que hay un 25% de probabilidad de que la precipitación sea lluvia, un 50% de que la precipitación sea nieve y un 25% de que no ocurra precipitación alguna.

¿Cuál de los siguientes simularía mejor lo que puede ocurrir durante la noche?

A lanzar una moneda al aire
B girar un girador de cuatro secciones iguales
C lanzar un cubo numerado estándar
D escoger de entre 25 canicas en una bolsa

Doblen aquí.

Solución

1. Puesto que existen 6 resultados posibles para cada cubo numerado, hay 6×6 ó 36 tiros posibles.

Para lograr que la suma de los cubos numerados sea 9, se tienen las combinaciones siguientes:

Cubo 1	Cubo 2
3	6
6	3
4	5
5	4

Hay 4 combinaciones posibles que resultarán en una suma de 9.

La respuesta es **A.**

Solución

2. *Ayuda: Consideren el número de resultados posibles y consideren sus probabilidades como fracciones de un todo.*

Las probabilidades pueden expresarse en términos de $\frac{1}{4}$. La opción B es la única que representa cuartos.

La respuesta es **B.**

NAME _____ DATE _____ PERIOD _____

9 Anticipation Guide

Probability

Step 1 ***Before you begin Chapter 9***

- Read each statement.
- Decide whether you Agree (A) or Disagree (D) with the statement.
- Write A or D in the first column OR if you are not sure whether you agree or disagree, write NS (Not Sure).

STEP 1 A, D, or NS	Statement	STEP 2 A or D
	1. The probability of an event happening is a ratio that compares the number of favorable outcomes to the number of unfavorable outcomes.	
	2. If the probability of an event happening is $\frac{3}{5}$ then it is more likely for the event to happen than to not happen.	
	3. In a probability experiment, a tree diagram can be used to show all the possible outcomes.	
	4. The Fundamental Counting Principle states that the number of possible outcomes can also be found by division.	
	5. To find the value of 4!, add $4 + 3 + 2 + 1$.	
	6. In a combination, choosing event A then event B would be the same as choosing event B then event A.	
	7. The experimental probability of an event happening will always be close to the theoretical probability of that event happening.	
	8. The act it out strategy is a good way to solve problems because the results will be the same every time the experiment is repeated.	
	9. A compound event consists of two or more simple events.	
	10. The probability of two independent events is found the same way as the probability of two dependent events.	

Step 2 ***After you complete Chapter 9***

- Reread each statement and complete the last column by entering an A or a D.
- Did any of your opinions about the statements change from the first column?
- For those statements that you mark with a D, use a piece of paper to write an example of why you disagree.

NOMBRE _____ FECHA _____ PERÍODO ___

9 Ejercicios preparatorios

Probabilidad

PASO 1 ***Antes de comenzar el Capítulo 9***

- Lee cada enunciado.
- Decide si estás de acuerdo (A) o en desacuerdo (D) con el enunciado.
- Escribe A o D en la primera columna O si no estás seguro(a) de la respuesta, escribe NS (No estoy seguro(a).

PASO 1 A, D o NS	Enunciado	PASO 2 A o D
	1. La probabilidad de que ocurra un evento es una razón que compara el número de resultados favorables con el número de resultados desfavorables.	
	2. Si la probabilidad de que ocurra un evento es $\frac{3}{5}$, entonces es más probable que ocurra el evento a que no ocurra.	
	3. En un experimento de probabilidad, se puede usar un diagrama de árbol para mostrar todos los resultados posibles.	
	4. El principio fundamental de contar establece que el número posible de resultados puede también calcularse mediante división.	
	5. Para calcular el valor de 4!, suma 4 + 3 + 2 + 1.	
	6. En una combinación, escoger el evento A y después el evento B sería igual a escoger el evento B y después el evento A.	
	7. La probabilidad experimental de que ocurra un evento siempre será cercana a la probabilidad teórica de que ocurra dicho evento.	
	8. La estrategia de hacer un simulacro es una buena forma de resolver problemas porque los resultados serán los mismos cada vez que se repita el experimento.	
	9. Un evento compuesto consta de dos o más eventos simples.	
	10. La probabilidad de dos eventos independientes se encuentra de la misma manera que la probabilidad de dos eventos dependientes.	

PASO 2 ***Después de completar el Capítulo 9***

- Vuelve a leer cada enunciado y completa la última columna con una A o una D.
- ¿Cambió cualquiera de tus opiniones sobre los enunciados de la primera columna?
- En una hoja de papel aparte, escribe un ejemplo de por qué estás en desacuerdo con los enunciados que marcaste con una D.

NAME _____ DATE _____ PERIOD _____

9-1 Lesson Reading Guide

Simple Events

Get Ready for the Lesson

Read the introduction at the top of page 460 in your textbook. Write your answers below.

1. What fraction of the cheesecake is chocolate? Write in simplest form.

2. Suppose your friend gives you the first piece of cheesecake without asking which type you prefer. Are your chances of getting original the same as getting raspberry?

Read the Lesson

Use the information from the introduction to answer Exercises 3–5.

3. How do you read P(raspberry)?

4. $P(\text{raspberry}) = \frac{4}{16}$; where does the 4 come from? Where does the 16 come from?

5. Probability can be written as a fraction, a decimal, or a percent. Write P(raspberry) as a decimal.

6. If three pieces of strawberry cheesecake were added to the pie, how would P(raspberry) change?

Remember What You Learned

7. Write the equation $P(A) + P(\text{not } A) = 1$ in words. What does it mean with respect to event A?

NAME _____ DATE _____ PERIOD _____

9-1 Study Guide and Intervention

Simple Events

The **probability** of a simple event is a ratio that compares the number of favorable outcomes to the number of possible outcomes. Outcomes occur at **random** if each outcome occurs by chance.

Two events that are the only ones that can possibly happen are **complementary events**. The sum of the probabilities of complementary events is 1.

Example 1 **What is the probability of rolling a multiple of 3 on a number cube marked with 1, 2, 3, 4, 5, and 6 on its faces.**

$$P(\text{multiple of 3}) = \frac{\text{multiples of 3 possible}}{\text{total numbers possible}}$$

$= \frac{2}{6}$ Two numbers are multiples of 3: 3 and 6.

$= \frac{1}{3}$ Simplify.

The probability of rolling a multiple of 3 is $\frac{1}{3}$ or about 33.3%.

Example 2 **What is the probability of *not* rolling a multiple of 3 on a number cube marked with 1, 2, 3, 4, 5, and 6 on its faces?**

$P(A) + P(\text{not } A) = 1$

$\frac{1}{3} + P(\text{not } A) = 1$ Substitute $\frac{1}{3}$ for $P(A)$.

$-\frac{1}{3} \quad -\frac{1}{3}$ Subtract $\frac{1}{3}$ from each side

$P(\text{not } A) = \frac{2}{3}$ Simplify.

The probability of *not* rolling a multiple of 3 is $\frac{2}{3}$ or about 66.7%.

Exercises

A set of 30 cards is numbered 1, 2, 3, …, 30. Suppose you pick a card at random without looking. Find the probability of each event. Write as a fraction in simplest form.

1. $P(12)$

2. $P(2 \text{ or } 3)$

3. $P(\text{odd number})$

4. $P(\text{a multiple of 5})$

5. $P(\text{not a multiple of 5})$

6. $P(\text{less than or equal to 10})$

NAME _____ DATE _____ PERIOD _____

9-1 Skills Practice

Simple Events

A set of 12 cards is numbered 1, 2, 3, ...12. Suppose you pick a card at random without looking. Find the probability of each event. Write as a fraction in simplest form.

1. P(5)

2. P(6 or 8)

3. P(a multiple of 3)

4. P(an even number)

5. P(a multiple of 4)

6. P(less than or equal to 8)

7. P(a factor of 12)

8. P(not a multiple of 4)

9. P(1, 3, or 11)

10. P(a multiple a 5)

The students at Job's high school were surveyed to determine their favorite foods. The results are shown in the table at the right. Suppose students were randomly selected and asked what their favorite food is. Find the probability of each event. Write as a fraction in simplest form.

Favorite Food	Responses
pizza	19
steak	8
chow mein	5
seafood	4
spaghetti	3
cereal	1

11. P(steak)

12. P(spaghetti)

13. P(cereal or seafood)

14. P(not chow mein)

15. P(pizza)

16. P(cereal or steak)

17. P(not steak)

18. P(not cereal or seafood)

19. P(chicken)

20. P(chow mein or spaghetti)

NAME _____ DATE _____ PERIOD _____

9-1 Practice

Simple Events

A set of cards is numbered 1, 2, 3, ... 24. Suppose you pick a card at random without looking. Find the probability of each event. Write as a fraction in simplest form.

1. P(5)

2. P(multiple of 4)

3. P(6 or 17)

4. P(not equal to 15)

5. P(not a factor of 6)

6. P(odd number)

COMMUNITY SERVICE **The table shows the students involved in community service. Suppose one student is randomly selected to represent the school at a state-wide awards ceremony. Find the probability of each event. Write as a fraction in simplest form.**

7. P(boy)

8. P(not 6th grader)

9. P(girl)

10. P(8th grader)

11. P(boy or girl)

12. P(6th or 7th grader)

13. P(7th grader)

14. P(not a 9th grader)

Community Service	
girls	15
boys	25
6th graders	20
7th graders	8
8th graders	12

MENU **A delicatessen serves different menu items, of which 2 are soups, 6 are sandwiches, and 4 are salads. How likely is it for each event to happen if you choose one item at random from the menu? Explain your reasoning.**

15. P(sandwich)

16. P(not a soup)

17. P(salad)

18. **NUMBER CUBE** What is the probability of rolling an even number or a prime number on a number cube? Write as a fraction in simplest form.

19. **CLOSING TIME** At a convenience store there is a 25% chance a customer enters the store within one minute of closing time. Describe the complementary event and find its probability.

NAME _____ DATE _____ PERIOD _____

9-1 Word Problem Practice

Simple Events

COINS Susan opened her piggy bank and counted the number of each coin. The table at the right shows the results. For Exercises 1–3, assume that the coins are put in a bag and one is chosen at random.

Coin	Number
quarters	15
dimes	21
nickels	22
pennies	32

1. What is the probability that a quarter is chosen?

2. What is the probability that a nickel or a dime is chosen?

3. What is the probability that the chosen coin is worth more than 5 cents?

4. NUMBER CUBES Juan has two number cubes, each with faces numbered 1, 2, …6. What is the probability that he can roll the cubes so that the sum of the faces showing equals 11?

5. SKATEBOARDS Carlotta bought a new skateboard for which the probability of having a defective wheel is 0.015. What is the probability of not having a defective wheel?

6. CALCULATORS Jake's teacher had 6 calculators for 28 students to use. If the first students to use the calculators are chosen at random, what is the probability that Jake will get one?

7. VEHICLES The rental car company had 14 sedans and 8 minivans available to rent. If the next customer picks a vehicle at random, what is the probability that a minivan is chosen?

8. MUSIC Tina has 16 pop CDs, 6 classical, and 2 rock. Tina chooses a CD at random. What is the probability she does not choose a classical CD?

Lesson 9–1

NAME _____ DATE _____ PERIOD _____

9-1 Enrichment

Coin-Tossing Experiments

If a coin is tossed 3 times, there are 8 possible outcomes. They are listed in the table below.

Number of Heads	0	1	2	3
Outcomes	TTT	HTT	HHT	HHH
		THT	THH	
		TTH	HTH	

Once all the outcomes are known, the probability of any event can be found. For example, the probability of getting 2 heads is $\frac{3}{8}$. Notice that this is the same as getting 1 tail.

1. A coin is tossed 4 times. Complete this chart to show the possible outcomes.

Number of Heads	0	1	2	3	4
Outcomes	TTTT				

2. What is the probability of getting all tails?

3. Now complete this table. Make charts like the one in Exercise 1 to help find the answers. Look for patterns in the numbers.

Number of Coin Tosses	2	3	4	5	6	7	8
Total Outcomes							
Probability of Getting All Tails							

4. What happens to the number of outcomes? the probability of all tails?

NAME _____ DATE _____ PERIOD _____

9-2 Lesson Reading Guide

Sample Spaces

Get Ready for the Lesson

Complete the Mini Lab at the top of page 465 in your textbook. Write your answers below.

1. Make a conjecture. Do you think this is a fair game? Explain.

2. Now, play the game. Who won? What was the final score?

Read the Lesson

3. How does a tree diagram resemble a tree?

4. How can you use a table to find the number of possible outcomes of an event?

5. How do you know the game played in Example 3 is fair?

Remember What You Learned

6. Draw a tree diagram that shows a fair game that is different from the examples in your textbook. Can you think of a way to draw a tree diagram that shows a game that is *not* fair? Make sure you include a description if the game is not clear from your diagram.

NAME _____ DATE _____ PERIOD _____

9-2 Study Guide and Intervention

Sample Spaces

A game in which players of equal skill have an equal chance of winning is a **fair game**. A **tree diagram** or table is used to show all of the possible outcomes, or **sample space**, in a probability experiment.

Example 1 **WATCHES** **A certain type of watch comes in brown or black and in a small or large size. Find the number of color-size combinations that are possible.**

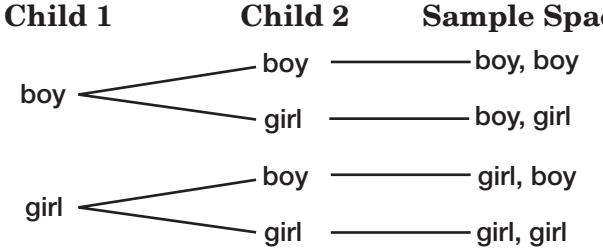
Make a table to show the sample space. Then give the total number of outcomes.

Color	Size
Brown	Small
Brown	Large
Black	Small
Black	Large

There are four different color and size combinations.

Example 2 **CHILDREN** **The chance of having either a boy or a girl is 50%. What is the probability of the Smiths having two girls?**

Make a tree diagram to show the sample space. Then find the probability of having two girls.



The sample space contains 4 possible outcomes. Only 1 outcome has both children being girls. So, the probability of having two girls is $\frac{1}{4}$.

Exercises

For each situation, make a tree diagram or table to show the sample space. Then give the total number of outcomes.

1. choosing an outfit from a green shirt, blue shirt, or a red shirt, and black pants or blue pants

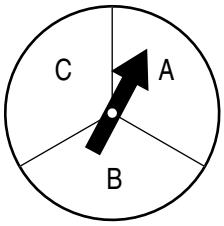
2. choosing a vowel from the word COUNTING and a consonant from the word PRIME

NAME _____ DATE _____ PERIOD _____

9-2 Skills Practice

Sample Spaces

The spinner at the right is spun twice.



1. Draw a tree diagram to represent the situation.

2. What is the probability of getting at least one A?

For each situation, make a tree diagram or table to show the sample space. Then give the total number of outcomes.

3. choosing a hamburger or hot dog and potato salad or macaroni salad

4. choosing a vowel from the word COMPUTER and a consonant from the word BOOK

5. choosing between the numbers 1, 2 or 3, and the colors blue, red, or green

Lesson 9–2

NAME _____ DATE _____ PERIOD _____

9-2 Practice

Sample Spaces

For each situation, find the sample space using a table or tree diagram.

1. choosing blue, green, or yellow wall paint with white, beige, or gray curtains

2. choosing a lunch consisting of a soup, salad, and sandwich from the menu shown in the table.

Soup	Salad	Sandwich
Tortellini Lentil	Caesar Macaroni	Roast Beef Ham Turkey

3. **GAME** Kimiko and Miko are playing a game in which each girl rolls a number cube. If the sum of the numbers is a prime number, then Miko wins. Otherwise Kimiko wins. Find the sample space. Then determine whether the game is fair.

NAME _____ DATE _____ PERIOD _____

9-2 Word Problem Practice

Sample Spaces

1. GASOLINE Craig stops at a gas station to fill his gas tank. He must choose between full-service or self-service and between regular, midgrade, and premium gasoline. Draw a tree diagram or table showing the possible combinations of service and gasoline type. How many possible combinations are there?

2. COINS Judy tosses a coin 4 times. Draw a tree diagram or table showing the possible outcomes. What is the probability of getting at least 2 tails?

3. COINS In Exercise 2, what is the probability of getting 2 heads, then 2 tails?

4. EQUIPMENT The computer accessory that Joanne is considering selling at her store comes in white, beige, gray, or black and has an optical mouse, mechanical mouse, or trackball. How many combinations of color and model must she stock in order to have at least one of every possible combination?

Lesson 9–2

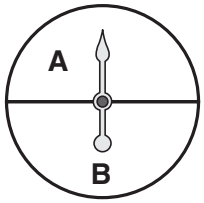
NAME _____ DATE _____ PERIOD _____

9-2 Enrichment

Probabilities and Regions

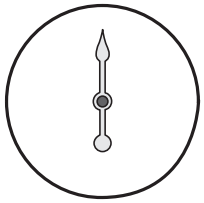
The spinner at the right can be used to indicate that the probability of landing in either of two regions is $\frac{1}{2}$.

$$P(A) = \frac{1}{2} \quad P(B) = \frac{1}{2}$$

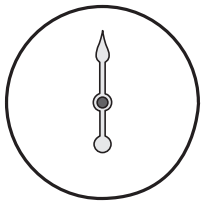


Read the description of each spinner. Using a protractor and ruler, divide each spinner into regions that show the indicated probability.

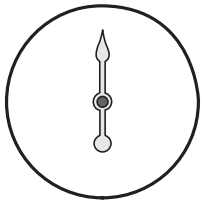
1. Two regions A and B: the probability of landing in region A is $\frac{3}{4}$. What is the probability of landing in region B?



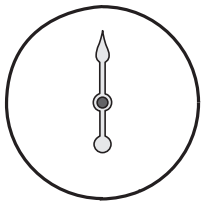
2. Three regions A, B, and C: the probability of landing in region A is $\frac{1}{2}$ and the probability of landing in region B is $\frac{1}{4}$. What is the probability of landing in region C?



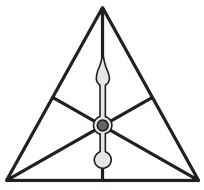
3. Three regions A, B, and C: the probability of landing in region A is $\frac{3}{8}$ and the probability of landing in region B is $\frac{1}{8}$. What is the probability of landing in region C?



4. Four regions A, B, C, and D: the probability of landing in region A is $\frac{1}{16}$, the probability of landing in region B is $\frac{1}{8}$, and the landing probability of in region C is $\frac{1}{4}$. What is the probability of landing in region D?



5. The spinner at the right is an equilateral triangle, divided into regions by line segments that divide the sides in half. Is the spinner divided into regions of equal probability?



NAME _____ DATE _____ PERIOD _____

9-3 Lesson Reading Guide

The Fundamental Counting Principle

Get Ready for the Lesson

Read the introduction at the top of page 471 in your textbook. Write your answers below.

1. According to the table, how many colors of sandals are available?

2. How many styles are available?

3. Find the product of the two numbers you found in Exercises 1 and 2.

4. Draw a tree diagram to find the number of different color and style combinations. How does the number of outcomes compare to the product you found above?

Read the Lesson

5. What operation is used in the Fundamental Counting Principle?

6. How is the information in a tree diagram or table different from the information provided by counting?

Remember What You Learned

7. Write the Fundamental Counting Principle in your own words.

NAME _____ DATE _____ PERIOD _____

9-3 Study Guide and Intervention

The 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 *N* can occur in $m \times n$ ways. This is called the **Fundamental Counting Principle**.

Example 1 **CLOTHING** **Andy has 5 shirts, 3 pairs of pants, and 6 pairs of socks. How many different outfits can Andy choose with a shirt, pair of pants, and pair of socks?**

$$\underbrace{5}_{\text{number of shirts}} \cdot \underbrace{3}_{\text{number of pants}} \cdot \underbrace{6}_{\text{number of socks}} = \underbrace{90}_{\text{total number of outfits}}$$

Andy can choose 90 different outfits.

Exercises

Use the Fundamental Counting Principle to find the total number of outcomes in each situation.

1. rolling two number cubes

2. tossing 3 coins

3. picking one consonant and one vowel

4. choosing one of 3 processor speeds, 2 sizes of memory, and 4 sizes of hard drive

5. choosing a 4-, 6-, or 8-cylinder engine and 2- or 4-wheel drive

6. rolling 2 number cubes and tossing 2 coins

7. choosing a color from 4 colors and a number from 4 to 10

NAME _____ DATE _____ PERIOD _____

9-3 Skills Practice

The Fundamental Counting Principle

Use the Fundamental Counting Principle to find the total number of outcomes in each situation.

1. rolling two number cubes and tossing one coin

2. choosing rye or Bermuda grass and 3 different mixtures of fertilizer

3. making a sandwich with ham, turkey, or roast beef; Swiss or provolone cheese; and mustard or mayonaise

4. tossing 4 coins

5. choosing from 3 sizes of distilled, filtered, or spring water

6. choosing from 3 flavors of juice and 3 sizes

7. choosing from 35 flavors of ice cream; one, two, or three scoops; and sugar or waffle cone

8. picking a day of the week and a date in the month of April

9. rolling 3 number cubes and tossing 2 coins

10. choosing a 4-letter password using only vowels

11. choosing a bicycle with or without shock absorbers; with or without lights; and 5 color choices

12. a license plate that has 3 numbers from 0 to 9 and 2 letters

NAME _____ DATE _____ PERIOD _____

9-3 Practice

The Fundamental Counting Principle

Use the Fundamental Counting Principle to find the total number of outcomes in each situation.

1. choosing from 8 car models, 5 exterior paint colors, and 2 interior colors

2. selecting a year in the last decade and a month of the year

3. picking from 3 theme parks and 1-day, 2-day, 3-day, and 5-day passes

4. choosing a meat and cheese sandwich from the list shown in the table

5. tossing a coin and rolling 2 number cubes

Cheese	Meat
Provolone	Salami
Swiss	Turkey
American	Tuna
Cheddar	Ham

6. selecting coffee in regular or decaf, with or without cream, and with or without sweeteners

7. **COINS** Find the number of possible outcomes if 2 quarters, 4 dimes, and 1 nickel are tossed.

8. **SOCIAL SECURITY** Find the number of possible 9-digit social security numbers if the digits may be repeated.

9. **AIRPORTS** Jolon will be staying with his grandparents for a week. There are four flights that leave the airport near Jolon's home that connect to an airport that has two different flights to his grandparents' hometown. Find the number of possible flights. Then find the probability of taking the earliest flight from each airport if the flight is selected at random.

10. **ANALYZE TABLES** The table shows the kinds of homes offered by a residential builder. If the builder offers a discount on one home at random, find the probability it will be a 4-bedroom home with an open porch. Explain your reasoning.

Number of Bedrooms	Style of Kitchen	Type of Porch
5-bedroom	Mediterranean	Open
4-bedroom	Contemporary	Screen
3-bedroom	Southwestern	
	Colonial	

NAME _____ DATE _____ PERIOD _____

9-3 Word Problem Practice

The Fundamental Counting Principle

1. SURFBOARD Jay owns 3 surfboards and 2 wetsuits. If he takes one surfboard and one wetsuit to the beach, how many different combinations can he choose?	**2. SHOPPING** John is trying to decide which bag of dog food to buy. The brand he wants comes in 4 flavors and 3 sizes. How many choices are there?
3. LOTTERY To purchase a lottery ticket, you must select 4 numbers from 0 to 9. How many possible lottery tickets can be chosen?	**4. RESTAURANTS** Miriam's favorite restaurant has 3 specials every day. Each special has 2 choices of vegetable and 3 choices of dessert. How many different meals could Miriam have?
5. ROUTES When Sunil goes to the building where he works, he can go through 4 different doors into the lobby. Then he can go to the seventh floor by taking 2 different elevators or 2 different stairways. How many different ways can Sunil get from outside the building to the seventh floor?	**6. STEREOS** Jailin went to her local stereo store. Given her budget and the available selection, she can choose between 2 CD players, 5 amplifiers, and 3 pairs of speakers. How many different stereos can Jailin purchase?
7. DESSERT For dessert you can choose apple, cherry, blueberry, or peach pie to eat, and milk or juice to drink. How many different combinations can you choose from?	**8. TESTS** John is taking a true or false quiz. There are six questions on the quiz. How many ways can the quiz be answered?

NAME _____ DATE _____ PERIOD _____

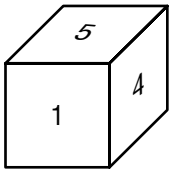
9-3 Enrichment

Curious Cubes

If a six-faced cube is rolled any number of times, the theoretical probability of the cube landing on any given face is $\frac{1}{6}$.

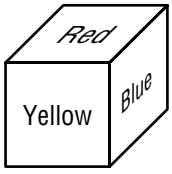
Each cube below has six faces and has been rolled 100 times. The outcomes have been tallied and recorded in a frequency table. Based on the data in each frequency table, what can you say are probably on the unseen faces of each cube?

1.



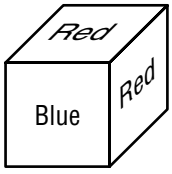
Outcome	Tally
1	15
2	14
3	18
4	16
5	19
6	18

2.



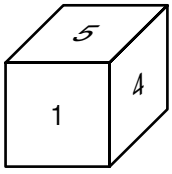
Outcome	Tally
blue	17
red	30
yellow	53

3.



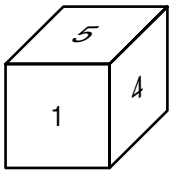
Outcome	Tally
red	30
blue	16
blank	54

4.



Outcome	Tally
1	34
4	32
5	34

5.



Outcome	Tally
1	14
5	13
4	18
2	16
blank	39

NAME _____ DATE _____ PERIOD _____

9-4 Lesson Reading Guide

Permutations

Get Ready for the Lesson

Complete the Mini Lab at the top of page 475 in your textbook. Write your answers below.

1. When you first started to make your list, how many choices did you have for your first class?

2. Once your first class was selected, how many choices did you have for the second class? then, the third class?

Read the Lesson

3. Explain why the arrangement Science, Math, Language Arts is a permutation of Math, Science, Language Arts.

4. In Example 1, on page 475, why is there only 1 choice for the third class?

5. In Example 2 on page 476, why are there only 7 choices for second place?

Remember What You Learned

6. Look up the word *permute* in a dictionary. How does the meaning of this word relate to the concepts in this lesson, especially the concept of permutations?

NAME _____ DATE _____ PERIOD _____

9-4 Study Guide and Intervention

Permutations

A **permutation** is an arrangement, or listing, of objects in which order is important. You can use the Fundamental Counting Principle to find the number of possible arrangements.

Example 1 **Find the value of $5 \cdot 4 \cdot 3 \cdot 2 \cdot 1$.**

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

Example 2 **Find the value of $4 \cdot 3 \cdot 2 \cdot 1 \cdot 2 \cdot 1$.**

$4 \cdot 3 \cdot 2 \cdot 1 \cdot 2 \cdot 1$
$= 48$ Simplify.

Example 3 **BOOKS How many ways can 4 different books be arranged on a bookshelf?**

This is a permutation. Suppose the books are placed on the shelf from left to right.

There are **4** choices for the first book.
There are **3** choices that remain for the second book.
There are **2** choices that remain for the third book.
There is **1** choice that remains for the fourth book.

$4 \cdot 3 \cdot 2 \cdot 1$
$= 24$ Simplify.

So, there are 24 ways to arrange 4 different books on a bookshelf.

Exercises

Find the value of each expression.

1. $3 \cdot 2 \cdot 1$

2. $7 \cdot 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1$

3. $6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 \cdot 3 \cdot 2 \cdot 1$

4. $9 \cdot 8 \cdot 7$

5. How many ways can you arrange the letters in the word GROUP?

6. How many different 4-digit numbers can be created if no digit can be repeated? Remember, a number cannot begin with 0.

NAME _____ DATE _____ PERIOD _____

9-4 Skills Practice

Permutations

Find the value of each expression.

1. $2 \cdot 1$

2. $4 \cdot 3 \cdot 2 \cdot 1$

3. $3 \cdot 2 \cdot 1 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1$

4. $9 \cdot 8 \cdot 7 \cdot 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1$

5. $2 \cdot 1 \cdot 8 \cdot 7 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1$

6. $3 \cdot 2 \cdot 1 \cdot 2 \cdot 1$

7. $11 \cdot 10 \cdot 9$

8. $10 \cdot 9 \cdot 8 \cdot 7 \cdot 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1$

9. $5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 \cdot 2 \cdot 1$

10. $5 \cdot 4 \cdot 3 \cdot 2$

11. $8 \cdot 7 \cdot 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1$

12. $6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1$

13. How many ways can you arrange the letters in the word PRIME?

14. How many ways can you arrange 8 different crates on a shelf if they are placed from left to right?

NAME _____ DATE _____ PERIOD _____

9-4 Practice

Permutations

Solve each problem.

1. **NUMBERS** How many different 2-digit numbers can be formed from the digits 4, 6, and 8? Assume no number can be used more than once.

2. **LETTERS** How many permutations are possible of the letters in the word NUMBERS?

3. **PASSENGERS** There are 5 passengers in a car. In how many ways can the passengers sit in the 5 passenger seats of the car?

4. **PAINTINGS** Mr. Bernstein owns 14 paintings, but has only enough wall space in his home to display three of them at any one time: one in the hallway, one in the den, and one in the parlor. How many ways can Mr. Bernstein display three paintings in his home?

5. **DOG SHOW** Mateo is one of the six dog owners in the terrier category. If the owners are selected in a random order to show their dogs, how many ways can the owners show their dogs?

6. **TIME** Michel, Jonathan, and two of their friends each ride their bikes to school. If they have an equally-likely chance of arriving first, what is the probability that Jonathan will arrive first and Michel will arrive second?

7. **BIRTHDAY** Glen received 6 birthday cards. If he is equally likely to read the cards in any order, what is the probability he reads the card from his parents and the card from his sister before the other cards?

CODES For Exercises 8–10, use the following information. A bank gives each new customer a 4-digit code number which allows the new customer to create their own password. The code number is assigned randomly from the digits 1, 3, 5, and 7, and no digit is repeated.

8. What is the probability that the code number for a new customer will begin or end with a 7?

9. What is the probability that the code number will *not* contain a 5?

10. What is the probability that the code number will start with 371?

NAME _____ DATE _____ PERIOD _____

9-4 Word Problem Practice

Permutations

1. AREA CODES How many different 3-digit area codes can be created if no digit can be repeated?	**2. CARDS** Jason is dealt five playing cards. In how many different orders could Jason have been dealt the same hand?
3. PASSWORDS How many different 3-letter passwords are possible if no letter may be repeated?	**4. RACING** All 22 students in Amy's class are going to run the 100-meter dash. In how many ways can the students finish in first, second, and third place?
5. LETTERS How many ways can you arrange the letters in the word HISTORY?	**6. PARKING** The parking lot for a company has three parking spaces for compact cars. The company has 8 employees with compact cars. How many ways can the compact parking spaces be filled?
7. SERIAL NUMBERS How many different 6-digit serial numbers are available if no digit can be repeated?	**8. WINNERS** There are 156 ways for 2 cars to win first and second place in a race. How many cars are in the race?

NAME _____ DATE _____ PERIOD _____

9-4 Enrichment

Cyclic Permutations

1. George, Alan, and William are in the same math class. George has five different shirts and wears a different one each day. In how many ways can George wear his five shirts in five days?

2. Alan has three different shirts and William has four. Which of the three students, George, Alan, or William, goes the greatest number of days before he has to wear a shirt for the second time? Explain.

George, Alan, and William always wear their shirts in the same order. Suppose that George's 5 shirts are red, tan, green, black, and white. He wears his shirts following this pattern:

$$B\ W\ R\ T\ G\ B\ W\ R\ T\ \ldots$$

No matter where George is in the pattern, his friends can always figure out which shirt George will wear next. Since these permutations are the same when they make up part of a cycle, they are called **cyclic permutations.**

3. Alan has shirts that are white, black, and purple. Make an organized list of all the different permutations.

4. How many different ways are there for Alan to wear his shirts so that his friends recognize different patterns? Explain.

5. William has athletic shirts that are labeled 1, 2, 3, and 4. Make an organized list of all the different permutations.

6. How many different ways are there for William to wear his shirts so that his friends recognize different patterns? Explain.

7. **CHALLENGE** For any given number of shirts, how can you determine the number of ways a person could wear the shirts to produce unique patterns?

NAME _____ DATE _____ PERIOD _____

9-4 TI-83/84 Plus Activity

Permutations

You can use a graphing calculator to help you find the number of permutations.

Example 1 **25 people are auditioning for 5 different parts in a play. In how many ways can the 5 parts be assigned?**

To calculate a permutation, find the total number of objects (n) and the number taken at one time (r). In this problem, $n = 25$. Because 5 students are needed, $r = 5$.

Enter: 25 MATH ▶ ▶ ▶ 2 5 ENTER **6,375,600**

The parts can be assigned in 6,375,600 different ways.

Exercises

Find the value of each permutation for the given values of *n* and *r*.

1. $n = 5, r = 2$

2. $n = 8, r = 3$

3. $n = 9, r = 6$

4. $n = 6, r = 2$

5. $n = 10, r = 6$

6. $n = 12, r = 4$

7. $n = 20, r = 2$

8. $n = 15, r = 7$

9. $n = 18, r = 3$

Solve.

10. Employees of Spies, Inc., are given 3-digit code numbers made up of the digits 1, 3, 5, 7, and 9. How many different 3-digit code numbers can be created?

11. How many different 4-letter arrangements are there in the letters A, S, N, D, T, R, and Y?

12. Twenty students have entered an art contest. Five students will each receive different awards. How many different groups of 5 students could be selected to receive awards?

NAME _____ DATE _____ PERIOD _____

9-5 Lesson Reading Guide

Combinations

Get Ready for the Lesson

Read the introduction at the top of page 480 in your textbook. Write your answers below.

1. Use the first letter of each vegetable to list all of the permutations of the ingredients added to the lettuce.

2. Cross out any arrangement that contains the same letters as another one in the list. How many are there now?

3. Explain the difference between the two lists.

Read the Lesson

4. How can you find the number of combinations of objects in a set?

5. Why might it be easier to calculate the number of combinations of a set of objects using a permutation rather than making a list?

For Exercises 6 and 7, refer to Example 2 on page 481 in your textbook.

6. In the diagram, how many points are there? How many line segments connect to any one point?

7. How does your answer to Exercise 6 above correspond to Example 2 in your book?

Remember What You Learned

8. Work with a partner. Take turns thinking of situations in which a selection from a group must be made, where order is or is not important. Tell each other which situations are permutations and which are combinations. Solve each problem and show your work.

NAME _____ DATE _____ PERIOD _____

9-5 Study Guide and Intervention

Combinations

An arrangement, or listing, of objects in which order is *not* important is called a **combination**. You can find the number of combinations of objects by dividing the number of permutations of the entire set by the number of ways each smaller set can be arranged.

Example 1 **Jill was asked by her teacher to choose 3 topics from the 8 topics given to her. How many different three-topic groups could she choose?**

There are $8 \cdot 7 \cdot 6$ permutations of three-topic groups chosen from eight. There are $3 \cdot 2 \cdot 1$ ways to arrange the groups.

$$\frac{8 \cdot 7 \cdot 6}{3 \cdot 2 \cdot 1} = \frac{336}{6} = 56$$

So, there are 56 different three-topic groups.

Tell whether each situation represents a *permutation* or *combination*. Then solve the problem.

Example 2 **On a quiz, you are allowed to answer any 4 out of the 6 questions. How many ways can you choose the questions?**

This is a combination because the order of the 4 questions is not important. So, there are $6 \cdot 5 \cdot 4 \cdot 3$ permutations of four questions chosen from six. There are $4 \cdot 3 \cdot 2 \cdot 1$ orders in which these questions can be chosen.

$$\frac{6 \cdot 5 \cdot 4 \cdot 3}{4 \cdot 3 \cdot 2 \cdot 1} = \frac{360}{24} = 15$$

So, there are 15 ways to choose the questions.

Example 3 **Five different cars enter a parking lot with only 3 empty spaces. How many ways can these spaces be filled?**

This is a permutation because each arrangement of the same 3 cars counts as a distinct arrrangement. So, there are $5 \cdot 4 \cdot 3$ or 60 ways the spaces can be filled.

Exercises

Tell whether each situation represents a *permutation* or *combination*. Then solve the problem.

1. How many ways can 4 people be chosen from a group of 11?

2. How many ways can 3 people sit in 4 chairs?

3. How many ways can 2 goldfish be chosen from a tank containing 15 goldfish?

NAME _____ DATE _____ PERIOD _____

9-5 Skills Practice

Combinations

Tell whether each situation represents a *permutation* or *combination*. Then solve the problem.

1. You are allowed to omit two out of 12 questions on a quiz. How many ways can you select the questions to omit?

2. Six students are to be chosen from a class of 18 to represent the class at a math contest. How many ways can the six students be chosen?

3. How many different 5-digit zip codes are possible if no digits are repeated?

4. In a race with six runners, how many ways can the runners finish first, second, or third?

5. How many ways can two names be chosen from 76 in a raffle if only one entry per person is allowed?

6. How many ways can six students be arranged in a lunch line?

7. A family has a bike rack that fits seven bikes but they only have five bikes. How many ways can the bikes fit in the bike rack?

8. How many ways can you select three sheriff deputies from eight candidates?

9. How many ways can four finalists be selected from 50 contestants?

10. How many 4-digit pin numbers are available if no number is repeated?

11. How many handshakes can occur between five people if everyone shakes hands?

NAME _____ DATE _____ PERIOD _____

9-5 Practice

Combinations

Solve each problem.

1. **BASKETBALL** In how many ways can a coach select 5 players from a team of 10 players?

2. **BOOKS** In how many ways can 3 books be selected from a shelf of 25 books?

3. **CAFETERIA** In how many ways can you choose 2 side dishes from 15 items?

4. **CHORES** Of 8 household chores, in how many ways can you do three-fourths of them?

5. **ELDERLY** Latanya volunteers to bake and deliver pastries to elderly people in her neighborhood. In how many different ways can Latanya deliver to 2 of the 6 elderly people in her neighborhood?

6. **DELI** A deli makes potato, macaroni, three bean, Caesar, 7-layer, and Greek salads. The deli randomly makes only four salads each day. What is the probability that the four salads made one day are 7-layer, macaroni, Greek, and potato?

7. **AUTOGRAPHS** A sports memorabilia enthusiast collected autographed baseballs from the players in the table. The enthusiast is giving one autographed baseball to each of his three grandchildren. If the baseballs are selected at random, what is the probability that the Hank Aaron, Alex Rodriquez, and Mickey Mantle autographed baseballs are given to his grandchildren?

Player
Cal Ripkin
Hank Aaron
Barry Bonds
Alex Rodriquez
Mickey Mantle

For Exercises 8–10, tell whether each problem represents a *permutation* or a *combination*. Then solve the problem.

8. **LOCKS** In how many ways can three different numbers be selected from 10 numbers to open a keypad lock?

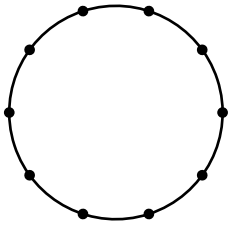
9. **MOVIES** How many ways can 10 DVDs be placed on a shelf?

10. **TRANSPORTATION** Eight people need transportation to the concert. How many different groups of 6 people can ride with Mrs. Johnson?

NAME _____ DATE _____ PERIOD _____

9-5 Word Problem Practice

Combinations

1. SNACKS A vending machine can display six snacks. If there are eight different kinds of snacks available, how many 2 groups of six different snacks can be purchased?	**2. MUSIC** Each month, Jose purchases two CDs from a selection of 20 bestselling CDs. How many different pairs of CDs can Jose choose if he chooses two different CDs?
3. TESTS On a math test, you can choose any 20 out of 23 questions. How many different groups of 20 questions can you choose?	**4. RESTAURANTS** The dinner special at a local pizza parlor gives you the choice of two toppings from a selection of six toppings. How many different choices are possible if two different toppings are chosen?
5. TESTING In a science fair experiment, two units are selected for testing from every 500 units produced. How many ways can these two units be selected?	**6. MEETINGS** Linda's teacher divided the class into groups of five and required each member of a group to meet with every other member of that group. How many meetings will each group have?
7. BASEBALL A baseball coach has 13 players to fill nine positions. How many different teams could he put together?	**8. GEOMETRY** Ten points are marked on a circle. How many different triangles can be drawn between any three points? 

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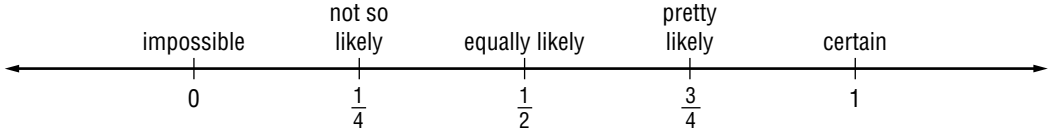
9-5 Enrichment

From Impossible to Certain Events

A probability is often expressed as a fraction. As you know, an event that is impossible is given a probability of 0 and an event that is certain is given a probability of 1. Events that are neither impossible nor certain are given a probability somewhere between 0 and 1. The probability line below shows relative probabilities.



Determine the probability of an event by considering its place on the diagram above.

1. Medical research will find a cure for all diseases.

2. There will be a personal computer in each home by the year 2010.

3. One day, people will live in space or under the sea.

4. Wildlife will disappear as Earth's human population increases.

5. There will be a fifty-first state in the United States.

6. The sun will rise tomorrow morning.

7. Most electricity will be generated by nuclear power by the year 2010.

8. The fuel efficiency of automobiles will increase as the supply of gasoline decreases.

9. Astronauts will land on Mars.

10. The percent of high school students who graduate and enter college will increase.

11. Global warming problems will be solved.

12. All people in the United States will exercise regularly within the near future.

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9-5 TI-83/84 Plus Activity

Combinations

A graphing calculator can be used to solve problems involving combinations. On the TI-83/84 Plus, the combination function can be found in the MATH (PRB) menu.

Example 1

How many ways can 2 people be chosen from a group of 10 people?

Since order does not matter, this is a combination.

Enter: 10 MATH ◀ 3 2 ENTER **45**

So, the number of ways 2 people can be chosen from a group of 10 people is 45.

Example 2

How many 5-card hands can be chosen from a deck of 52 cards?

Since order does not matter, this is a combination.

Enter: 52 MATH ◀ 3 5 ENTER **2,598,960**

So, the number of 5-card hands that can be chosen from a 52-card deck is 2,598,960.

Exercises

Solve each problem.

1. How many groups of 3 people can be chosen from a group of 5 people?
2. How many groups of 4 people can be chosen from a group of 8 people?
3. How many groups of 10 people can be chosen from a group of 20 people?
4. How many groups of 2 people can be chosen from a group of 12 people?
5. How many groups of 8 people can be chosen from a group of 9 people?
6. How many 2-topping pizzas can be made from a pizza restaurant offering 6 different toppings?
7. How many 3-topping pizzas can be made from a pizza restaurant offering 10 different toppings?
8. How many 7-card hands can be chosen from a deck of 52 cards?
9. How many 4-card hands can be chosen from a deck of 52 cards?
10. How many two-topping sundaes can be made from an ice cream shop offering 9 different toppings?

NAME _____ DATE _____ PERIOD _____

9-6 Study Guide and Intervention

Problem-Solving Investigation: Act It Out

By acting out a problem, you are able to see all possible solutions to the problem being posed.

Example **CLOTHING** **Ricardo has two shirts and three pairs of pants to choose from for his outfit to wear on the first day of school. How many different outfits can he make by wearing one shirt and one pair of pants?**

Understand We know that he has two shirts and three pairs of pants to choose from. We can use a coin for the shirts and an equally divided spinner labeled for the pants.

Plan Let's make a list showing all possible outcomes of tossing a coin and then spinning a spinner.

Solve H = Heads
T = Tails
Spinner = 1, 2, 3

Flip a Coin	Spin a Spinner
H	1
H	2
H	3
T	1
T	2
T	3

There are six possible outcomes of tossing a coin and spinning a spinner. So, there are 6 different possible outfits that Ricardo can wear for the first day of school.

Check Tossing a coin has two outcomes and there are two shirts. Spinning a three-section spinner has three outcomes and there are three pairs of pants. Therefore, the solution of 6 different outcomes with a coin and spinner represent the 6 possible outfit outcomes for Ricardo.

Exercises

1. **SCIENCE FAIR** There are 4 students with projects to present at the school science fair. How many different ways can these 4 projects be displayed on four tables in a row?

2. **GENDER** Determine whether tossing a coin is a good way to predict the gender of the next 5 babies born at General Hospital. Justify your answer.

3. **OLYMPICS** Four runners are entered in the first hurdles heat of twelve heats at the Olympics. The first two move on to the next round. Assuming no ties, how many different ways can the four runners come in first and second place?

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9-6 Skills Practice

Problem-Solving Investigation: Act it Out

Use the act it out strategy to solve.

1. **SCHOOL** Determine whether rolling a 6-sided number cube is a good way to answer a 20-question multiple-choice test if there are six choices for each question. Justify your answer.

2. **GYMNASTICS** Five gymnasts are entered in a competition. Assuming that there are no ties, how many ways can first, second, and third places be awarded?

3. **LUNCH** How many ways can 3 friends sit together in three seats at lunch?

4. **SCHEDULE** How many different schedules can Sheila create if she has to take English, math, science, social studies, and art next semester. Assume that there is only one lunch period available.

5. **BAND CONCERTS** The band is having a holiday concert. In the first row, the first trumpet is always furthest to the right and the first trombone is always the furthest to the left. How many ways are there to arrange the other 4 people who need to sit in the front?

6. **TEAMS** Mr. D is picking teams for volleyball is gym by having the students count off by 2's. The 1's will be on one team and the 2's on the other. Would flipping a coin would work just as well to pick the teams? Justify your answer.

NAME _____ DATE _____ PERIOD _____

9-6 Practice

Problem-Solving Investigation: Act It Out

Mixed Problem Solving

For Exercises 1 and 2, use the act it out strategy.

1. **POP QUIZ** Use the information in the table to determine whether tossing a nickel and a dime is a good way to answer a 5-question multiple-choice quiz if each question has answer choices A, B, C, and D. Justify your answer.

Nickel	Dime	Answer Choice
H	H	A
H	T	B
T	H	C
T	T	D

2. **BOWLING** Bill, Lucas, Carmen, and Dena go bowling every week. When ordered from highest to lowest, how many ways can their scores be arranged if Lucas is never first and Carmen always beats Bill?

Use any strategy to solve Exercises 3–6. Some strategies are shown below.

PROBLEM-SOLVING STRATEGIES
• Draw a diagram. • Use reasonable answers. • Act it out.

3. **BOOKS** What is the probability of five books being placed in alphabetical order of their titles if randomly put on a book shelf?

4. **NUMBER THEORY** The sum of a 2-digit number and the 2-digit number when the digits are reversed is 77. If the difference of the same two numbers is 45, what are the two 2-digit numbers?

5. **BASEBALL** In one game, Rafael was up to bat 3 times and made 2 hits. In another game, he was up to bat 5 times with no hits. What percent of the times at bat did Rafael make a hit?

6. **RESTAURANT** A restaurant offers the possibility of 168 three-course dinners. Each dinner has an appetizer, an entrée, and a dessert. If the number of appetizers decreases from 7 to 5, find how many fewer possible three-course dinners the restaurant offers.

NAME _____ DATE _____ PERIOD _____

9-6 Word Problem Practice

Problem-Solving Investigation: Act It Out

Solve each problem using any strategy you have learned.

1. POLLS Out of 200 people, 32% said that their favorite animal was a cat and 44% said that their favorite animal was a dog. How many more people chose dog than cat?

2. PEACHES Roi is picking peaches; he needs a total of $3\frac{1}{2}$ bushels of peaches. If he has already picked 3 bushels, how many more does he need to pick?

A 2 bushels **C** $3\frac{1}{2}$ bushels

B $\frac{1}{2}$ bushel **D** 3 bushels

3. BASEBALL Thirty-two teams are playing in the championship. If a team is eliminated once it loses, how many total games will be played in the championship?

4. GEOMETRY Find the next two terms is the sequence.

5. POOL RENTAL The table below shows how much Ford Middle School was charged to rent the pool for a party based on the number of hours it was rented. Predict the cost for 5 hours.

# of hours	Cost
1	$120
1.5	$180
2	$240
2.5	$300

6. GEOMETRY Use the formula $D = rt$ where D is the distance, r is the rate, and t is the time to determine how far Alyssa drove if she drove 55 miles per hour for 4 hours.

7. SCHOOL ELECTIONS How many ways can a president, vice president, secretary and treasurer be elected from a choice of 6 students?

8. SHOPPING Morty bought skis. The skis cost $215 and he got $35 in change. How much did Morty pay with?

NAME _____ DATE _____ PERIOD _____

9-7 Lesson Reading Guide

Theoretical and Experimental Probability

Get Ready for the Lesson

Complete the Mini Lab at the top of page 486 in your textbook. Write your answers below.

1. Compare the number of times you *expected* to roll doubles with the number of times you *actually* rolled doubles.

2. Write the probability of rolling doubles out of 36 rolls using the number of times you *expected* to roll doubles from Step 1. Then write the probability of rolling doubles out of 36 rolls using the number of times you *actually* rolled doubles from Step 2.

Read the Lesson

3. Look up the word *experimental* in a dictionary. Write the meaning for the word as used in the lesson.

4. How does theoretical probability differ from experimental probability?

5. Complete the sentence: Experimental probability can be based on _____ and can be used to make predictions about future events.

Remember What You Learned

6. Work with a partner. Design an experiment that you can use to express the experimental probability of an event. Compare your findings with those of others in your class.

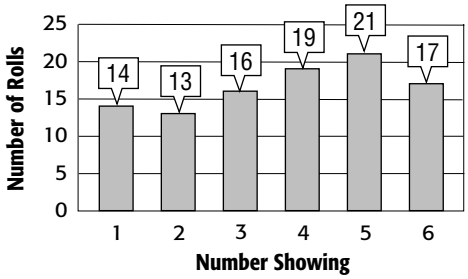
NAME _____ DATE _____ PERIOD _____

9-7 Study Guide and Intervention

Theoretical and Experimental Probability

Experimental probability is found using frequencies obtained in an experiment or game. **Theoretical probability** is the expected probability of an event occurring.

Example 1 **The graph shows the results of an experiment in which a number cube was rolled 100 times. Find the experimental probability of rolling a 3 for this experiment.**



$$P(3) = \frac{\text{number of times 3 occurs}}{\text{number of possible outcomes}}$$

$$= \frac{16}{100} \text{ or } \frac{4}{25}$$

The experimental probability of rolling a 3 is $\frac{4}{25}$, which is close to its theoretical probability of $\frac{1}{6}$.

Example 2 **In a telephone poll, 225 people were asked for whom they planned to vote in the race for mayor. What is the experimental probability of Juarez being elected?**

Candidate	Number of People
Juarez	75
Davis	67
Abramson	83

Of the 225 people polled, 75 planned to vote for Juarez.

So, the experimental probability is $\frac{75}{225}$ or $\frac{1}{3}$.

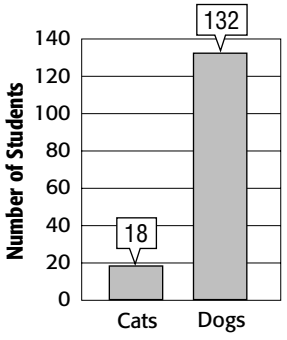
Example 3 **Suppose 5,700 people vote in the election. How many can be expected to vote for Juarez?**

$\frac{1}{3} \cdot 5{,}700 = 1{,}900$

About 1,900 will vote for Juarez.

Exercises

For Exercises 1–3, use the graph of a survey of 150 students asked whether they prefer cats or dogs.



1. What is the probability of a student preferring dogs?

2. Suppose 100 students were surveyed. How many can be expected to prefer dogs?

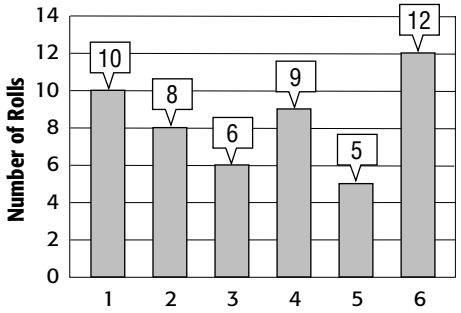
3. Suppose 300 students were surveyed. How many can be expected to prefer cats?

NAME _____ DATE _____ PERIOD _____

9-7 Skills Practice

Theoretical and Experimental Probability

For Exercises 1–5, a number cube is rolled 50 times and the results are shown in the graph below.



1. Find the experimental probability of rolling a 2.

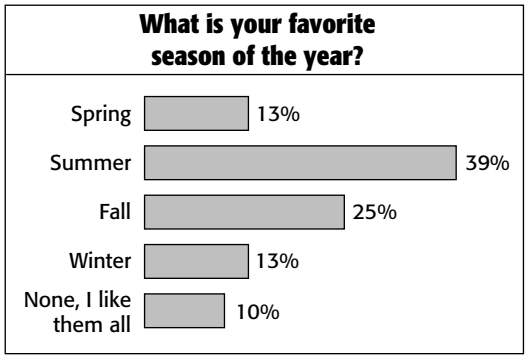
2. What is the theoretical probability of rolling a 2?

3. Find the experimental probability of *not* rolling a 2.

4. What is the theoretical probability of *not* rolling a 2?

5. Find the experimental probability of rolling a 1.

For Exercises 6–9, use the results of the survey at the right.



6. What is the probability that a person's favorite season is fall? Write the probability as a fraction.

7. Out of 300 people, how many would you expect to say that fall is their favorite season?

8. Out of 20 people, how many would you expect to say that they like all the seasons?

9. Out of 650 people, how many more would you expect to say that they like summer than say that they like winter?

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9-7 Practice

Theoretical and Experimental Probability

For Exercises 1–4, a number cube is rolled 24 times and lands on 2 four times and on 6 three times.

1. Find the experimental probability of landing on a 2.

2. Find the experimental probability of *not* landing on a 6.

3. Compare the experimental probability you found in Exercise 1 to its theoretical probability.

4. Compare the experimental probability you found in Exercise 2 to its theoretical probability.

ENTERTAINMENT For Exercises 5–7, use the results of the survey in the table shown.

5. What is the probability that someone in the survey considered reading books or surfing the Internet as the best entertainment value? Write the probability as a fraction.

6. Out of 500 people surveyed, how many would you expect considered reading books or surfing the Internet as the best entertainment value?

7. Out of 300 people surveyed, is it reasonable to expect that 30 considered watching television as the best entertainment value? Why or why not?

Best Entertainment Value	
Type of Entertainment	**Percent**
Playing Interactive Games	48%
Reading Books	22%
Renting Movies	10%
Going to Movie Theaters	10%
Surfing the Internet	9%
Watching Television	1%

For Exercises 8–10, a spinner marked with four sections blue, green, yellow, and red was spun 100 times. The results are shown in the table.

8. Find the experimental probability of landing on green.

9. Find the experimental probability of landing on red.

10. If the spinner is spun 50 more times, how many of these times would you expect the pointer to land on blue?

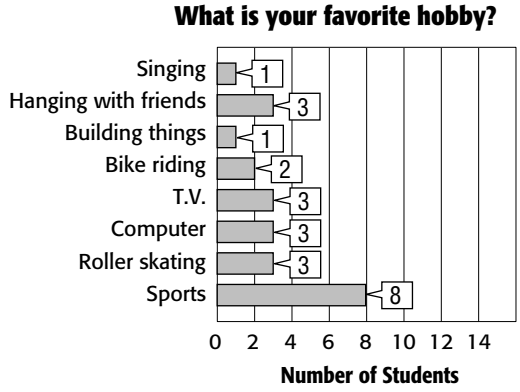
Section	Frequency
Blue	14
Green	10
Yellow	8
Red	68

NAME _____ DATE _____ PERIOD _____

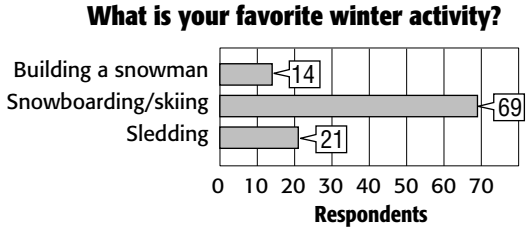
9-7 Word Problem Practice

Theoretical and Experimental Probability

HOBBIES For Exercises 1–3, use the graph of a survey of 24 seventh grade students asked to name their favorite hobby .



WINTER ACTIVITIES For Exercises 5 and 6, use the graph of a survey with 104 responses in which respondents were asked about their favorite winter activities.



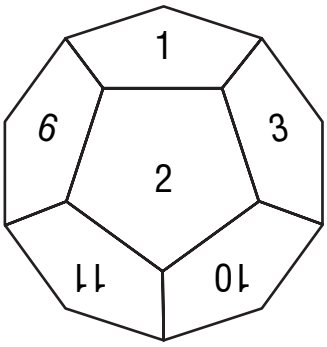
1. What is the probability that a student's favorite hobby is roller skating?	**2.** Suppose 200 seventh grade students were surveyed. How many can be expected to say that roller skating is their favorite hobby?
3. Suppose 60 seventh grade students were surveyed. How many can be expected to say that bike riding is their favorite hobby?	**4.** **MARBLES** A bag contains 5 blue, 4 red, 9 white, and 6 green marbles. If a marble is drawn at random and replaced 100 times, how many times would you expect to draw a green marble?
5. What is the probability that someone's favorite winter activity is building a snowman? Write the probability as a fraction.	**6.** If 500 people had responded, how many would have been expected to list sledding as their favorite winter activity? Round to the nearest whole person.

Lesson 9–7

NAME _____ DATE _____ PERIOD _____

9-7 Enrichment

Rolling a Dodecahedron



A **dodecahedron** is a solid. It has twelve faces, and each face is a pentagon.

At the right, you see a dodecahedron whose faces are marked with the integers from 1 through 12. You can roll this dodecahedron just as you roll a number cube. With the dodecahedron, however, there are *twelve* equally likely outcomes.

Refer to the dodecahedron shown at the right. Find the probability of each event.

1. $P(5)$

2. $P(\text{odd})$

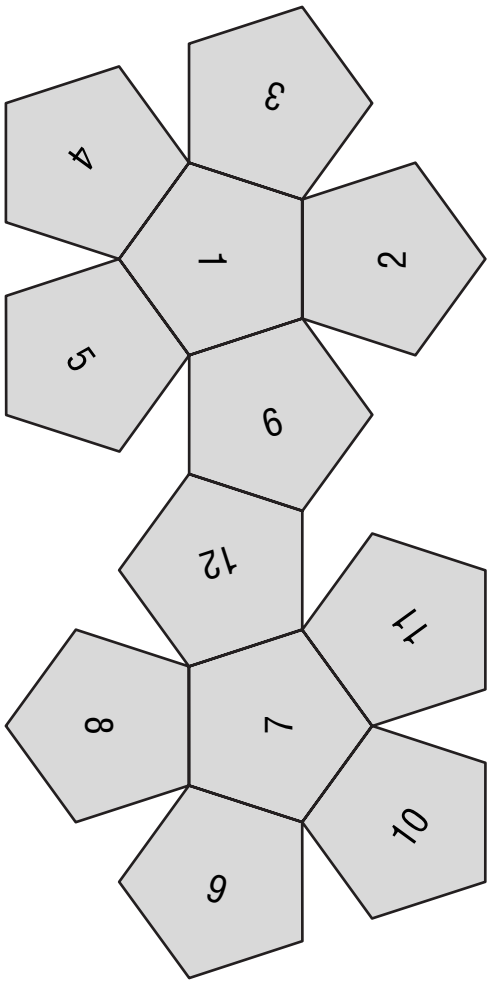
3. $P(\text{prime})$

4. $P(\text{divisible by } 5)$

5. $P(\text{less than } 4)$

6. $P(\text{fraction})$

You can make your own dodecahedron by cutting out the pattern at the right. Fold along each of the solid lines. Then use tape to join the faces together so that your dodecahedron looks like the one shown above.



7. Roll your dodecahedron 100 times. Record your results on a separate sheet of paper, using a table like this.

Outcome	Tally	Frequency
1		
2		

8. Use your results from Exercise 7. Find the experimental probability for each of the events described in Exercises 1–6.

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9-7 TI-73 Activity

Experimental Probability

Use your calculator to simulate flipping a coin or rolling a number cube. These features are found in the MATH PRB (probability) menu. The calculator displays a random number that represents heads or tails on a coin or the number on a number cube. The calculator calls number cubes *dice*.

Example 1 **Roll two number cubes 100 times. Calculate the experimental probability of rolling double-1, double-2, double-3, double-4, double-5, or double-6.**

Step 1 Clear Home.

2nd [MEM] 5 ENTER

Step 2 Choose the dice feature in MATH PRB.

MATH ▶ ▶ 7

Step 3 The display shows dice(. Use 2 dice.

2 ENTER

Step 4 Interpret the result and continue for 100 rolls.

The display shows an ordered pair of digits, like (3 5). This means the first cube shows a 3 and the second cube shows a 5. If a double, like (2 2) or (5 5), appears, tally it in the chart below. Continue with the next roll by pressing ENTER .

Exercises

Use your graphing calculator to complete the following.

Double	Tally	Number	Fraction	Percent
(1, 1)				
(2, 2)				
(3, 3)				
(4, 4)				
(5, 5)				
(6, 6)				

1. Complete the table for 100 rolls. Calculate the Fraction and Percent columns.
2. The theoretical probability of rolling double-1 (or any other double) is 1/36 or about 3%. Compare this theoretical probability with your experimental results.

3. Do another experiment, but use the coin feature of MATH PRB. Explore the probability of a family with three children having all girls. Flip 3 coins. Each coin stands for one child. If the result is a 1, then the child is a boy; if it is 0, then the child is a girl. Flip the three coins 100 times. Tally the results of 3 girls and of 3 boys. Describe your results.

	Tally	Number	Fraction	Percent
All girls (0, 0, 0)				
All boys (1, 1, 1)				

NAME _____ DATE _____ PERIOD _____

9-8 Lesson Reading Guide

Compound Events

Get Ready for the Lesson

Read the introduction at the top of page 492 in your textbook. Write your answers below.

1. If Reginald picks one quarter without looking, what is the probability it is from Colorado?

2. Suppose he tosses the coin. What is the probability it lands heads up?

3. Make a tree diagram to find the probability of choosing a Colorado quarter that lands heads up.

4. How are the answers to Exercises 1, 2, and 3 related?

Read the Lesson

Use the introduction to the lesson to answer Exercises 5–8.

5. What does a compound event consist of?

6. Define independent events.

7. Write the probability of independent events in symbols.

8. How can you find the probability of two independent events?

Remember What You Learned

9. List several independent compound events. Explain why you consider the events to be independent.

NAME _____ DATE _____ PERIOD _____

9-8 Study Guide and Intervention

Compound Events

A **compound event** consists of two or more simple events. If the outcome of one event does not affect the outcome of a second event, the events are called **independent events**. The probability of two independent events can be found by multiplying the probability of the first event by the probability of the second event.

Example 1 **A coin is tossed and a number cube is rolled. Find the probability of tossing tails and rolling a 5.**

$P(\text{tails}) = \frac{1}{2}$ $P(5) = \frac{1}{6}$

$P(\text{tails and } 5) = \frac{1}{2} \cdot \frac{1}{6}$ or $\frac{1}{12}$

So, the probability of tossing tails and rolling a 5 is $\frac{1}{12}$.

Example 2 **MARBLES A bag contains 7 blue, 3 green, and 3 red marbles. If Agnes randomly draws two marbles from the bag, replacing the first before drawing the second, what is the probability of drawing a green and then a blue marble?**

$P(\text{green}) = \frac{3}{13}$ 13 marbles, 3 are green

$P(\text{blue}) = \frac{7}{13}$ 13 marbles, 7 are blue

$P(\text{green, then blue}) = \frac{3}{13} \cdot \frac{7}{13} = \frac{21}{169}$

So, the probability that Agnes will draw a green, then a blue marble is $\frac{21}{169}$.

Exercises

1. Find the probability of rolling a 2 and then an even number on two consecutive rolls of a number cube.

2. A penny and a dime are tossed. What is the probability that the penny lands on heads and the dime lands on tails?

3. Lazlo's sock drawer contains 8 blue and 5 black socks. If he randomly pulls out one sock, what is the probability that he picks a blue sock?

Lesson 9–8

NAME _____ DATE _____ PERIOD _____

9-8 Skills Practice

Compound Events

1. Four coins are tossed. What is the probability of tossing all heads?

2. One letter is randomly selected from the word PRIME and one letter is randomly selected from the word MATH. What is the probability that both letters selected are vowels?

3. A card is chosen at random from a deck of 52 cards. It is then replaced and a second card is chosen. What is the probability of getting a jack and then an eight?

For Exercises 4–6, use the information below.

A standard deck of playing cards contains 52 cards in four suits of 13 cards each. Two suits are red and two suits are black. Find each probability. Assume the first card is replaced before the second card is drawn.

4. P(black, queen) **5.** P(black, diamond) **6.** P(jack, queen)

7. What is the probability of spinning a number greater than 5 on a spinner numbered 1 to 8 and tossing a tail on a coin?

8. Two cards are chosen at random from a standard deck of cards with replacement. What is the probability of getting 2 aces?

9. A CD rack has 8 classical CDs, 5 pop CDs, and 3 rock CDs. One CD is chosen and replaced, then a second CD is chosen. What is the probability of choosing a rock CD then a classical CD?

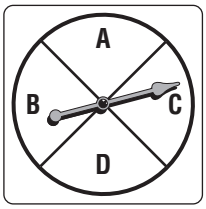
10. A jar holds 15 red pencils and 10 blue pencils. What is the probability of drawing one red pencil from the jar?

NAME _____ DATE _____ PERIOD _____

9-8 Practice

Compound Events

A number cube is rolled and a spinner like the one shown is spun. Find each probability.



1. P(6 and D)

2. P(multiple of 2 and B)

3. P(not 6 and not A)

A set of 7 cards is labeled 1–7. A second set of 12 cards contains the following colors: 3 green, 6 red, 2 blue, and 1 white. One card from each set is selected. Find each probability.

4. P(6 and green)

5. P(prime and blue)

6. P(odd and red)

7. P(7 and white)

8. P(multiple of 3 and red)

9. P(even and white)

A coin is tossed, a number cube is rolled, and a letter is picked from the word *framer*.

10. P(tails, 5, m)

11. P(heads, odd, r)

12. P(heads, 6, vowel)

13. P(tails, prime, consonant)

14. P(not tails, multiple of 3, a)

15. P(not heads, 2, f)

16. **TOLL ROAD** Mr. Espinoza randomly chooses one of five toll booths when entering a toll road when driving to work. What is the probability he will select the middle toll booth on Monday and Tuesday?

MARBLES For Exercises 17–20, use the information in the table shown to find each probability. After a marble is randomly picked from a bag containing marbles of four different colors, the color of the marble is observed and then it is returned to the bag.

Marbles	
Color	**Number**
White	6
Green	2
Red	1
Blue	3

17. P(red)

18. P(green, blue)

19. P(red, white, blue)

20. P(blue, blue, blue)

Lesson 9–8

NAME _____ DATE _____ PERIOD _____

9-8 Word Problem Practice

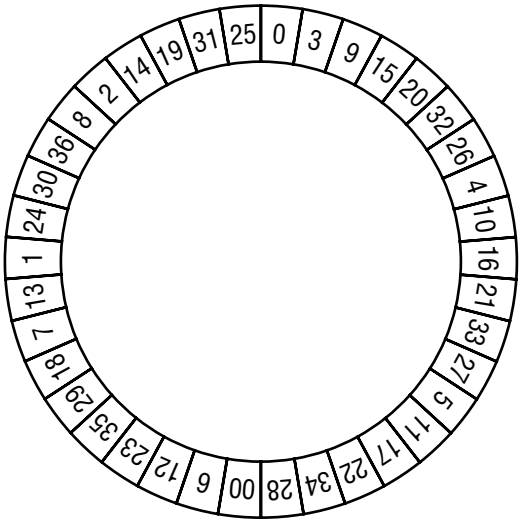
Compound Events

1. SAFETY Eighty percent of all California drivers wear seat belts. If three drivers are pulled over, what is the probability that all would be wearing their seat belts? Write as a percent to the nearest tenth.	**2. VEGETABLES** A nationwide survey showed that 65% of all children in the United States dislike eating vegetables. If three children are chosen at random, what is the probability that all three dislike eating vegetables? Write as a percent to the nearest tenth.
3. QUALITY In a shipment of 50 calculators, 4 are defective. One calculator is randomly selected and tested. What is the probability that it is defective?	**4. MARBLES** A bag contains 6 green marbles, 2 blue marbles, and 3 white marbles. Gwen draws one marble from the jar and replaces it. Jeff then draws one marble from the jar. What is the probability that Gwen draws a blue marble and Jeff draws a white marble?
5. DEMONSTRATION Ms. Morris needs a student to help her with a demonstration for her class of 12 girls and 14 boys. She randomly chooses a student. What is the probability that she chooses a girl?	**6. SURVEY** Ruben surveyed his class and found that 4 out of 22 students walk to school. If one of the 22 students is selected at random, what is the probability that the chosen student DOES NOT walk to school?

NAME _____ DATE _____ PERIOD _____

9-8 Enrichment

Compound Events



The game of roulette is played by dropping a ball into a spinning, bowl-shaped wheel. When the wheel stops spinning, the ball will come to rest in any of 38 locations.

On a roulette wheel, the eighteen even numbers from 2 through 36 are colored red and the eighteen odd numbers from 1 through 35 are colored black. The numbers 0 and 00 are colored green.

To find the probability of two independent events, the results of two spins, find the probability of each event first.

$$P(\text{red}) = \frac{18}{38} \text{ or } \frac{9}{19}$$

$$P(\text{black}) = \frac{18}{38} \text{ or } \frac{9}{19}$$

Then multiply.

$$P(\text{red, then black}) = \frac{9}{19} \times \frac{9}{19} \text{ or } \frac{81}{361}$$

Find each probability.

1. black, then black

2. prime number, then a composite number

3. a number containing at least one 0, then a number containing at least one 2

4. red, then black

5. the numbers representing your age, month of birth, and then day of birth

Lesson 9–8

NAME _____ DATE _____ PERIOD _____

9-8 TI-73 Activity

Probability and Percents

When you solve probability problems, use your calculator to express fractions as decimals and percents.

Example 1 **Two number cubes are rolled. Find the probability that both cubes show an odd number. Report the probability as a percent.**

The probability of a cube showing an odd number is $\frac{1}{2}$. To find the probability that both first and second cubes are odd, multiply $\frac{1}{2}$ by $\frac{1}{2}$.

Keys:	Display:
1 b/c 2 ▶ × 1 b/c 2 ENTER	$\frac{1}{2} * \frac{1}{2}$ $\frac{1}{4}$
F↔D ENTER	$\frac{1}{4}$ F←→D .25
× 100 ENTER	Ans∗100 25

The probability that both cubes show odd numbers is 25%.

Example 2 **There are 3 red marbles and 5 blue marbles in a bag. Two marbles are drawn and the first marble is replaced before the second is drawn. What is the probability of drawing 2 blue marbles? Report the probability as a percent.**

Keys:	Display:
5 b/c 8 ▶ × 5 b/c 8 ENTER	$\frac{5}{8} * \frac{5}{8}$ $\frac{25}{64}$
F↔D ENTER	$\frac{25}{64}$ F←→D 0.390625
× 100 ENTER	Ans∗100 0.390625

The probability of drawing 2 blue marbles is 39.06%.

Find each probability. Report your answer as a percent. Round percents to the nearest hundredth when necessary.

1. You draw 2 marbles from a bag replacing the first marble before drawing the second. The bag contains 4 yellow marbles, 2 white marbles, and 6 red marbles.

a. What is the probability that your first marble is red and the second is yellow?

b. What is the probability that both marbles are white?

c. What is the probability that neither marble is red?

d. What is the probability that both marbles are red?

2. You have three number cubes.

a. What is the probability that you will roll all even numbers?

b. What is the probability that you will roll only numbers less than 3?

c. **CHALLENGE** What is the probability that you will roll a 1 on only one number cube?

NAME _____ DATE _____ PERIOD _____

9 Student Recording Sheet

Use this recording sheet with pages 504–505 of the Student Edition.

Part 1: Multiple Choice

Read each question. Then fill in the correct answer.

1. Ⓐ Ⓑ Ⓒ Ⓓ

2. Ⓕ Ⓖ Ⓗ Ⓙ

3. Ⓐ Ⓑ Ⓒ Ⓓ

4. Ⓕ Ⓖ Ⓗ Ⓙ

5. Ⓐ Ⓑ Ⓒ Ⓓ

6. Ⓕ Ⓖ Ⓗ Ⓙ

7. Ⓐ Ⓑ Ⓒ Ⓓ

8. Ⓕ Ⓖ Ⓗ Ⓙ

9. Ⓐ Ⓑ Ⓒ Ⓓ

Part 2: Short Response/Grid in

Record your answer in the blank.

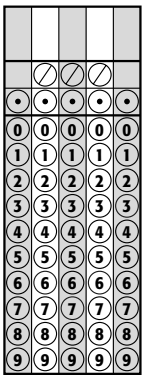
For grid in questions, also enter your answer in the grid by writing each number or symbol in a box. Then fill in the corresponding circle for that number or symbol.

10. _____

11. _____

12. _____ (*grid in*)

12.



Part 3: Extended Response

Record your answers for Question 13 on the back of this paper.

Assessment

NAME _____ DATE _____ PERIOD _____

9 Rubric for Scoring Extended Response

SCORE _____

(Use to score the Extended-Response question on page 505 of the Student Edition.)

General Scoring Guidelines

- If a student gives only a correct numerical answer to a problem but does not show how he or she arrived at the answer, the student will be awarded only 1 credit. All extended response questions require the student to show work.
- A fully correct answer for a multiple-part question requires correct responses for all parts of the question. For example, if a question has three parts, the correct response to one or two parts of the question that required work to be shown is *not* considered a fully correct response.
- Students who use trial and error to solve a problem must show their method. Merely showing that the answer checks or is correct is not considered a complete response for full credit.

Exercise 13 Rubric

Score	Specific Criteria
4	A correct tree diagram is given. The probability that Audrey will wear the red shirt with white pants first will be correctly determined to be $\frac{1}{12}$. The probability that Audrey will wear a yellow shirt with black pants the first day and a green shirt with brown pants the second day is correctly determined to be $\frac{1}{12} \times \frac{1}{12}$ or $\frac{1}{132}$.
3	The probabilities are computed correctly, but there are one or two mistakes in the tree diagram.
2	The probabilities are computed correctly, but the tree diagram is incorrect or not given. **OR** The tree diagram is correct, but only one of the probabilities is computed correctly.
1	The tree diagram is correct, but neither probability is computed correctly. **OR** One probability is computed correctly, but the other probability and the tree diagram are incorrect or not given.
0	Response is completely incorrect.

NAME _____ DATE _____ PERIOD _____

9 Chapter 9 Quiz 1

SCORE _____

(Lessons 9-1 and 9-2)

For Questions 1–3, a bag contains 3 blue, 5 red, and 8 yellow balls. Find each probability if you draw one ball at random from the bag. Write as a fraction in simplest form.

1. P(yellow) **1.** _____

2. P(blue or red) **2.** _____

3. P(not blue) **3.** _____

4. Make a tree diagram on another piece of paper to find the number of ways you can arrange the colors yellow, red, blue, and green if no color can be used more than once. What is the total number of possible arrangements? **4.** _____

5. **MULTIPLE CHOICE** Supose there are 2 colors (red and blue) for 4 cars (one color per car). Give the total number of possible car-color choices.

A. 4 choices **B.** 6 choices **C.** 8 choices **D.** 10 choices **5.** _____

NAME _____ DATE _____ PERIOD _____

9 Chapter 9 Quiz 2

SCORE _____

(Lessons 9-3 and 9-4)

1. There are 3 paths connecting the library and the post office, 2 paths connecting the post office and the bank, and 4 paths connecting the bank to home. Find the number of ways to walk from the library to home. **1.** _____

2. **SNEAKERS** An athletic shoe manufacturer makes sneakers that are white leather or one of three canvas colors with lace-up or Velcro closures. How many different sneakers can be made? **2.** _____

3. In how many ways can a president and vice-president be randomly selected from a class of 28 students? **3.** _____

4. How many permutations are possible of the letters in the word *plant*? **4.** _____

5. In how many ways can 8 pieces of luggage be arranged on a conveyor belt? **5.** _____

Assessment

NAME _____ DATE _____ PERIOD _____

9 Chapter 9 Quiz 3

SCORE _____

(Lessons 9-5 and 9-6)

1. **ART** How many ways can 4 Van Gogh and 5 Monet paintings be hung in 4 spaces if order is not important? **1.** _____

2. **CARROTS** Austin has 10 carrots and he wants to feed 6 of them to his rabbits. How many ways can he do this? **2.** _____

3. In how many ways can you pick 3 fish from a tank of 9 if order is not important? **3.** _____

4. Five people are getting into a car. Two people have already claimed the front seats. In how many different ways can the back three seats be taken? **4.** _____

5. There are six finalists in the science fair. In how many different ways can first and second places be awarded? **5.** _____

NAME _____ DATE _____ PERIOD _____

9 Chapter 9 Quiz 4

SCORE _____

(Lessons 9-7 and 9-8)

SHIRTS Grant has 6 different shirts to choose from: maroon, blue, brown, gold, green, and purple.

1. If Grant selects a shirt at random, what is the probability it will be blue or green? **1.** _____

2. If Grant chooses shirts 10 times and chooses the gold one 4 times, what is the experimental probability that the gold shirt is chosen? **2.** _____

3. Find the theoretical probability that a gold shirt is chosen. Discuss any difference between this result and the result found in Question 2. **3.** _____

4. A coin is tossed, and a number cube is rolled. Find P (tails, factor of 12). **4.** _____

5. Four rap CDs, seven dance CDs, two country CDs, three R & B CDs, and five pop CDs are on a shelf. Without replacing the first CD, Ryan takes a second. Find P(R & B, then dance). **5.** _____

NAME _____ DATE _____ PERIOD _____

9 Chapter 9 Mid-Chapter Test

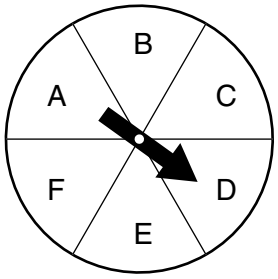
SCORE _____

(Lessons 9-1 and 9-4)

PART I

Write the letter for the correct answer in the blank at the right of each question.

Use the spinner at the right to find each probability. Write as a fraction in simplest form.



1. P(C)

A. $\frac{1}{8}$ **B.** $\frac{1}{6}$ **C.** $\frac{1}{3}$ **D.** 6 **1.** _____

2. P(vowel)

F. $\frac{1}{6}$ **G.** $\frac{1}{3}$ **H.** $\frac{1}{2}$ **J.** 3 **2.** _____

3. P(not D)

A. 5 **B.** $\frac{5}{6}$ **C.** $\frac{5}{8}$ **D.** $\frac{1}{6}$ **3.** _____

4. **LETTERS** How many permutations are possible of the letters in the word *locker*?

F. 720 **G.** 120 **H.** 21 **J.** 6 **4.** _____

5. **ART** Eight different color markers are in a box: red, blue, green, yellow, pink, purple, brown, and black. Anne randomly selects two. What is the probability that she selects a red and blue marker?

A. $\frac{1}{64}$ **B.** $\frac{1}{56}$ **C.** $\frac{1}{4}$ **D.** $\frac{1}{8}$ **5.** _____

6. **CONCERT** There are four soloists at an orchestra concert. In how many different orders can the musicians play a solo during the evening?

F. 4 **G.** 10 **H.** 12 **J.** 24 **6.** _____

PART II

For each situation, use a tree diagram to find the total number of outcomes.

7. tossing a quarter and tossing a penny **7.** _____

8. choosing to watch TV or read a book and choosing pretzels, an apple, or popcorn for a snack **8.** _____

9. choosing a book to read from 5 mysteries and choosing another book to read from 6 biographies **9.** _____

Use the Fundamental Counting Principle to find the total number of outcomes in each situation.

10. choosing belt buckles from a collection of 6 bronze, 4 wooden, and 5 silver belt buckles if you choose one of each kind of buckle **10.** _____

11. choosing a school sweatshirt that is gray or white and choosing small, medium, large, or extra-large **11.** _____

12. choosing toast, muffin, or bagel and choosing coffee, milk, or juice **12.** _____

13. choosing an album, CD, and cassette to listen to from a collection of 5 albums, 7 CDs, and 4 cassettes **13.** _____

Assessment

NAME _____ DATE _____ PERIOD _____

9 Chapter 9 Vocabulary Test

SCORE _____

combination	outcome
complementary events	permutation
compound events	probability
dependent events	random
disjoint events	sample space
experimental probability	simple event
Fundamental Counting Principle	theoretical probability
independent events	tree diagram

Choose from the terms above to complete each sentence.

1. A(n) _____ is a possible result. **1.** _____

2. Probability found using frequencies in a game or experiment is called _____. **2.** _____

3. A(n) _____ is not affected by the outcome of the previous event. **3.** _____

4. The set of all possible outcomes is called the _____. **4.** _____

5. A(n) _____ is one of two events that are the only ones that can possibly happen and the sum of whose probabilities is 1. **5.** _____

6. A(n) _____ is an arrangement, or listing, of objects in which order is important. **6.** _____

7. The chance of an event happening is called _____. **7.** _____

8. A(n) _____ is an arrangement, or listing, in which order is not important. **8.** _____

9. _____ cannot happen at the same time. **9.** _____

10. A(n) _____ is made up of two or more simple events. **10.** _____

Define each term in your own words.

11. Fundamental Counting Principle **11.** _____

12. dependent events **12.** _____

NAME _____ DATE _____ PERIOD _____

9 Chapter 9 Test, Form 1

SCORE _____

Write the letter for the correct answer in the blank at the right of each question.

1. How many different 4-digit numbers are there if no digit is repeated?

A. 4 **B.** 24 **C.** 504 **D.** 4,536 **1.** _____

2. In how many ways can you choose 2 side dishes out of 8?

F. 56 **G.** 28 **H.** 16 **J.** 4 **2.** _____

DOGS The boarders at a kennel are made up of the following dogs. If one dog is randomly selected for a 30-minute training session, find the probability of each event. The fractions are written in simplest form.

3. P(retriever)

A. $\frac{3}{4}$ **B.** $\frac{3}{5}$ **C.** $\frac{1}{2}$ **D.** $\frac{3}{8}$ **3.** _____

4. P(not male)

F. $\frac{19}{24}$ **G.** $\frac{7}{12}$ **H.** $\frac{1}{2}$ **J.** $\frac{7}{24}$ **4.** _____

Boarders	
Males	10
Females	14
Pointers	6
Retrievers	18

5. P(cat)

A. 0 **B.** $\frac{1}{100}$ **C.** $\frac{1}{2}$ **D.** 1 **5.** _____

For Questions 6–8, use the Fundamental Counting Principle to find the total number of outcomes in each situation.

6. tossing a quarter and a penny

F. 1 **G.** 2 **H.** 4 **J.** 8 **6.** _____

7. choosing a meat, a vegetable, and a beverage from 3 kinds of meat, 2 kinds of vegetables, and 4 kinds of beverages

A. 9 **B.** 10 **C.** 24 **D.** 48 **7.** _____

8. picking a day of the week and rolling a number cube

F. 13 **G.** 14 **H.** 30 **J.** 42 **8.** _____

9. A blue number cube and an orange number cube are rolled. Find P(3, then even).

A. $\frac{6}{5}$ **B.** $\frac{2}{3}$ **C.** $\frac{1}{6}$ **D.** $\frac{1}{12}$ **9.** _____

10. A bag contains 3 orange, 5 black, and 2 white marbles. Two marbles are drawn, but the first marble is not replaced. Find P(white, then black).

F. $\frac{5}{9}$ **G.** $\frac{1}{9}$ **H.** $\frac{1}{10}$ **J.** $\frac{1}{15}$ **10.** _____

Use a tree diagram.

11. TESTS Justine is taking a test with four true/false questions. How many possible ways can the four answers appear on the test?

A. 4 **B.** 8 **C.** 16 **D.** 32 **11.** _____

12. RINGS Lianna has enough money to buy one ring. She can choose a silver or a gold band and an onyx, opal, or topaz setting. From how many different combinations does she have to choose?

F. 2 **G.** 4 **H.** 6 **J.** 8 **12.** _____

9 Chapter 9 Test, Form 1 *(continued)*

Tell whether each problem represents a *permutation* (P) or a *combination* (C). Then solve the problem.

13. Ten students remain in a game of musical chairs. If four chairs are removed, how many different groups of six students can remain?

A. P; 65 **B.** C; 105 **C.** C; 210 **D.** C; 420 **13.**_____

14. How many different ways can five airplanes be arranged at five gates?

F. C; 5 **G.** C; 24 **H.** P; 96 **J.** P; 120 **14.**_____

15. In how many ways can Zoe choose 4 figurines from a collection of 7?

A. C; 11 **B.** C; 28 **C.** C; 35 **D.** P; 5,040 **15.**_____

16. **RACING** In a cross-country race with 8 runners, how many different ways can they come across the finish line?

F. P; 40,320 **G.** P; 5,760 **H.** C; 1,120 **J.** C; 36 **16.**_____

BASEBALL **Corey has two tickets to a baseball game. He can take one of his friends with him, but five of his friends would like to go. They are Jane, Meg, Matt, Ted, and Amy. To decide, Corey writes each of his friends' names on a separate piece of paper and selects one.**

17. What is the probability that Corey picks a boy?

A. $\frac{1}{5}$ **B.** $\frac{2}{5}$ **C.** $\frac{3}{5}$ **D.** $\frac{2}{3}$ **17.**_____

18. What is the probability that Corey picks someone whose name does not begin with the letter *M*?

F. $\frac{3}{5}$ **G.** $\frac{2}{5}$ **H.** $\frac{1}{5}$ **J.** $\frac{1}{6}$ **18.**_____

19. If Corey draws a name 20 times and Amy's name is picked twice, what is the experimental probability that Amy's name is picked?

A. $\frac{2}{5}$ **B.** $\frac{1}{5}$ **C.** $\frac{1}{6}$ **D.** $\frac{1}{10}$ **19.**_____

20. Choose the best comparison between the theoretical and experimental probability that Amy will go to the game. Use the experimental probability from Question 19.

F. The theoretical probability is greater than the experimental probability. **20.**_____

G. The theoretical probability is less than the experimental probability.

H. The theoretical probability is equal to the experimental probability.

J. The theoretical probability is not related to the experimental probability.

Bonus **CLASSES** Tim can select 4 of his classes from the following options: algebra, American Sign Language, typing, English, Spanish, tennis, and science. What is the probability that Tim will select science, algebra, typing, and Spanish? **B:**_____

NAME _____ DATE _____ PERIOD _____

9 Chapter 9 Test, Form 2A

SCORE _____

Write the letter for the correct answer in the blank at the right of each question.

1. How many different 5-digit numbers are there if no digit is repeated?
A. 120 **B.** 720 **C.** 15,120 **D.** 27,216 **1.** _____

2. In how many ways can you choose 2 side dishes out of 9?
F. 72 **G.** 36 **H.** 18 **J.** 9 **2.** _____

DOGS The boarders at a kennel are made up of the following dogs. If one dog is randomly selected for a 30-minute training session, find the probability of each event. The fractions are written in simplest form.

Boarders	
Males	10
Females	14
Pointers	6
Retrievers	18

3. P(female)
A. $\frac{7}{12}$ **B.** $\frac{1}{2}$ **C.** $\frac{7}{17}$ **D.** $\frac{7}{24}$ **3.** _____

4. P(not pointer)
F. $\frac{3}{8}$ **G.** $\frac{1}{2}$ **H.** $\frac{3}{4}$ **J.** $\frac{7}{8}$ **4.** _____

5. P(pointer or retriever)
A. 24 **B.** 1 **C.** $\frac{1}{2}$ **D.** 0 **5.** _____

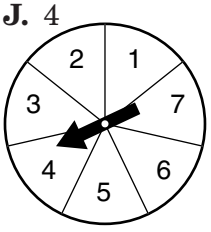
For Questions 6–8, use the Fundamental Counting Principle to find the total number of outcomes in each situation.

6. tossing a nickel, a quarter, a penny, and rolling a number cube
F. 4 **G.** 12 **H.** 24 **J.** 48 **6.** _____

7. choosing coffee or tea, with cream, milk, or honey served in a glass or a plastic cup
A. 24 **B.** 12 **C.** 7 **D.** 6 **7.** _____

8. picking a number from 1 to 20 and a letter from the alphabet
F. 520 **G.** 260 **H.** 46 **J.** 4 **8.** _____

9. The spinner at the right has an equal chance of landing on each number. Find P(6, then 6).
A. $\frac{1}{49}$ **B.** $\frac{1}{21}$ **C.** $\frac{1}{10}$ **D.** $\frac{2}{7}$ **9.** _____



10. There are 5 peppermint, 4 licorice, 8 grape, 2 orange, and 9 cherry jelly beans in a bag. Paco picks a jelly bean. Without replacing the first one, he picks a second jelly bean. Find P(grape, then cherry).
F. $\frac{8}{9}$ **G.** $\frac{2}{21}$ **H.** $\frac{12}{145}$ **J.** $\frac{1}{125}$ **10.** _____

Use a tree diagram.

11. CLOTHING Janet has 4 blouses, 2 pairs of pants, and 3 pairs of socks that can be worn together. How many outfits can she make?
A. 9 **B.** 18 **C.** 20 **D.** 24 **11.** _____

12. TRAILS At Brand-X Ranch you can ride the Buckin' Billy, Tennessee Lady, or Lag-Behind Nell. One trail goes through the woods, another goes up a mountain, and a third trail goes by a stream. How many different horse rides can you take?
F. 3 **G.** 6 **H.** 9 **J.** 12 **12.** _____

9 Chapter 9 Test, Form 2A *(continued)*

Tell whether each problem represents a *permutation* (P) or a *combination* (C). Then solve the problem.

13. Twelve students remain in a game of tag. If 6 students go out in the next minute, how many different groups of six students can remain?

A. C; 924 **B.** P; 1,140 **C.** C; 1,638 **D.** P; 665,280 **13.** _____

14. Brandon has 8 different plates with which to set the table. How many different ways can he place the plates?

F. C; 36 **G.** C; 336 **H.** P; 6,720 **J.** P; 40,320 **14.** _____

15. In how many ways can Mia choose 10 mugs from a collection of 15?

A. C; 360,360 **B.** C; 3,003 **C.** C; 150 **D.** P; 105 **15.** _____

16. **BAND** How many ways can 7 clarinet players be seated in 7 chairs in the concert band?

F. P; 56 **G.** C; 792 **H.** P; 5,040 **J.** C; 823,543 **16.** _____

FOOTBALL Tori has four tickets to a football game. She can take three of her friends with her, but five of her friends would like to go. They are Tom, Jill, Joe, Marvin, and Ginger. To decide, Tori writes each of her friends' names on a separate piece of paper and selects one.

17. What is the probability that Tori picks a boy?

A. $\frac{1}{5}$ **B.** $\frac{2}{5}$ **C.** $\frac{3}{5}$ **D.** $\frac{2}{3}$ **17.** _____

18. What is the probability that Tori picks someone whose name begins with the letter *J*?

F. $\frac{3}{5}$ **G.** $\frac{1}{2}$ **H.** $\frac{2}{5}$ **J.** $\frac{1}{6}$ **18.** _____

19. If Tori draws a name 15 times and Tom's name is picked five times, what is the experimental probability that Tom's name is picked?

A. $\frac{5}{5}$ **B.** $\frac{5}{6}$ **C.** $\frac{1}{3}$ **D.** $\frac{1}{5}$ **19.** _____

20. Choose the best comparison between the theoretical and experimental probability that Tom will go to the game. Use the experimental probability from Question 19.

F. The theoretical probability is greater than the experimental probability.

G. The theoretical probability is less than the experimental probability.

H. The theoretical probability is equal to the experimental probability.

J. The theoretical probability is not related to the experimental probability. **20.** _____

Bonus **CLASSES** Ishi can select 3 of her classes from the following options: French, Spanish, German, art, band, and consumer science. What is the probability that Ishi will select French, art, and band? **B:** _____

NAME _____ DATE _____ PERIOD ____

9 Chapter 9 Test, Form 2B

SCORE ____

Write the letter for the correct answer in the blank at the right of each question.

1. How many different 5-letter passwords can be made using the letters A, E, I, O, and U if no letter is repeated?

A. 4 **B.** 24 **C.** 25 **D.** 120 **1.** ____

2. In how many ways can you choose 2 side dishes out of 10?

F. 180 **G.** 90 **H.** 45 **J.** 20 **2.** ____

DOGS The boarders at a kennel are made up of the following dogs. If one dog is randomly selected for a 30-minute training session, find the probability of each event. The fractions are written in simplest form.

3. P(male)

A. $\frac{5}{7}$ **B.** $\frac{1}{2}$ **C.** $\frac{5}{12}$ **D.** $\frac{5}{24}$ **3.** ____

Boarders	
Males	10
Females	14
Pointers	6
Retrievers	18

4. P(not retriever)

F. $\frac{5}{8}$ **G.** $\frac{1}{3}$ **H.** $\frac{1}{4}$ **J.** $\frac{1}{8}$ **4.** ____

5. P(male or female)

A. 0 **B.** 1 **C.** $\frac{1}{2}$ **D.** 24 **5.** ____

For Questions 6–8, use the Fundamental Counting Principle to find the total number of outcomes in each situation.

6. tossing a dime, a quarter, a penny, and a nickel and rolling a number cube

F. 5 **G.** 14 **H.** 48 **J.** 96 **6.** ____

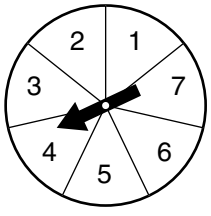
7. choosing iced tea or lemonade, with lemon or lime twist, served in small, medium, or large size glasses

A. 6 **B.** 7 **C.** 12 **D.** 24 **7.** ____

8. picking a number from 1 to 30 and a letter from the alphabet

F. 780 **G.** 390 **H.** 56 **J.** 4 **8.** ____

9. The spinner at the right has an equal chance of landing on each number. Find P(an odd number, then an even number).



A. $\frac{7}{7}$ **B.** $\frac{12}{49}$ **C.** $\frac{7}{49}$ **D.** $\frac{2}{49}$ **9.** ____

10. There are 2 bunny counters, 16 mouse counters, 8 snake counters, and 7 monkey counters in the bag. Gina takes 2 counters without replacing the first counter. Find P(snake, then bunny).

F. $\frac{11}{66}$ **G.** $\frac{1}{16}$ **H.** $\frac{1}{33}$ **J.** $\frac{1}{66}$ **10.** ____

Use a tree diagram.

11. EQUIPMENT Raymond has 4 mouth guards, 5 pairs of shin guards, and 3 pairs of turf shoes. How many different combinations of sports equipment can he wear if he wears one of each type?

A. 60 **B.** 50 **C.** 20 **D.** 15 **11.** ____

9 Chapter 9 Test, Form 2B *(continued)*

12. **SPORTS** If there are 8 footballs and 4 basketballs, how many different ways could you choose 1 football and 1 basketball?

F. 8 **G.** 12 **H.** 24 **J.** 32 **12.** _____

Tell whether each problem represents a *permutation* (P) or a *combination* (C). Then solve the problem.

13. Twenty students remain in a spelling bee. If 7 students misspell words in the next round, how many different groups of 13 contestants can remain?

A. C; 390,700,800 **B.** C; 77,520 **C.** P; 5,040 **D.** P; 1,820 **13.** _____

14. How many different ways can Dana arrange 9 pairs of shoes in a row?

F. C; 45 **G.** P; 3,039 **H.** C; 60,480 **J.** P; 362,880 **14.** _____

15. In how many ways can Justin choose 11 cars from a collection of 20?

A. P; 39,916,800 **B.** C; 167,960 **C.** C; 10,890 **D.** P; 110 **15.** _____

16. How many different ways can Cora give 10 stuffed animals to the 10 guests at her birthday party?

F. P; 3,628,800 **G.** P; 80,640 **H.** C; 65,978 **J.** C; 155 **16.** _____

SOCCER Noriko has four tickets to a soccer game. She can take three of her friends with her, but seven would like to go. They are Isabel, Dan, Joni, Ike, Xavier, Patti, and Ian. To decide, Noriko writes each of her friends' names on a separate piece of paper and selects one.

17. What is the probability that Noriko picks a boy?

A. $\frac{2}{3}$ **B.** $\frac{4}{7}$ **C.** $\frac{3}{7}$ **D.** $\frac{1}{7}$ **17.** _____

18. What is the probability that Noriko picks someone whose name begins with the letter *I*?

F. $\frac{2}{7}$ **G.** $\frac{3}{7}$ **H.** $\frac{4}{7}$ **J.** $\frac{5}{7}$ **18.** _____

19. If Noriko draws a name 20 times and Patti's name is picked six times, what is the experimental probability that Patti's name is chosen?

A. $\frac{1}{4}$ **B.** $\frac{3}{10}$ **C.** $\frac{7}{20}$ **D.** $\frac{6}{7}$ **19.** _____

20. Choose the best comparison between the theoretical and experimental probability that Patti will go to the game. Use the experimental probability from Question 17.

F. The theoretical probability is greater than the experimental probability.

G. The theoretical probability is less than the experimental probability.

H. The theoretical probability is equal to the experimental probability.

J. The theoretical probability is not related to the experimental probability. **20.** _____

Bonus **CLASSES** Carol can select two classes from these options: French, Spanish, consumer science, industrial technology, art, and music. What is the probability that Carol will select industrial technology and music? **B:** _____

NAME _____ DATE _____ PERIOD _____

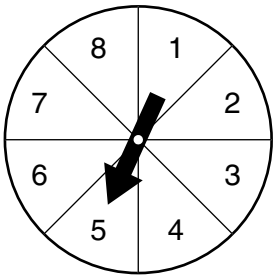
9 Chapter 9 Test, Form 2C

SCORE _____

1. On another piece of paper, make a tree diagram to find how many different ways you can arrange the letters C, A, R, and S, if you use each letter once. How many ways are possible? **1.** _____

2. **CRAFT** Rodrigo is making round, square, and rectangular window ornaments. He cuts some from origami paper and others from old wallpaper. He then paints them either red or green. Make a tree diagram on another piece of paper to find how many different kinds of ornaments Rodrigo can make. What is the total number of ornaments? **2.** _____

Use the spinner to find each probability. Write as a fraction in simplest form.



3. *P*(even number) **3.** _____

4. *P*(2 or 3) **4.** _____

Use the Fundamental Counting Principle to find the total number of outcomes in each situation.

5. buying bedroom furniture if you can select one each from 7 dressers, 4 beds, 6 lamps, and 9 night tables **5.** _____

6. choosing one of each kind of pet from 8 hamsters, 3 guinea pigs, and 10 gerbils **6.** _____

7. the total number of sharks tagged in 6 days by 8 scientists if each scientist tags 3 new sharks every day **7.** _____

Tell whether each problem represents a *permutation* or a *combination*. Then solve the problem.

8. **RACING** In how many ways can 7 runners finish first, second, and third in a race? **8.** _____

9. How many different two-topping ice cream sundaes are available if there are 6 toppings to choose from? **9.** _____

10. In how many ways can you choose a committee of four people from the nine in the club? **10.** _____

11. How many different 3-digit codes can be created if no digit can be repeated? **11.** _____

9 Chapter 9 Test, Form 2C *(continued)*

12. How many 6-digit numbers are there if no digit is repeated? **12.** _____

13. **DESIGN** In how many ways can you choose 2 colors for a design out of 14 colors? **13.** _____

CARPOOL **Angie can fit 5 people in her van but 7 of her friends want to ride with her to the lacrosse game. Her friends are Sara, Penny, Geoff, Greg, Kimberly, Phil, and Lester. To decide, Angie writes each of her friends' names on a separate piece of paper and selects one.**

14. What is the probability that Angie picks a girl? **14.** _____

15. What is the probability that Angie picks someone whose name begins with the letter *G* or *P*? **15.** _____

16. If Angie picks a name 18 times and Sara's name is picked 10 times, what is the experimental probability that Sara's name is picked? **16.** _____

17. How does the theoretical probability that Sara will get a ride compare to the experimental probability in Question 16? **17.** _____

Find each probability.

18. **PENS** Gwen has 4 blue pens, 8 black pens, 2 green pens, and 3 red pens in her desk drawer. She takes out two pens without replacing the first pen. Find *P*(green, then blue). **18.** _____

19. **BEADS** Giovanni has a bag of 17 wooden beads, 1 flowered bead, 4 tie-dyed beads, and 10 red beads. After replacing his first bead, he pulls out a second bead. Find *P*(tie-dyed, then flowered). **19.** _____

20. **APPLES** Melody's dad brought home a crate of apples he picked from their orchards. The crate contained 10 Granny Smiths, 14 Red Delicious, 4 Golden Delicious, and 18 Braeburns. Without replacing the first apple, she took out a second apple. Find *P*(Golden Delicious, then Braeburn). **20.** _____

Bonus **PASSWORDS** Determine the number of passwords that can be made from 2 letters followed by 4 digits if no letter or digit can be used more than once. **B:** _____

NAME _____ DATE _____ PERIOD _____

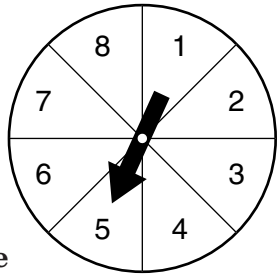
9 Chapter 9 Test, Form 2D

SCORE _____

1. On another piece of paper, make a tree diagram to find how many different ways you can arrange red, yellow, blue, and green colored pencils in a 4-pencil holder. How many arrangements are there? **1.** _____

2. **LUNCH** Barry sells hot dogs with or without mustard. His customers can also choose potato chips, corn chips, or pretzels. Make a tree diagram on another piece of paper to find out how many different orders Barry might receive if customers choose one type of hot dog and one type of chip or pretzel. How many different kinds of orders might Barry receive? **2.** _____

Use the spinner to find each probability. Write as a fraction in simplest form.



3. P(odd number) **3.** _____

4. P(4, or 5) **4.** _____

Use the Fundamental Counting Principle to find the total number of outcomes in each situation.

5. total number of trees planted in 5 days by 30 people, who each plant 3 trees per day **5.** _____

6. total number of disguises you can create with 2 different contact-lens colors, 3 different wigs, 2 different noses, and 1 mustache if one of each is chosen **6.** _____

7. choosing an outfit from 2 different hats, 3 pairs of pants, 3 pairs of shoes, and a shirt if one of each is chosen **7.** _____

Tell whether each problem represents a *permutation* or a *combination*. Then solve the problem.

8. In how many ways can you select three classes from a total of 10 being offered? **8.** _____

9. How many ways can a president and vice-president be chosen from a committee of 8 members? **9.** _____

10. How many ways can 5 models line up to have their picture taken? **10.** _____

11. How many different 3-flavor shakes are available if there are 7 flavors of ice cream available? **11.** _____

9 Chapter 9 Test, Form 2D *(continued)*

Find the value of each expression.

12. How many different 7-digit numbers are there if no digits is repeated? **12.** _____

13. **DESIGN** In how many ways can you choose 3 colors for a design out of 11 colors? **13.** _____

CARPOOL **Luis can fit 3 people in his car, including himself, but 5 of his friends want to ride with him to the track meet. His friends are Tim, Maria, Lilly, Katey, and Ruben. To decide, Luis writes each of his friends' names on a separate piece of paper and selects one.**

14. What is the probability that Luis picks a girl? **14.** _____

15. What is the probability that Luis picks someone whose name ends with the letter *Y*? **15.** _____

16. If Luis picks a name 12 times and Ruben's name is picked 4 times, what is the experimental probability that Ruben's name is picked? **16.** _____

17. How does the theoretical probability that Ruben will get a ride compare to the experimental probability in Question 16? **17.** _____

Find each probability.

18. **PETS** Yvonne is playing with her gerbils. She has 4 white, 3 brown, and 1 gray gerbil. Without replacing the first one, she takes a second gerbil out of the cage. Find P(white, then gray). **18.** _____

19. **CLOTHES** Andrew has 3 pairs of jeans shorts, 1 pair of camouflage shorts, and 2 pairs of black shorts in a drawer. He chooses one pair, puts them back and chooses another. Find P(jeans, then camouflage). **19.** _____

20. **PUPPETS** Shari has 4 lamb puppets, 5 horse puppets, and 2 dog puppets in a bag. Without replacing the first, she takes out a second puppet. Find P(horse, then lamb). **20.** _____

Bonus **PASSWORDS** Determine the number of passwords that can be made from 2 letters followed by 3 digits if no letter or digit can be used more than once. **B:** _____

NAME _____ DATE _____ PERIOD _____

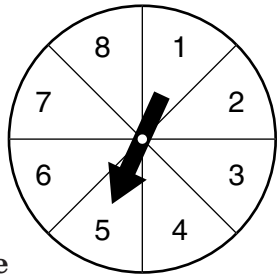
9 Chapter 9 Test, Form 3

SCORE _____

1. On another piece of paper, make a tree diagram to find how many different ways you can arrange the numbers 1, 4, and 5 if no number can be used more than once. How many arrangements are there? **1.** _____

2. **MUSIC** Angela is deciding which song to play next. She can choose one that is fast or slow, current or old, and Country or Top 40. Make a tree diagram on another piece of paper to find how many types of songs she can choose from. How many types are there? **2.** _____

Use the spinner to find each probability. Write as a fraction in simplest form.



3. *P*(number less than 5) **3.** _____

4. *P*(even number or 7) **4.** _____

Use the Fundamental Counting Principle to find the total number of outcomes in each situation.

5. total number of toads found by 21 scientists in 3 days if each scientist finds 7 new toads each day **5.** _____

6. choosing one of each kind of ball from 4 glowballs, 15 superballs, and 8 moonballs **6.** _____

7. choosing one of each color paint from 3 yellow paints, 4 green paints, and 2 white paints **7.** _____

Tell whether each problem represents a *permutation* or a *combination*. Then solve the problem.

8. How many ways can 6 family photos be set in a line on a fireplace mantel? **8.** _____

9. How many different 4-topping salads are available if there are 8 toppings to choose from? **9.** _____

10. How many ways can you pick 3 kittens from a litter of 7 kittens? **10.** _____

11. How many different 3-letter security passwords can be created if no letter can be repeated? **11.** _____

Assessment

9 Chapter 9 Test, Form 3 *(continued)*

Find the value of each expression.

12. How many different passwords are there if the first two characters are two different letters and the last 4 characters are digits, where no digit is repeated? **12.** _____

13. **FOOD** In how many ways can you choose 3 side dishes from 12 choices? **13.** _____

CARPOOL **Misu can fit 3 other people into his car but 5 of his friends want to get a ride to the baseball game. His friends are Brittany, Anne, Steve, Monique, and John. To decide, Misu writes each of his friends' names on a separate piece of paper and selects one.**

14. What is the probability that Misu picks a girl? **14.** _____

15. What is the probability that Misu picks someone whose name ends with the letter *E*? **15.** _____

16. If Misu chooses a name 16 times and Monique's name is picked 6 times, what is the experimental probability that Monique's name is picked? **16.** _____

17. How does the theoretical probability that Monique will get a ride compare to the experimental probability in Question 16? **17.** _____

Find each probability.

18. **BASKETBALL** Rita has a record of making 2 out of every 5 free throws. What is the probability that she will make both of her next two free throws? **18.** _____

19. **TESTS** On a math test, 5 out of 20 students got an A. If three of the 20 students are chosen at random, what is the probability that all three got an A on the test? **19.** _____

20. Three cards are chosen at random from a standard deck of cards without replacement. What is the probability of getting 3 aces? **20.** _____

Bonus **PASSWORDS** Determine the number of passwords that can be made from 3 letters followed by 3 digits if no letter or digit can be used more than once and the digit 0 cannot be used. **B:** _____

NAME _____ DATE _____ PERIOD _____

SCORE _____

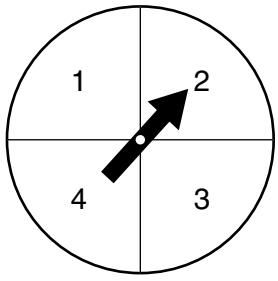
9 Chapter 9 Extended-Response Test

Demonstrate your knowledge by giving a clear, concise solution to each problem. Be sure to include all relevant drawings and justify your answers. You may show your solutions in more than one way or investigate beyond the requirements of the problem. If necessary, record your answer on another piece of paper.

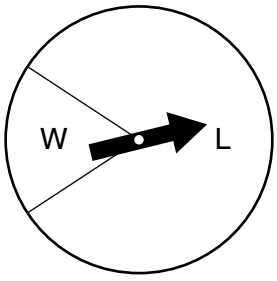
1. Seven Oaks Middle School is having its Spring fair.

a. A game uses spinner A below. If a player spins a 1, he or she wins a prize. Explain how to find the theoretical probability of winning a prize.

Spinner A



Spinner B



b. A second game uses spinner B. A player must spin a W to win. Explain how to find the experimental probability of spinning a W.

2. A bag contains 1 white (W), 3 blue (B_1, B_2, B_3), and 2 red (R_1, R_2) marbles.

a. Use a tree diagram to list all of the possible outcomes for tossing a coin and then drawing a marble from the bag.

b. Explain what is meant by *independent events*.

c. Find the probability of tossing a head and drawing a red marble. Explain you reasoning.

d. Find the probability of drawing two blue marbles if the first marble is not replaced. Explain each step.

3. Rayna and her husband have 8 nieces, 9 nephews, 6 cousins, 3 aunts, and 5 uncles.

a. Explain how you could use the Fundamental Counting Principle to find how many ways Rayna could choose a team to play charades if she wants one of each type of relative on the team.

b. How many ways could just the nieces stand in line to limbo? Explain your method.

c. If everyone except Rayna and her husband wants to play musical chairs but there are only 10 chairs available, how many ways could 10 of the relatives sit in the chairs when the music stops? Explain your method.

NAME _____ DATE _____ PERIOD _____

9 Standardized Test Practice

SCORE _____

(Chapters 1–9)

1. Which equation could be used to find the width of a rectangle with a perimeter of 80 inches and a length of 25 inches? (Lesson 3-2)

A $80 = 25 + \frac{w}{2}$ **C** $80 = 25 - w$

B $80 = 50 + 2w$ **D** $80 = 50 - 2w$

1. Ⓐ Ⓑ Ⓒ Ⓓ

2. Solve $w - 7.3 = 12.8$. (Lesson 3-2)

F -20.1 **G** 5.5 **H** 14.6 **J** 20.1

2. Ⓕ Ⓖ Ⓗ Ⓙ

3. Find the GCF of 30 and 42. (Lesson 4-2)

A 2 **B** 3 **C** 6 **D** 210

3. Ⓐ Ⓑ Ⓒ Ⓓ

4. Write $\frac{9}{20}$ as a percent. (Lesson 4-6)

F 0.45% **G** 4.5% **H** 45% **J** 450%

4. Ⓕ Ⓖ Ⓗ Ⓙ

5. Find $\frac{9}{16} - \frac{1}{4}$. (Lesson 5-2)

A $\frac{1}{4}$ **B** $\frac{5}{16}$ **C** $\frac{1}{2}$ **D** $\frac{13}{16}$

5. Ⓐ Ⓑ Ⓒ Ⓓ

6. What is $\frac{3}{8} \times \frac{5}{8}$? (Lesson 5-5)

F $\frac{15}{64}$ **G** $\frac{3}{5}$ **H** $\frac{15}{16}$ **J** 1

6. Ⓕ Ⓖ Ⓗ Ⓙ

7. Solve $\frac{1}{2}k = \frac{2}{7}$. Check your solution. (Lesson 5-6)

A 7 **B** $\frac{7}{4}$ **C** $\frac{4}{7}$ **D** $\frac{1}{7}$

7. Ⓐ Ⓑ Ⓒ Ⓓ

8. Write the ratio $2\frac{2}{3}$ yards to 4 feet as a fraction in simplest form. (Lesson 6-1)

F $\frac{1}{2}$ **G** $\frac{2}{3}$ **H** $\frac{2.7}{4}$ **J** $\frac{2}{1}$

8. Ⓕ Ⓖ Ⓗ Ⓙ

9. Solve the proportion: $\frac{8}{3} = \frac{20}{w}$. (Lesson 6-6)

A $\frac{2}{15}$ **B** 1.2 **C** 7.5 **D** $53\frac{1}{3}$

9. Ⓐ Ⓑ Ⓒ Ⓓ

10. **LAYAWAY** Angie wants to put a winter coat on layaway at a store. To do so, she must pay the store 20% of the cost of the coat so they will hold it. If the coat costs $125, how much of a deposit does Angie need to pay the store? (Lesson 7-2)

F $250 **G** $25 **H** $12.50 **J** $2.50

10. Ⓕ Ⓖ Ⓗ Ⓙ

11. Find the sales tax to the nearest cent on a $25 pair of shoes with 5.75% sales tax. (Lesson 7-7)

A $1.43 **B** $1.44 **C** $1.77 **D** $5.75

11. Ⓐ Ⓑ Ⓒ Ⓓ

12. Find the simple interest to the nearest cent for a principal of $4,329, an interest rate of 9.25%, and a time period of 18 months. (Lesson 7-8)

F $7,207.79 **G** $4,929.94 **H** $4,356.25 **J** $600.65

12. Ⓕ Ⓖ Ⓗ Ⓙ

9 Standardized Test Practice *(continued)*

(Chapters 1–9)

13. **SOFTWARE** The data in the table shows the prices of the top-selling business software. Find the median of the data. (Lesson 8-2)

Software Prices ($)			
18	89	86	19
201	115	36	53
53	43		

A $53
B $71.30
C $183
D $201

13. Ⓐ Ⓑ Ⓒ Ⓓ

14. To determine the most popular kind of music in California, a survey of 100 randomly selected households in Sacramento is conducted. Of the households, 34 chose pop music. The researcher concluded that 34% of California households prefer pop music. Which of the following methods did the researcher use? (Lesson 8-8)

F simple random survey
G systematic random sample
H convenience sample
J stratified random sample

14. Ⓕ Ⓖ Ⓗ Ⓙ

15. **GAMES** Gene made up a game where each player tosses two coins and a number cube. Use a tree diagram to find how many outcomes are possible. (Lesson 9-2)

A 6 **B** 24 **C** 30 **D** 36

15. Ⓐ Ⓑ Ⓒ Ⓓ

16. If there are 6 baseballs, 10 tennis balls, and 11 golf balls available, how many different combinations of balls could be made if one of each type is chosen? (Lesson 9-3)

F 660 **G** 66 **H** 60 **J** 27

16. Ⓕ Ⓖ Ⓗ Ⓙ

17. **SALAD BARS** If Philip made three trips to a salad bar with 10 different items and chose only one different item each time, in how many ways could he have selected his food? (Lesson 9-5)

A 1,000 **B** 720 **C** 120 **D** 30

17. Ⓐ Ⓑ Ⓒ Ⓓ

18. A water cooler holds 3 gallons of water. How many cups does the cooler hold? (Lesson 6-4)

F 12 **G** 24 **H** 48 **J** 60

18. Ⓕ Ⓖ Ⓗ Ⓙ

19. How many different ways can 6 notebooks be arranged on a shelf? (Lesson 9-4)

A 4,320 **B** 720 **C** 216 **D** 36

19. Ⓐ Ⓑ Ⓒ Ⓓ

NAME _____ DATE _____ PERIOD _____

9 Standardized Test Practice *(continued)*

(Chapters 1–9)

Part 2: Short Response

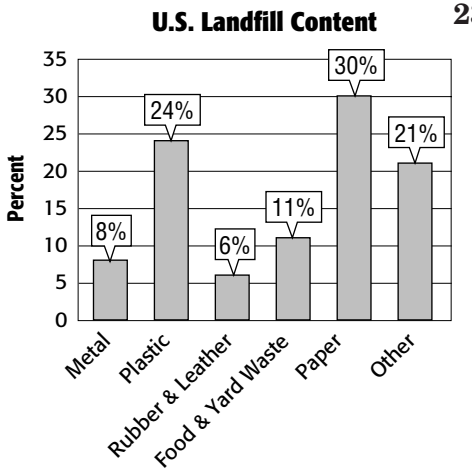
Instructions: Write answers to short responses in the space provided.

20. Find $3 - (-17)$. (Lesson 2-5) **20.** _____

21. Write 16% as a fraction in simplest form. (Lesson 4-6) **21.** _____

22. Find $2\frac{3}{4} \div 2$. Write in simplest form. (Lesson 5-7) **22.** _____

23. **LANDFILLS** The graph shows the content in U.S. landfills. How much more plastic is there than food and yard waste? (Lesson 8-4) **23.** _____



24. **ASSIGNMENTS** Linda must finish 7 projects from a list of 13 for her industrial technology class. In how many ways can Linda do this if the order is not important? (Lesson 9-5) **24.** _____

25. **PHOTOGRAPHY** Paul is the photographer hired for a wedding. He is arranging 3 women, 3 men, and 2 children in a line for a picture. (Lesson 9-4)

a. How many ways can he arrange them if he wants them in the following order: child, woman, man, woman, man, woman, man, child? Explain. **25a.** _____

b. How many ways can he arrange all of the people if the order of women, men, and children does not matter? Explain. **25b.** _____

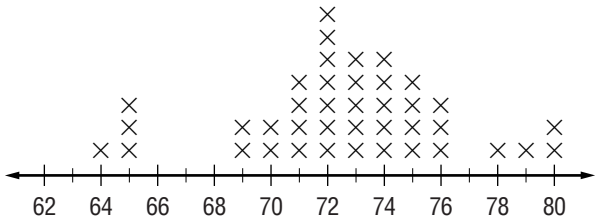
NAME _____ DATE _____ PERIOD _____

9 Unit 4 Test

SCORE _____

(Chapters 8 and 9)

MILES PER HOUR For Questions 1–3, use the line plot that shows the speeds (in miles per hour) of 40 cars traveling on the freeway. (Lesson 2-3)

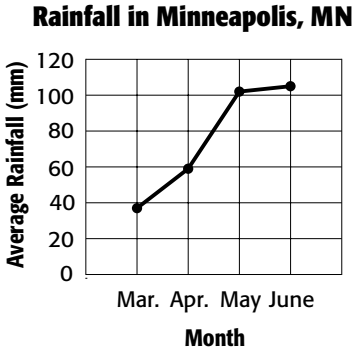


1. What is the range of the data? **1.** _____

2. What speed occurred most often? **2.** _____

3. Identify any clusters, gaps, or outliers. **3.** _____

4. RAINFALL The graph shows the average rainfall in Minneapolis, Minnesota, each month from March to June. Predict the average rainfall for July. **4.** _____



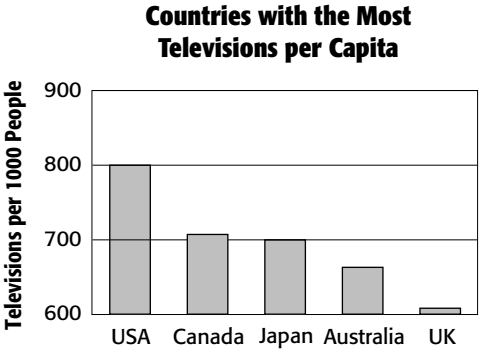
5. Find the mean, median, and mode for the data.
$5, $9, $13, $7, $6, $5, $11 **5.** _____

6. Make a stem-and-leaf plot for the data.
25, 35, 43, 50, 56,
38, 45, 29, 40, 47 **6.** _____

7. TESTS The data shows the quiz scores earned by students in a science class. What is the median? **7.** _____

Quiz Scores				
18	17	20	10	15
19	0	13	17	14
17	20	11	10	9

8. TELEVISIONS The graph shows the countries with the most televisions per capita. Why might this graph be considered misleading? **8.** _____



Assessment

NAME _____ DATE _____ PERIOD _____

9 Unit 4 Test *(continued)*

(Chapters 8 and 9)

9. A number cube is rolled two times. Find the probability of rolling an odd number then an even number. **9.** _____

10. A card is drawn from a standard deck of 52 cards. A second card is drawn without replacing the first card. Find P(black card, then red card). **10.** _____

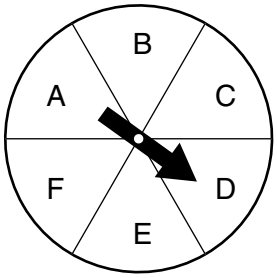
For Questions 11–13, a set of 12 cards is numbered 1, 2, 3, ... , 12. Suppose you pick a card at random without looking. Find the probability of each event. Write as a fraction in simplest form.

11. P(5 or 7) **11.** _____

12. P(multiple of 3) **12.** _____

13. P(not an even number) **13.** _____

Use the spinner to find each probability. Write as a fraction in simplest form.



14. $P(E)$ **14.** _____

15. P(not a vowel) **15.** _____

16. Make a tree diagram on another piece of paper to show the sample space for picking a number from 1 to 6 and choosing a color yellow, purple, or green. Then give the total number of outcomes. **16.** _____

17. Use the Fundamental Counting Principle to find the total number of outcomes in the following situation. Find the total number of cans of food donated to the Hunger Taskforce by 40 people in 17 days if each person donates 2 cans every day. **17.** _____

For Questions 18 and 19, tell whether each problem represents a *permutation* or *combination*. Then solve the problem.

18. How many different ways can you choose 5 books from a total of 15 books? **18.** _____

19. How many different ways can 11 board games be stacked? **19.** _____

20. Tell whether the following event is *independent* or *dependent*. Then find the probability. Choose a particular male from 20 males and a particular female from 10 females. **20.** _____

NAME _____ DATE _____ PERIOD ____

9 Anticipation Guide

Probability

Step 1 ***Before you begin Chapter 9***

- Read each statement.
- Decide whether you Agree (A) or Disagree (D) with the statement.
- Write A or D in the first column OR if you are not sure whether you agree or disagree, write NS (Not Sure).

STEP 1 A, D, or NS	Statement	STEP 2 A or D
	1. The probability of an event happening is a ratio that compares the number of favorable outcomes to the number of unfavorable outcomes.	D
	2. If the probability of an event happening is $\frac{3}{5}$ then it is more likely for the event to happen than to not happen.	A
	3. In a probability experiment, a tree diagram can be used to show all the possible outcomes.	A
	4. The Fundamental Counting Principle states that the number of possible outcomes can also be found by division.	D
	5. To find the value of 4!, add 4 + 3 + 2 + 1.	D
	6. In a combination, choosing event A then event B would be the same as choosing event B then event A.	A
	7. The experimental probability of an event happening will always be close to the theoretical probability of that event happening.	D
	8. The act it out strategy is a good way to solve problems because the results will be the same every time the experiment is repeated.	D
	9. A compound event consists of two or more simple events.	A
	10. The probability of two independent events is found the same way as the probability of two dependent events.	D

Step 2 ***After you complete Chapter 9***

- Reread each statement and complete the last column by entering an A or a D.
- Did any of your opinions about the statements change from the first column?
- For those statements that you mark with a D, use a piece of paper to write an example of why you disagree.

NAME _____ DATE _____ PERIOD ____

9-1 Lesson Reading Guide

Simple Events

Get Ready for the Lesson

Read the introduction at the top of page 460 in your textbook. Write your answers below.

1. What fraction of the cheesecake is chocolate? Write in simplest form. $\frac{1}{4}$

2. Suppose your friend gives you the first piece of cheesecake without asking which type you prefer. Are your chances of getting original the same as getting raspberry? **Yes, there is the same number of original pieces as raspberry.**

Read the Lesson

Use the information from the introduction to answer Exercises 3–5.

3. How do you read P(raspberry)? **The probability of getting raspberry**

4. P(raspberry) = $\frac{4}{16}$; where does the 4 come from? Where does the 16 come from? **The 4 is the number of raspberry slices; the 16 is the total number of slices.**

5. Probability can be written as a fraction, a decimal, or a percent. Write P(raspberry) as a decimal. **25%**

6. If three pieces of strawberry cheesecake were added to the pie, how would P(raspberry) change? **It would become $\frac{4}{19}$.**

Remember What You Learned

7. Write the equation $P(A) + P(\text{not } A) = 1$ in words. What does it mean with respect to event A? **Sample answer: The probability of A either happening or not happening is equal to 1; it is certain that event A will either happen or not happen.**

NAME _____ DATE _____ PERIOD ____

9-1 Study Guide and Intervention

Simple Events

The **probability** of a simple event is a ratio that compares the number of favorable outcomes to the number of possible outcomes. Outcomes occur at **random** if each outcome occurs by chance.

Two events that are the only ones that can possibly happen are **complementary events**. The sum of the probabilities of complementary events is 1.

Example 1 **What is the probability of rolling a multiple of 3 on a number cube marked with 1, 2, 3, 4, 5, and 6 on its faces.**

$$P(\text{multiple of 3}) = \frac{\text{multiples of 3 possible}}{\text{total numbers possible}}$$

$= \frac{2}{6}$ Two numbers are multiples of 3: 3 and 6.

$= \frac{1}{3}$ Simplify.

The probability of rolling a multiple of 3 is $\frac{1}{3}$ or about 33.3%.

Example 2 **What is the probability of *not* rolling a multiple of 3 on a number cube marked with 1, 2, 3, 4, 5, and 6 on its faces?**

$P(A) + P(\text{not } A) = 1$

$\frac{1}{3} + P(\text{not } A) = 1$ Substitute $\frac{1}{3}$ for $P(A)$.

$-\frac{1}{3} \quad -\frac{1}{3}$ Subtract $\frac{1}{3}$ from each side

$P(\text{not } A) = \frac{2}{3}$ Simplify.

The probability of *not* rolling a multiple of 3 is $\frac{2}{3}$ or about 66.7%.

Exercises

A set of 30 cards is numbered 1, 2, 3, ..., 30. Suppose you pick a card at random without looking. Find the probability of each event. Write as a fraction in simplest form.

1. $P(12)$ $\frac{1}{30}$
2. $P(2 \text{ or } 3)$ $\frac{1}{15}$
3. $P(\text{odd number})$ $\frac{1}{2}$
4. $P(\text{a multiple of 5})$ $\frac{1}{5}$
5. $P(\text{not a multiple of 5})$ $\frac{4}{5}$
6. $P(\text{less than or equal to 10})$ $\frac{1}{3}$

NAME _____ DATE _____ PERIOD ____

9-1 Skills Practice

Simple Events

A set of 12 cards is numbered 1, 2, 3, ...12. Suppose you pick a card at random without looking. Find the probability of each event. Write as a fraction in simplest form.

1. $P(5)$ $\frac{1}{12}$
2. $P(6 \text{ or } 8)$ $\frac{1}{6}$
3. $P(\text{a multiple of 3})$ $\frac{1}{3}$
4. $P(\text{an even number})$ $\frac{1}{2}$
5. $P(\text{a multiple of 4})$ $\frac{1}{4}$
6. $P(\text{less than or equal to 8})$ $\frac{2}{3}$
7. $P(\text{a factor of 12})$ $\frac{1}{2}$
8. $P(\text{not a multiple of 4})$ $\frac{3}{4}$
9. $P(1, 3, \text{or } 11)$ $\frac{1}{4}$
10. $P(\text{a multiple a 5})$ $\frac{1}{6}$

The students at Job's high school were surveyed to determine their favorite foods. The results are shown in the table at the right. Suppose students were randomly selected and asked what their favorite food is. Find the probability of each event. Write as a fraction in simplest form.

Favorite Food	Responses
pizza	19
steak	8
chow mein	5
seafood	4
spaghetti	3
cereal	1

11. $P(\text{steak})$ $\frac{1}{5}$
12. $P(\text{spaghetti})$ $\frac{3}{40}$
13. $P(\text{cereal or seafood})$ $\frac{1}{8}$
14. $P(\text{not chow mein})$ $\frac{7}{8}$
15. $P(\text{pizza})$ $\frac{19}{40}$
16. $P(\text{cereal or steak})$ $\frac{9}{40}$
17. $P(\text{not steak})$ $\frac{4}{5}$
18. $P(\text{not cereal or seafood})$ $\frac{7}{8}$
19. $P(\text{chicken})$ 0
20. $P(\text{chow mein or spaghetti})$ $\frac{1}{5}$

NAME _____ DATE _____ PERIOD ____

9-1 Practice

Simple Events

A set of cards is numbered 1, 2, 3, ... 24. Suppose you pick a card at random without looking. Find the probability of each event. Write as a fraction in simplest form.

1. P(5) $\frac{1}{24}$
2. P(multiple of 4) $\frac{1}{4}$
3. P(6 or 17) $\frac{1}{12}$
4. P(not equal to 15) $\frac{23}{24}$
5. P(not a factor of 6) $\frac{5}{6}$
6. P(odd number) $\frac{1}{2}$

COMMUNITY SERVICE The table shows the students involved in community service. Suppose one student is randomly selected to represent the school at a state-wide awards ceremony. Find the probability of each event. Write as a fraction in simplest form.

7. P(boy) $\frac{5}{8}$
8. P(not 6th grader) $\frac{1}{2}$
9. P(girl) $\frac{3}{8}$
10. P(8th grader) $\frac{3}{10}$
11. P(boy or girl) 1
12. P(6th or 7th grader) $\frac{7}{10}$
13. P(7th grader) $\frac{1}{5}$
14. P(not a 9th grader) 1

Community Service	
girls	15
boys	25
6th graders	20
7th graders	8
8th graders	12

MENU A delicatessen serves different menu items, of which 2 are soups, 6 are sandwiches, and 4 are salads. How likely is it for each event to happen if you choose one item at random from the menu? Explain your reasoning.

15. P(sandwich) $\frac{1}{2}$
There are 6 sandwich items of the 12 menu items.
$\frac{6}{12} = \frac{1}{2}$

16. P(not a soup) $\frac{5}{6}$
There are 2 soup items. So there are 10 non-soup items of the 12 menu items.
$\frac{10}{12} = \frac{5}{6}$

17. P(salad) $\frac{1}{3}$
There are 4 salad items of the 12 menu items.
$\frac{4}{12} = \frac{1}{3}$

18. **NUMBER CUBE** What is the probability of rolling an even number or a prime number on a number cube? Write as a fraction in simplest form. $\frac{5}{6}$

19. **CLOSING TIME** At a convenience store there is a 25% chance a customer enters the store within one minute of closing time. Describe the complementary event and find its probability. **There is a 75% chance no customer will enter within one minute of closing time.**

NAME _____ DATE _____ PERIOD ____

9-1 Word Problem Practice

Simple Events

COINS Susan opened her piggy bank and counted the number of each coin. The table at the right shows the results. For Exercises 1–3, assume that the coins are put in a bag and one is chosen at random.

Coin	Number
quarters	15
dimes	21
nickels	22
pennies	32

1. What is the probability that a quarter is chosen? $\frac{1}{6}$
2. What is the probability that a nickel or a dime is chosen? $\frac{43}{90}$
3. What is the probability that the chosen coin is worth more than 5 cents? $\frac{2}{5}$
4. **NUMBER CUBES** Juan has two number cubes, each with faces numbered 1, 2, ...6. What is the probability that he can roll the cubes so that the sum of the faces showing equals 11? $\frac{1}{18}$
5. **SKATEBOARDS** Carlotta bought a new skateboard for which the probability of having a defective wheel is 0.015. What is the probability of not having a defective wheel? **0.985**
6. **CALCULATORS** Jake's teacher had 6 calculators for 28 students to use. If the first students to use the calculators are chosen at random, what is the probability that Jake will get one? $\frac{3}{14}$
7. **VEHICLES** The rental car company had 14 sedans and 8 minivans available to rent. If the next customer picks a vehicle at random, what is the probability that a minivan is chosen? $\frac{4}{11}$
8. **MUSIC** Tina has 16 pop CDs, 6 classical, and 2 rock. Tina chooses a CD at random. What is the probability she does not choose a classical CD? $\frac{3}{4}$

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9-1 Enrichment

Coin-Tossing Experiments

If a coin is tossed 3 times, there are 8 possible outcomes. They are listed in the table below.

Number of Heads	0	1	2	3
Outcomes	TTT	HTT	HHT	HHH
		THT	THH	
		TTH	HTH	

Once all the outcomes are known, the probability of any event can be found. For example, the probability of getting 2 heads is $\frac{3}{8}$. Notice that this is the same as getting 1 tail.

1. A coin is tossed 4 times. Complete this chart to show the possible outcomes.

Number of Heads	0	1	2	3	4
Outcomes	TTTT	HTTT	HHTT	THHH	HHHH
		THTT	HTHT	HTHH	
		TTHT	THHT	HHTH	
		TTTH	TTHH	HHHT	
			THTH		
			HTTH		

2. What is the probability of getting all tails? $\frac{1}{16}$

3. Now complete this table. Make charts like the one in Exercise 1 to help find the answers. Look for patterns in the numbers.

Number of Coin Tosses	2	3	4	5	6	7	8
Total Outcomes	4	8	16	32	64	128	256
Probability of Getting All Tails	$\frac{1}{4}$	$\frac{1}{8}$	$\frac{1}{16}$	$\frac{1}{32}$	$\frac{1}{64}$	$\frac{1}{128}$	$\frac{1}{256}$

4. What happens to the number of outcomes? the probability of all tails?
Sample answer: It is doubling; it is halving.

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9-2 Lesson Reading Guide

Sample Spaces

Get Ready for the Lesson

Complete the Mini Lab at the top of page 465 in your textbook. Write your answers below.

1. Make a conjecture. Do you think this is a fair game? Explain.
See students' work.

2. Now, play the game. Who won? What was the final score?
See students' work.

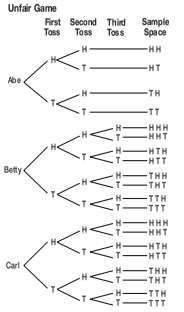
Read the Lesson

3. How does a tree diagram resemble a tree? **Sample answer: It starts with a base for each event (the first item on the left) and then branches out to show the possible outcomes for the event.**
4. How can you use a table to find the number of possible outcomes of an event? **Sample answer: Count the number of entries listed in the tree in the sample space.**
5. How do you know the game played in Example 3 is fair? **Sample answer: Of the four possible outcomes, two favor each player. Therefore, the probability that each player can win is 50%.**

Remember What You Learned

6. Draw a tree diagram that shows a fair game that is different from the examples in your textbook. Can you think of a way to draw a tree diagram that shows a game that is *not* fair? Make sure you include a description if the game is not clear from your diagram.
Sample answer:
Fair game: Player 1 tosses a coin twice. Player 2 tosses a coin twice. The player that gets tails the most wins.

Unfair game: Abe, Betty, and Carl each toss a coin. The player that gets tails the most after 3 tosses wins. The player whose name begins with a vowel gets only 2 tosses.



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9-2 Study Guide and Intervention

Sample Spaces

A game in which players of equal skill have an equal chance of winning is a **fair game**. A **tree diagram** or table is used to show all of the possible outcomes, or **sample space**, in a probability experiment.

Example 1 WATCHES **A certain type of watch comes in brown or black and in a small or large size. Find the number of color-size combinations that are possible.**

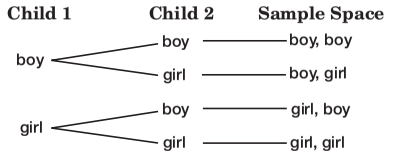
Make a table to show the sample space. Then give the total number of outcomes.

Color	Size
Brown	Small
Brown	Large
Black	Small
Black	Large

There are four different color and size combinations.

Example 2 CHILDREN **The chance of having either a boy or a girl is 50%. What is the probability of the Smiths having two girls?**

Make a tree diagram to show the sample space. Then find the probability of having two girls.



The sample space contains 4 possible outcomes. Only 1 outcome has both children being girls. So, the probability of having two girls is $\frac{1}{4}$.

Exercises

For each situation, make a tree diagram or table to show the sample space. Then give the total number of outcomes.

1. choosing an outfit from a green shirt, blue shirt, or a red shirt, and black pants or blue pants **See students' work. There are 6 outcomes.**

2. choosing a vowel from the word COUNTING and a consonant from the word PRIME **See students' work. There are 9 outcomes.**

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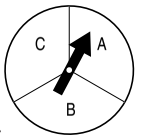
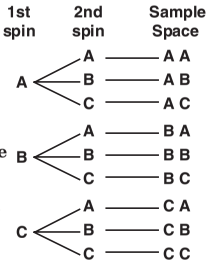
9-2 Skills Practice

Sample Spaces

The spinner at the right is spun twice.



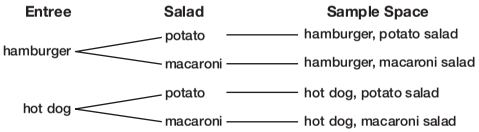
1. Draw a tree diagram to represent the situation.



2. What is the probability of getting at least one A? $\frac{5}{9}$

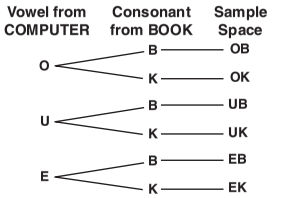
For each situation, make a tree diagram or table to show the sample space. Then give the total number of outcomes.

3. choosing a hamburger or hot dog and potato salad or macaroni salad



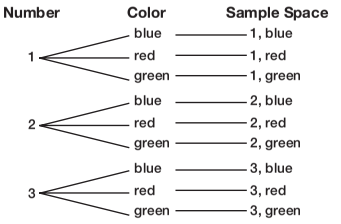
There are 4 possible outcomes.

4. choosing a vowel from the word COMPUTER and a consonant from the word BOOK



There are 6 possible outcomes.

5. choosing between the numbers 1, 2 or 3, and the colors blue, red, or green



There are 9 possible outcomes.

Answers

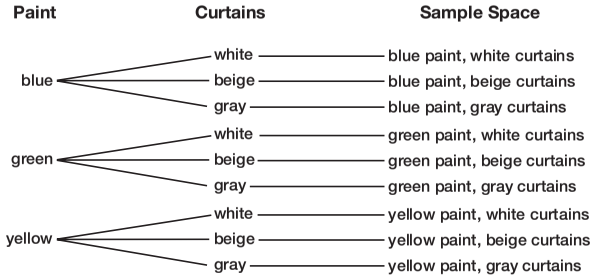
NAME _____ DATE _____ PERIOD ____

9-2 Practice

Sample Spaces

For each situation, find the sample space using a table or tree diagram.

1. choosing blue, green, or yellow wall paint with white, beige, or gray curtains



2. choosing a lunch consisting of a soup, salad, and sandwich from the menu shown in the table.

Soup	Salad	Sandwich
Tortellini Lentil	Caesar Macaroni	Roast Beef Ham Turkey

sample answer:

Tortellini	Caesar	Roast Beef
Tortellini	Caesar	Ham
Tortellini	Caesar	Turkey
Tortellini	Macaroni	Roast Beef
Tortellini	Macaroni	Ham
Tortellini	Macaroni	Turkey
Lentil	Caesar	Roast Beef
Lentil	Caesar	Ham
Lentil	Caesar	Turkey
Lentil	Macaroni	Roast Beef
Lentil	Macaroni	Ham
Lentil	Macaroni	Turkey

3. **GAME** Kimiko and Miko are playing a game in which each girl rolls a number cube. If the sum of the numbers is a prime number, then Miko wins. Otherwise Kimiko wins. Find the sample space. Then determine whether the game is fair.

Sum = 2	Sum = 3	Sum = 4	Sum = 5	Sum = 6	Sum = 7	Sum = 8	Sum = 9	Sum = 10	Sum = 11	Sum = 12
1 + 1 = 2	2 + 1 = 3 1 + 2 = 3	1 + 3 = 4 2 + 2 = 4 3 + 1 = 4	1 + 4 = 5 2 + 3 = 5 3 + 2 = 5 4 + 1 = 5	1 + 5 = 6 2 + 4 = 6 3 + 3 = 6 4 + 2 = 6 5 + 1 = 6	1 + 6 = 7 2 + 5 = 7 3 + 4 = 7 4 + 3 = 7 5 + 2 = 7 6 + 1 = 7	2 + 6 = 8 3 + 5 = 8 4 + 4 = 8 5 + 3 = 8 6 + 2 = 8	3 + 6 = 9 4 + 5 = 9 5 + 4 = 9 6 + 3 = 9	4 + 6 = 10 5 + 5 = 10 6 + 4 = 10	5 + 6 = 11 6 + 5 = 11	6 + 6 = 12

$P(\text{Kimiko}) = \frac{3+5+5+4+3+1}{36} = \frac{7}{12}$; $P(\text{Miko}) = \frac{1+2+4+6+2}{36} = \frac{5}{12}$

The game is not fair since the probabilities are unequal.

NAME _____ DATE _____ PERIOD ____

9-2 Word Problem Practice

Sample Spaces

1. **GASOLINE** Craig stops at a gas station to fill his gas tank. He must choose between full-service or self-service and between regular, midgrade, and premium gasoline. Draw a tree diagram or table showing the possible combinations of service and gasoline type. How many possible combinations are there?	2. **COINS** Judy tosses a coin 4 times. Draw a tree diagram or table showing the possible outcomes. What is the probability of getting at least 2 tails?
3. **COINS** In Exercise 2, what is the probability of getting 2 heads, then 2 tails?	4. **EQUIPMENT** The computer accessory that Joanne is considering selling at her store comes in white, beige, gray, or black and has an optical mouse, mechanical mouse, or trackball. How many combinations of color and model must she stock in order to have at least one of every possible combination?

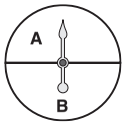
NAME _____ DATE _____ PERIOD ____

9-2 Enrichment

Probabilities and Regions

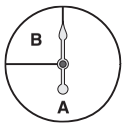
The spinner at the right can be used to indicate that the probability of landing in either of two regions is $\frac{1}{2}$.

$$P(A) = \frac{1}{2} \quad P(B) = \frac{1}{2}$$

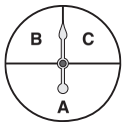


Read the description of each spinner. Using a protractor and ruler, divide each spinner into regions that show the indicated probability.

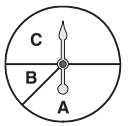
1. Two regions A and B: the probability of landing in region A is $\frac{3}{4}$. What is the probability of landing in region B?
   $P(B) = \frac{1}{4}$



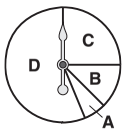
2. Three regions A, B, and C: the probability of landing in region A is $\frac{1}{2}$ and the probability of landing in region B is $\frac{1}{4}$. What is the probability of landing in region C?
   $P(C) = \frac{1}{4}$



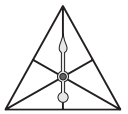
3. Three regions A, B, and C: the probability of landing in region A is $\frac{3}{8}$ and the probability of landing in region B is $\frac{1}{8}$. What is the probability of landing in region C?
   $P(C) = \frac{1}{2}$



4. Four regions A, B, C, and D: the probability of landing in region A is $\frac{1}{16}$, the probability of landing in region B is $\frac{1}{8}$, and the landing probability of in region C is $\frac{1}{4}$. What is the probability of landing in region D?
   $P(D) = \frac{9}{16}$



5. The spinner at the right is an equilateral triangle, divided into regions by line segments that divide the sides in half. Is the spinner divided into regions of equal probability? **yes**



NAME _____ DATE _____ PERIOD ____

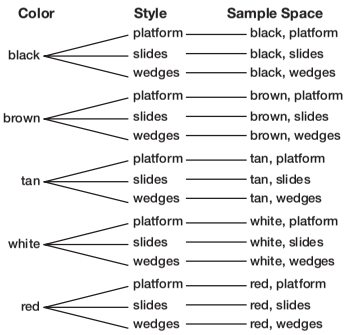
9-3 Lesson Reading Guide

The Fundamental Counting Principle

Get Ready for the Lesson

Read the introduction at the top of page 471 in your textbook. Write your answers below.

1. According to the table, how many colors of sandals are available? **5**
2. How many styles are available? **3**
3. Find the product of the two numbers you found in Exercises 1 and 2. **21**
4. Draw a tree diagram to find the number of different color and style combinations. How does the number of outcomes compare to the product you found above?
   There are 15 different types of shoes available. This is the same as the product found in Exercise 3.



Read the Lesson

5. What operation is used in the Fundamental Counting Principle? **multiplication**
6. How is the information in a tree diagram or table different from the information provided by counting? **Sample answer: The tree diagram, in addition to indicating the total number of possible outcomes, also lists the outcomes so that you can see the content of the outcomes as well as their number.**

Remember What You Learned

7. Write the Fundamental Counting Principle in your own words.
   Sample answer: 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 *N* can occur in $m \times n$ ways.

Answers

NAME _____ DATE _____ PERIOD ____

9-3 Study Guide and Intervention

The 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 N can occur in $m \times n$ ways. This is called the **Fundamental Counting Principle**.

Example 1 CLOTHING **Andy has 5 shirts, 3 pairs of pants, and 6 pairs of socks. How many different outfits can Andy choose with a shirt, pair of pants, and pair of socks?**

number of shirts		number of pants		number of socks		total number of outfits
5	·	3	·	6	=	90

Andy can choose 90 different outfits.

Exercises

Use the Fundamental Counting Principle to find the total number of outcomes in each situation.

1. rolling two number cubes **36**
2. tossing 3 coins **8**
3. picking one consonant and one vowel **105**
4. choosing one of 3 processor speeds, 2 sizes of memory, and 4 sizes of hard drive **24**
5. choosing a 4-, 6-, or 8-cylinder engine and 2- or 4-wheel drive **6**
6. rolling 2 number cubes and tossing 2 coins **144**
7. choosing a color from 4 colors and a number from 4 to 10 **28**

NAME _____ DATE _____ PERIOD ____

9-3 Skills Practice

The Fundamental Counting Principle

Use the Fundamental Counting Principle to find the total number of outcomes in each situation.

1. rolling two number cubes and tossing one coin **72**
2. choosing rye or Bermuda grass and 3 different mixtures of fertilizer **6**
3. making a sandwich with ham, turkey, or roast beef; Swiss or provolone cheese; and mustard or mayonaise **12**
4. tossing 4 coins **16**
5. choosing from 3 sizes of distilled, filtered, or spring water **9**
6. choosing from 3 flavors of juice and 3 sizes **9**
7. choosing from 35 flavors of ice cream; one, two, or three scoops; and sugar or waffle cone **210**
8. picking a day of the week and a date in the month of April **210**
9. rolling 3 number cubes and tossing 2 coins **864**
10. choosing a 4-letter password using only vowels **625**
11. choosing a bicycle with or without shock absorbers; with or without lights; and 5 color choices **20**
12. a license plate that has 3 numbers from 0 to 9 and 2 letters **676,000**

NAME _____ DATE _____ PERIOD ____

9-3 Practice

The Fundamental Counting Principle

Use the Fundamental Counting Principle to find the total number of outcomes in each situation.

1. choosing from 8 car models, 5 exterior paint colors, and 2 interior colors **80**
2. selecting a year in the last decade and a month of the year **120**
3. picking from 3 theme parks and 1-day, 2-day, 3-day, and 5-day passes **12**
4. choosing a meat and cheese sandwich from the list shown in the table **16**
5. tossing a coin and rolling 2 number cubes **72**

Cheese	Meat
Provolone	Salami
Swiss	Turkey
American	Tuna
Cheddar	Ham

6. selecting coffee in regular or decaf, with or without cream, and with or without sweeteners **8**
7. **COINS** Find the number of possible outcomes if 2 quarters, 4 dimes, and 1 nickel are tossed. **$2^7 = 128$**
8. **SOCIAL SECURITY** Find the number of possible 9-digit social security numbers if the digits may be repeated. **10^9 or 1,000,000,000**
9. **AIRPORTS** Jolon will be staying with his grandparents for a week. There are four flights that leave the airport near Jolon's home that connect to an airport that has two different flights to his grandparents' hometown. Find the number of possible flights. Then find the probability of taking the earliest flight from each airport if the flight is selected at random. **8; $\frac{1}{8}$**
10. **ANALYZE TABLES** The table shows the kinds of homes offered by a residential builder. If the builder offers a discount on one home at random, find the probability it will be a 4-bedroom home with an open porch. Explain your reasoning.

Number of Bedrooms	Style of Kitchen	Type of Porch
5-bedroom	Mediterranean	Open
4-bedroom	Contemporary	Screen
3-bedroom	Southwestern	
	Colonial	

Sample answer: The builder offers $3 \cdot 4 \cdot 2 = 24$ kinds of homes. The discounted home has 1 choice for the number of bedrooms, 4 choices for the style of kitchen, and 1 choice for the type of porch. Since $1 \cdot 4 \cdot 1 = 4$, the probability is $\frac{4}{24} = \frac{1}{6}$.

NAME _____ DATE _____ PERIOD ____

9-3 Word Problem Practice

The Fundamental Counting Principle

1. **SURFBOARD** Jay owns 3 surfboards and 2 wetsuits. If he takes one surfboard and one wetsuit to the beach, how many different combinations can he choose? **6**
2. **SHOPPING** John is trying to decide which bag of dog food to buy. The brand he wants comes in 4 flavors and 3 sizes. How many choices are there? **12**
3. **LOTTERY** To purchase a lottery ticket, you must select 4 numbers from 0 to 9. How many possible lottery tickets can be chosen? **10,000**
4. **RESTAURANTS** Miriam's favorite restaurant has 3 specials every day. Each special has 2 choices of vegetable and 3 choices of dessert. How many different meals could Miriam have? **18**
5. **ROUTES** When Sunil goes to the building where he works, he can go through 4 different doors into the lobby. Then he can go to the seventh floor by taking 2 different elevators or 2 different stairways. How many different ways can Sunil get from outside the building to the seventh floor? **16**
6. **STEREOS** Jailin went to her local stereo store. Given her budget and the available selection, she can choose between 2 CD players, 5 amplifiers, and 3 pairs of speakers. How many different stereos can Jailin purchase? **30**
7. **DESSERT** For dessert you can choose apple, cherry, blueberry, or peach pie to eat, and milk or juice to drink. How many different combinations can you choose from? **8**
8. **TESTS** John is taking a true or false quiz. There are six questions on the quiz. How many ways can the quiz be answered? **64**

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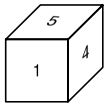
9-3 Enrichment

Curious Cubes

If a six-faced cube is rolled any number of times, the theoretical probability of the cube landing on any given face is $\frac{1}{6}$.

Each cube below has six faces and has been rolled 100 times. The outcomes have been tallied and recorded in a frequency table. Based on the data in each frequency table, what can you say are probably on the unseen faces of each cube?

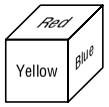
1.



Outcome	Tally
1	15
2	14
3	18
4	16
5	19
6	18

The faces are numbered 2, 3, and 6.

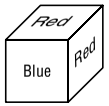
2.



Outcome	Tally
blue	17
red	30
yellow	53

There are two yellow faces and one red face.

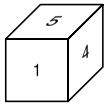
3.



Outcome	Tally
red	30
blue	16
blank	54

The faces are blank.

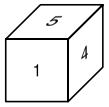
4.



Outcome	Tally
1	34
4	32
5	34

The faces are numbered 1, 4, and 5.

5.



Outcome	Tally
1	14
5	13
4	18
2	16
blank	39

One face is numbered 2 and two faces are blank.

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9-4 Lesson Reading Guide

Permutations

Get Ready for the Lesson

Complete the Mini Lab at the top of page 475 in your textbook. Write your answers below.

1. When you first started to make your list, how many choices did you have for your first class? **3**

2. Once your first class was selected, how many choices did you have for the second class? then, the third class? **2; 1**

Read the Lesson

3. Explain why the arrangement Science, Math, Language Arts is a permutation of Math, Science, Language Arts. **The order of the classes is different.**

4. In Example 1, on page 475, why is there only 1 choice for the third class? **Sample answer: Since there are only three classes, only 1 choice remains for the third class.**

5. In Example 2 on page 476, why are there only 7 choices for second place? **Sample answer: There are only 8 swimmers, and one of them comes in first place. That person cannot come in second place as well. So, there are only 7 swimmers left that could come in second place.**

Remember What You Learned

6. Look up the word *permute* in a dictionary. How does the meaning of this word relate to the concepts in this lesson, especially the concept of permutations? **Sample answer: The word permute means to arrange in all possible ways. A permutation is the listing of all of these arrangements.**

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9-4 Study Guide and Intervention

Permutations

A **permutation** is an arrangement, or listing, of objects in which order is important. You can use the Fundamental Counting Principle to find the number of possible arrangements.

Example 1 **Find the value of $5 \cdot 4 \cdot 3 \cdot 2 \cdot 1$.**

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

Example 2 **Find the value of $4 \cdot 3 \cdot 2 \cdot 1 \cdot 2 \cdot 1$.**

$4 \cdot 3 \cdot 2 \cdot 1 \cdot 2 \cdot 1$
$= 48$ Simplify.

Example 3 **BOOKS How many ways can 4 different books be arranged on a bookshelf?**

This is a permutation. Suppose the books are placed on the shelf from left to right.

There are **4** choices for the first book.
There are **3** choices that remain for the second book.
There are **2** choices that remain for the third book.
There is **1** choice that remains for the fourth book.

$4 \cdot 3 \cdot 2 \cdot 1$
$= 24$ Simplify.

So, there are 24 ways to arrange 4 different books on a bookshelf.

Exercises

Find the value of each expression.

1. $3 \cdot 2 \cdot 1$ **6**
2. $7 \cdot 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1$ **5,040**
3. $6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 \cdot 3 \cdot 2 \cdot 1$ **4,320**
4. $9 \cdot 8 \cdot 7$ **504**
5. How many ways can you arrange the letters in the word GROUP? **120**
6. How many different 4-digit numbers can be created if no digit can be repeated? Remember, a number cannot begin with 0. **4,536**

NAME _____ DATE _____ PERIOD ____

9-4 Skills Practice

Permutations

Find the value of each expression.

1. $2 \cdot 1$ **2**
2. $4 \cdot 3 \cdot 2 \cdot 1$ **24**
3. $3 \cdot 2 \cdot 1 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1$ **720**
4. $9 \cdot 8 \cdot 7 \cdot 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1$ **362,880**
5. $2 \cdot 1 \cdot 8 \cdot 7 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1$ **80,640**
6. $3 \cdot 2 \cdot 1 \cdot 2 \cdot 1$ **12**
7. $11 \cdot 10 \cdot 9$ **990**
8. $10 \cdot 9 \cdot 8 \cdot 7 \cdot 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1$ **3,628,800**
9. $5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 \cdot 2 \cdot 1$ **240**
10. $5 \cdot 4 \cdot 3 \cdot 2$ **120**
11. $8 \cdot 7 \cdot 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1$ **40,320**
12. $6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1$ **720**
13. How many ways can you arrange the letters in the word PRIME? **120**
14. How many ways can you arrange 8 different crates on a shelf if they are placed from left to right? **40,320**

Answers

NAME _____ DATE _____ PERIOD ____

9-4 Practice

Permutations

Solve each problem.

1. **NUMBERS** How many different 2-digit numbers can be formed from the digits 4, 6, and 8? Assume no number can be used more than once. **6**

2. **LETTERS** How many permutations are possible of the letters in the word NUMBERS? **7! or 5,040**

3. **PASSENGERS** There are 5 passengers in a car. In how many ways can the passengers sit in the 5 passenger seats of the car? **5! or 120**

4. **PAINTINGS** Mr. Bernstein owns 14 paintings, but has only enough wall space in his home to display three of them at any one time: one in the hallway, one in the den, and one in the parlor. How many ways can Mr. Bernstein display three paintings in his home? **2,184**

5. **DOG SHOW** Mateo is one of the six dog owners in the terrier category. If the owners are selected in a random order to show their dogs, how many ways can the owners show their dogs? **6! or 720**

6. **TIME** Michel, Jonathan, and two of their friends each ride their bikes to school. If they have an equally-likely chance of arriving first, what is the probability that Jonathan will arrive first and Michel will arrive second? $\frac{1}{12}$

7. **BIRTHDAY** Glen received 6 birthday cards. If he is equally likely to read the cards in any order, what is the probability he reads the card from his parents and the card from his sister before the other cards? $\frac{1}{30}$

CODES For Exercises 8–10, use the following information. A bank gives each new customer a 4-digit code number which allows the new customer to create their own password. The code number is assigned randomly from the digits 1, 3, 5, and 7, and no digit is repeated.

8. What is the probability that the code number for a new customer will begin or end with a 7? $\frac{1}{2}$

9. What is the probability that the code number will *not* contain a 5? **0**

10. What is the probability that the code number will start with 371? $\frac{1}{24}$

NAME _____ DATE _____ PERIOD ____

9-4 Word Problem Practice

Permutations

1. **AREA CODES** How many different 3-digit area codes can be created if no digit can be repeated? **720**	2. **CARDS** Jason is dealt five playing cards. In how many different orders could Jason have been dealt the same hand? **120**
3. **PASSWORDS** How many different 3-letter passwords are possible if no letter may be repeated? **15,600**	4. **RACING** All 22 students in Amy's class are going to run the 100-meter dash. In how many ways can the students finish in first, second, and third place? **9,240**
5. **LETTERS** How many ways can you arrange the letters in the word HISTORY? **5,040**	6. **PARKING** The parking lot for a company has three parking spaces for compact cars. The company has 8 employees with compact cars. How many ways can the compact parking spaces be filled? **336**
7. **SERIAL NUMBERS** How many different 6-digit serial numbers are available if no digit can be repeated? **720**	8. **WINNERS** There are 156 ways for 2 cars to win first and second place in a race. How many cars are in the race? **13**

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9-4 Enrichment

Cyclic Permutations

1. George, Alan, and William are in the same math class. George has five different shirts and wears a different one each day. In how many ways can George wear his five shirts in five days?
5 × 4 × 3 × 2 × 1 = 120 ways

2. Alan has three different shirts and William has four. Which of the three students, George, Alan, or William, goes the greatest number of days before he has to wear a shirt for the second time? Explain.
George. Alan can wear his shirts in 3 × 2 × 1 = 6 different ways, and William can wear his shirts in 4 × 3 × 2 × 1 = 24 different ways.

George, Alan, and William always wear their shirts in the same order. Suppose that George's 5 shirts are red, tan, green, black, and white. He wears his shirts following this pattern:

B W R T G B W R T ...

No matter where George is in the pattern, his friends can always figure out which shirt George will wear next. Since these permutations are the same when they make up part of a cycle, they are called **cyclic permutations.**

3. Alan has shirts that are white, black, and purple. Make an organized list of all the different permutations.
WBP; BWP; PWB and WPB; BPW; PBW

4. How many different ways are there for Alan to wear his shirts so that his friends recognize different patterns? Explain.
2 ways; WBP, BPW and PWB are cyclic permutations, and WPB, BWP and PBW are cyclic permutations.

5. William has athletic shirts that are labeled 1, 2, 3, and 4. Make an organized list of all the different permutations.
1234; 2134; 3124; 4123 1342; 2341; 3241; 4231 1243; 2143; 3142; 4132
1423; 2413; 3412; 4312 1324; 2314; 3214; 4213 1432; 2431; 3421; 4321

6. How many different ways are there for William to wear his shirts so that his friends recognize different patterns? Explain. **6 ways; 1234, 1243, 1324, 1342, 1423 and 1432 are unique cycles. All other permutations can be written as one of these, but in a different order.**

7. **CHALLENGE** For any given number of shirts, how can you determine the number of ways a person could wear the shirts to produce unique patterns? **Take the factorial of one less than the number of shirts, that is $(n - 1)!$.**

NAME _____ DATE _____ PERIOD ____

9-4 TI-83/84 Plus Activity

Permutations

You can use a graphing calculator to help you find the number of permutations.

Example 1 **25 people are auditioning for 5 different parts in a play. In how many ways can the 5 parts be assigned?**

To calculate a permutation, find the total number of objects (n) and the number taken at one time (r). In this problem, $n = 25$. Because 5 students are needed, $r = 5$.

Enter: 25 MATH ▶ ▶ ▶ 2 5 ENTER 6,375,600

The parts can be assigned in 6,375,600 different ways.

Exercises

Find the value of each permutation for the given values of n and r.

1. $n = 5, r = 2$ **20**
2. $n = 8, r = 3$ **336**
3. $n = 9, r = 6$ **60,480**
4. $n = 6, r = 2$ **30**
5. $n = 10, r = 6$ **151,200**
6. $n = 12, r = 4$ **11,880**
7. $n = 20, r = 2$ **380**
8. $n = 15, r = 7$ **32,432,400**
9. $n = 18, r = 3$ **4,896**

Solve.

10. Employees of Spies, Inc., are given 3-digit code numbers made up of the digits 1, 3, 5, 7, and 9. How many different 3-digit code numbers can be created? **60**

11. How many different 4-letter arrangements are there in the letters A, S, N, D, T, R, and Y? **840**

12. Twenty students have entered an art contest. Five students will each receive different awards. How many different groups of 5 students could be selected to receive awards? **1,860,480**

Answers

NAME _____ DATE _____ PERIOD ____

9-5 Lesson Reading Guide

Combinations

Get Ready for the Lesson

Read the introduction at the top of page 480 in your textbook. Write your answers below.

1. Use the first letter of each vegetable to list all of the permutations of the ingredients added to the lettuce. **TGC, TGR, TCR, GTC, GTR, GCR, CTB, CTR, CGR; 9**
2. Cross out any arrangement that contains the same letters as another one in the list. How many are there now? **4**
3. Explain the difference between the two lists. **The list in Exercise 1 is a permutation where order is important. The list in Exercise 2 does not take order into account.**

Read the Lesson

4. How can you find the number of combinations of objects in a set? **Sample answer: Divide the number of permutations of the entire set by the number of ways each smaller set can be arranged.**
5. Why might it be easier to calculate the number of combinations of a set of objects using a permutation rather than making a list? **Sample answer: A list could be quite lengthy, depending on the number of objects in the set and the number of them being chosen.**

For Exercises 6 and 7, refer to Example 2 on page 481 in your textbook.

6. In the diagram, how many points are there? How many line segments connect to any one point? **8; 7**
7. How does your answer to Exercise 6 above correspond to Example 2 in your book? **There are 8 · 7 ways to choose 2 people.**

Remember What You Learned

8. Work with a partner. Take turns thinking of situations in which a selection from a group must be made, where order is or is not important. Tell each other which situations are permutations and which are combinations. Solve each problem and show your work. **See students' work.**

NAME _____ DATE _____ PERIOD ____

9-5 Study Guide and Intervention

Combinations

An arrangement, or listing, of objects in which order is *not* important is called a **combination**. You can find the number of combinations of objects by dividing the number of permutations of the entire set by the number of ways each smaller set can be arranged.

Example 1 **Jill was asked by her teacher to choose 3 topics from the 8 topics given to her. How many different three-topic groups could she choose?**

There are $8 \cdot 7 \cdot 6$ permutations of three-topic groups chosen from eight. There are $3 \cdot 2 \cdot 1$ ways to arrange the groups.

$$\frac{8 \cdot 7 \cdot 6}{3 \cdot 2 \cdot 1} = \frac{336}{6} = 56$$

So, there are 56 different three-topic groups.

Tell whether each situation represents a *permutation* or *combination*. Then solve the problem.

Example 2 **On a quiz, you are allowed to answer any 4 out of the 6 questions. How many ways can you choose the questions?**

This is a combination because the order of the 4 questions is not important. So, there are $6 \cdot 5 \cdot 4 \cdot 3$ permutations of four questions chosen from six. There are $4 \cdot 3 \cdot 2 \cdot 1$ orders in which these questions can be chosen.

$$\frac{6 \cdot 5 \cdot 4 \cdot 3}{4 \cdot 3 \cdot 2 \cdot 1} = \frac{360}{24} = 15$$

So, there are 15 ways to choose the questions.

Example 3 **Five different cars enter a parking lot with only 3 empty spaces. How many ways can these spaces be filled?**

This is a permutation because each arrangement of the same 3 cars counts as a distinct arrrangement. So, there are $5 \cdot 4 \cdot 3$ or 60 ways the spaces can be filled.

Exercises

Tell whether each situation represents a *permutation* or *combination*. Then solve the problem.

1. How many ways can 4 people be chosen from a group of 11? **combination; 330**
2. How many ways can 3 people sit in 4 chairs? **permutation; 24**
3. How many ways can 2 goldfish be chosen from a tank containing 15 goldfish? **combination; 105**

NAME _____ DATE _____ PERIOD ____

9-5 Skills Practice

Combinations

Tell whether each situation represents a *permutation* or *combination*. Then solve the problem.

1. You are allowed to omit two out of 12 questions on a quiz. How many ways can you select the questions to omit?
   combination; 66

2. Six students are to be chosen from a class of 18 to represent the class at a math contest. How many ways can the six students be chosen?
   combination; 18,564

3. How many different 5-digit zip codes are possible if no digits are repeated?
   permutation; 30,240

4. In a race with six runners, how many ways can the runners finish first, second, or third?
   permutation; 120

5. How many ways can two names be chosen from 76 in a raffle if only one entry per person is allowed?
   combination; 2,850

6. How many ways can six students be arranged in a lunch line?
   permutation; 720

7. A family has a bike rack that fits seven bikes but they only have five bikes. How many ways can the bikes fit in the bike rack?
   permutation; 2,520

8. How many ways can you select three sheriff deputies from eight candidates?
   combination; 56

9. How many ways can four finalists be selected from 50 contestants?
   combination; 230,300

10. How many 4-digit pin numbers are available if no number is repeated?
    permutation; 5,040

11. How many handshakes can occur between five people if everyone shakes hands?
    combination; 10

NAME _____ DATE _____ PERIOD ____

9-5 Practice

Combinations

Solve each problem.

1. **BASKETBALL** In how many ways can a coach select 5 players from a team of 10 players? **252**

2. **BOOKS** In how many ways can 3 books be selected from a shelf of 25 books? **2,300**

3. **CAFETERIA** In how many ways can you choose 2 side dishes from 15 items? **105**

4. **CHORES** Of 8 household chores, in how many ways can you do three-fourths of them? **28**

5. **ELDERLY** Latanya volunteers to bake and deliver pastries to elderly people in her neighborhood. In how many different ways can Latanya deliver to 2 of the 6 elderly people in her neighborhood? **15**

6. **DELI** A deli makes potato, macaroni, three bean, Caesar, 7-layer, and Greek salads. The deli randomly makes only four salads each day. What is the probability that the four salads made one day are 7-layer, macaroni, Greek, and potato? $\frac{1}{15}$

7. **AUTOGRAPHS** A sports memorabilia enthusiast collected autographed baseballs from the players in the table. The enthusiast is giving one autographed baseball to each of his three grandchildren. If the baseballs are selected at random, what is the probability that the Hank Aaron, Alex Rodriquez, and Mickey Mantle autographed baseballs are given to his grandchildren? $\frac{1}{10}$

Player
Cal Ripkin
Hank Aaron
Barry Bonds
Alex Rodriquez
Mickey Mantle

For Exercises 8–10, tell whether each problem represents a *permutation* or a *combination*. Then solve the problem.

8. **LOCKS** In how many ways can three different numbers be selected from 10 numbers to open a keypad lock? **permutation; 720**

9. **MOVIES** How many ways can 10 DVDs be placed on a shelf?
   permutation; 10! or 3,628,800

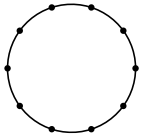
10. **TRANSPORTATION** Eight people need transportation to the concert. How many different groups of 6 people can ride with Mrs. Johnson?
    combination; 28

Answers

NAME _____ DATE _____ PERIOD ____

9-5 Word Problem Practice

Combinations

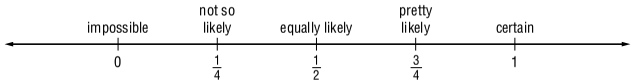
1. SNACKS A vending machine can display six snacks. If there are eight different kinds of snacks available, how many 2 groups of six different snacks can be purchased? **28**	**2. MUSIC** Each month, Jose purchases two CDs from a selection of 20 bestselling CDs. How many different pairs of CDs can Jose choose if he chooses two different CDs? **190**
3. TESTS On a math test, you can choose any 20 out of 23 questions. How many different groups of 20 questions can you choose? **1,771**	**4. RESTAURANTS** The dinner special at a local pizza parlor gives you the choice of two toppings from a selection of six toppings. How many different choices are possible if two different toppings are chosen? **15**
5. TESTING In a science fair experiment, two units are selected for testing from every 500 units produced. How many ways can these two units be selected? **124,750**	**6. MEETINGS** Linda's teacher divided the class into groups of five and required each member of a group to meet with every other member of that group. How many meetings will each group have? **10**
7. BASEBALL A baseball coach has 13 players to fill nine positions. How many different teams could he put together? **715**	**8. GEOMETRY** Ten points are marked on a circle. How many different triangles can be drawn between any three points? **120** 

NAME _____ DATE _____ PERIOD ____

9-5 Enrichment

From Impossible to Certain Events

A probability is often expressed as a fraction. As you know, an event that is impossible is given a probability of 0 and an event that is certain is given a probability of 1. Events that are neither impossible nor certain are given a probability somewhere between 0 and 1. The probability line below shows relative probabilities.



Determine the probability of an event by considering its place on the diagram above. **Answers will vary. Accept logical responses.**

1. Medical research will find a cure for all diseases.
2. There will be a personal computer in each home by the year 2010.
3. One day, people will live in space or under the sea.
4. Wildlife will disappear as Earth's human population increases.
5. There will be a fifty-first state in the United States.
6. The sun will rise tomorrow morning.
7. Most electricity will be generated by nuclear power by the year 2010.
8. The fuel efficiency of automobiles will increase as the supply of gasoline decreases.
9. Astronauts will land on Mars.
10. The percent of high school students who graduate and enter college will increase.
11. Global warming problems will be solved.
12. All people in the United States will exercise regularly within the near future.

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9-5 TI-83/84 Plus Activity

Combinations

A graphing calculator can be used to solve problems involving combinations. On the TI-83/84 Plus, the combination function can be found in the MATH (PRB) menu.

Example 1 **How many ways can 2 people be chosen from a group of 10 people?**

Since order does not matter, this is a combination.

Enter: 10 MATH ◀ 3 2 ENTER 45

So, the number of ways 2 people can be chosen from a group of 10 people is 45.

Example 2 **How many 5-card hands can be chosen from a deck of 52 cards?**

Since order does not matter, this is a combination.

Enter: 52 MATH ◀ 3 5 ENTER 2,598,960

So, the number of 5-card hands that can be chosen from a 52-card deck is 2,598,960.

Exercises

Solve each problem.

1. How many groups of 3 people can be chosen from a group of 5 people? **10**
2. How many groups of 4 people can be chosen from a group of 8 people? **70**
3. How many groups of 10 people can be chosen from a group of 20 people? **184,756**
4. How many groups of 2 people can be chosen from a group of 12 people? **66**
5. How many groups of 8 people can be chosen from a group of 9 people? **9**
6. How many 2-topping pizzas can be made from a pizza restaurant offering 6 different toppings? **15**
7. How many 3-topping pizzas can be made from a pizza restaurant offering 10 different toppings? **120**
8. How many 7-card hands can be chosen from a deck of 52 cards? **133,784,560**
9. How many 4-card hands can be chosen from a deck of 52 cards? **270,725**
10. How many two-topping sundaes can be made from an ice cream shop offering 9 different toppings? **36**

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9-6 Study Guide and Intervention

Problem-Solving Investigation: Act It Out

By acting out a problem, you are able to see all possible solutions to the problem being posed.

Example **CLOTHING** **Ricardo has two shirts and three pairs of pants to choose from for his outfit to wear on the first day of school. How many different outfits can he make by wearing one shirt and one pair of pants?**

Understand We know that he has two shirts and three pairs of pants to choose from. We can use a coin for the shirts and an equally divided spinner labeled for the pants.

Plan Let's make a list showing all possible outcomes of tossing a coin and then spinning a spinner.

Solve H = Heads
T = Tails
Spinner = 1, 2, 3

Flip a Coin	Spin a Spinner
H	1
H	2
H	3
T	1
T	2
T	3

There are six possible outcomes of tossing a coin and spinning a spinner. So, there are 6 different possible outfits that Ricardo can wear for the first day of school.

Check Tossing a coin has two outcomes and there are two shirts. Spinning a three-section spinner has three outcomes and there are three pairs of pants. Therefore, the solution of 6 different outcomes with a coin and spinner represent the 6 possible outfit outcomes for Ricardo.

Exercises

1. **SCIENCE FAIR** There are 4 students with projects to present at the school science fair. How many different ways can these 4 projects be displayed on four tables in a row? **24 ways**
2. **GENDER** Determine whether tossing a coin is a good way to predict the gender of the next 5 babies born at General Hospital. Justify your answer. **No; there is only one scenario in which the prediction is correct.**
3. **OLYMPICS** Four runners are entered in the first hurdles heat of twelve heats at the Olympics. The first two move on to the next round. Assuming no ties, how many different ways can the four runners come in first and second place? **12 ways**

Answers

NAME _____ DATE _____ PERIOD ____

9-6 Skills Practice

Problem-Solving Investigation: Act it Out

Use the act it out strategy to solve.

1. **SCHOOL** Determine whether rolling a 6-sided number cube is a good way to answer a 20-question multiple-choice test if there are six choices for each question. Justify your answer. **No, you only have a 1 in 6 chance of getting the correct answer.**

2. **GYMNASTICS** Five gymnasts are entered in a competition. Assuming that there are no ties, how many ways can first, second, and third places be awarded? **60**

3. **LUNCH** How many ways can 3 friends sit together in three seats at lunch? **6**

4. **SCHEDULE** How many different schedules can Sheila create if she has to take English, math, science, social studies, and art next semester. Assume that there is only one lunch period available. **120**

5. **BAND CONCERTS** The band is having a holiday concert. In the first row, the first trumpet is always furthest to the right and the first trombone is always the furthest to the left. How many ways are there to arrange the other 4 people who need to sit in the front? **24**

6. **TEAMS** Mr. D is picking teams for volleyball is gym by having the students count off by 2's. The 1's will be on one team and the 2's on the other. Would flipping a coin would work just as well to pick the teams? Justify your answer. **Approximately, yes; because the probability of getting either heads or tails is $\frac{1}{2}$, the same as getting a one or a two.**

NAME _____ DATE _____ PERIOD ____

9-6 Practice

Problem-Solving Investigation: Act It Out

Mixed Problem Solving

For Exercises 1 and 2, use the act it out strategy.

1. **POP QUIZ** Use the information in the table to determine whether tossing a nickel and a dime is a good way to answer a 5-question multiple-choice quiz if each question has answer choices A, B, C, and D. Justify your answer.

Nickel	Dime	Answer Choice
H	H	A
H	T	B
T	H	C
T	T	D

No; Sample answer: The experiment produces only 1-2 correct answers, so tossing a nickel and a dime is not a good way to answer a 5-question multiple-choice quiz.

2. **BOWLING** Bill, Lucas, Carmen, and Dena go bowling every week. When ordered from highest to lowest, how many ways can their scores be arranged if Lucas is never first and Carmen always beats Bill? **9**

Use any strategy to solve Exercises 3–6. Some strategies are shown below.

PROBLEM-SOLVING STRATEGIES
• Draw a diagram.
• Use reasonable answers.
• Act it out.

3. **BOOKS** What is the probability of five books being placed in alphabetical order of their titles if randomly put on a book shelf? $\frac{1}{120}$

4. **NUMBER THEORY** The sum of a 2-digit number and the 2-digit number when the digits are reversed is 77. If the difference of the same two numbers is 45, what are the two 2-digit numbers? **The numbers are 61 and 16.**

5. **BASEBALL** In one game, Rafael was up to bat 3 times and made 2 hits. In another game, he was up to bat 5 times with no hits. What percent of the times at bat did Rafael make a hit? **25%**

6. **RESTAURANT** A restaurant offers the possibility of 168 three-course dinners. Each dinner has an appetizer, an entrée, and a dessert. If the number of appetizers decreases from 7 to 5, find how many fewer possible three-course dinners the restaurant offers. **48**

NAME _____ DATE _____ PERIOD ____

9-6 Word Problem Practice

Problem-Solving Investigation: Act It Out

Solve each problem using any strategy you have learned.

1. **POLLS** Out of 200 people, 32% said that their favorite animal was a cat and 44% said that their favorite animal was a dog. How many more people chose dog than cat? **24**

2. **PEACHES** Roi is picking peaches; he needs a total of $3\frac{1}{2}$ bushels of peaches. If he has already picked 3 bushels, how many more does he need to pick? **B**

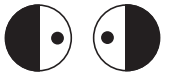
A 2 bushels **C** $3\frac{1}{2}$ bushels

B $\frac{1}{2}$ bushel **D** 3 bushels

3. **BASEBALL** Thirty-two teams are playing in the championship. If a team is eliminated once it loses, how many total games will be played in the championship? **31**

4. **GEOMETRY** Find the next two terms is the sequence.

Answer:



5. **POOL RENTAL** The table below shows how much Ford Middle School was charged to rent the pool for a party based on the number of hours it was rented. Predict the cost for 5 hours. **$600**

# of hours	Cost
1	$120
1.5	$180
2	$240
2.5	$300

6. **GEOMETRY** Use the formula $D = rt$ where D is the distance, r is the rate, and t is the time to determine how far Alyssa drove if she drove 55 miles per hour for 4 hours. **220 miles**

7. **SCHOOL ELECTIONS** How many ways can a president, vice president, secretary and treasurer be elected from a choice of 6 students? **360**

8. **SHOPPING** Morty bought skis. The skis cost $215 and he got $35 in change. How much did Morty pay with? **$250**

NAME _____ DATE _____ PERIOD ____

9-7 Lesson Reading Guide

Theoretical and Experimental Probability

Get Ready for the Lesson

Complete the Mini Lab at the top of page 486 in your textbook. Write your answers below.

1. Compare the number of times you *expected* to roll doubles with the number of times you *actually* rolled doubles. **Sample answer: The number of times doubles is expected on 36 tosses is 6. Students' experiments may vary slightly.**

2. Write the probability of rolling doubles out of 36 rolls using the number of times you *expected* to roll doubles from Step 1. Then write the probability of rolling doubles out of 36 rolls using the number of times you *actually* rolled doubles from Step 2. **See students' work. Sample answer: The expected probability of doubles is $\frac{6}{36}$, or $\frac{1}{6}$. Students' experimental probabilities may vary slightly.**

Read the Lesson

3. Look up the word *experimental* in a dictionary. Write the meaning for the word as used in the lesson. **Sample answer: based on experience rather than on theory**

4. How does theoretical probability differ from experimental probability? **Sample answer: Theoretical probability is the expected probability of an event happening. Experimental probability is based on something you actually try (for example, an experiment or game).**

5. Complete the sentence: Experimental probability can be based on **past performances** and can be used to make predictions about future events.

Remember What You Learned

6. Work with a partner. Design an experiment that you can use to express the experimental probability of an event. Compare your findings with those of others in your class. **See students' work.**

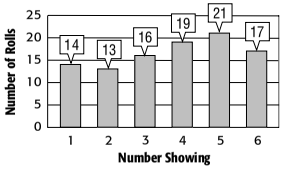
NAME _____ DATE _____ PERIOD ____

9-7 Study Guide and Intervention

Theoretical and Experimental Probability

Experimental probability is found using frequencies obtained in an experiment or game. **Theoretical probability** is the expected probability of an event occurring.

Example 1 **The graph shows the results of an experiment in which a number cube was rolled 100 times. Find the experimental probability of rolling a 3 for this experiment.**



$P(3) = \frac{\text{number of times 3 occurs}}{\text{number of possible outcomes}}$

$= \frac{16}{100}$ or $\frac{4}{25}$

The experimental probability of rolling a 3 is $\frac{4}{25}$, which is close to its theoretical probability of $\frac{1}{6}$.

Example 2 **In a telephone poll, 225 people were asked for whom they planned to vote in the race for mayor. What is the experimental probability of Juarez being elected?**

Candidate	Number of People
Juarez	75
Davis	67
Abramson	83

Of the 225 people polled, 75 planned to vote for Juarez.

So, the experimental probability is $\frac{75}{225}$ or $\frac{1}{3}$.

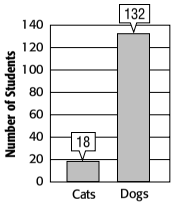
Example 3 **Suppose 5,700 people vote in the election. How many can be expected to vote for Juarez?**

$\frac{1}{3} \cdot 5{,}700 = 1{,}900$

About 1,900 will vote for Juarez.

Exercises

For Exercises 1–3, use the graph of a survey of 150 students asked whether they prefer cats or dogs.



1. What is the probability of a student preferring dogs? $\frac{22}{25}$
2. Suppose 100 students were surveyed. How many can be expected to prefer dogs? **88**
3. Suppose 300 students were surveyed. How many can be expected to prefer cats? **36**

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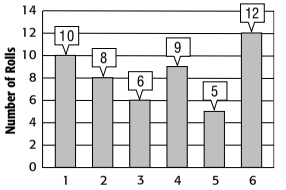
9-7 Skills Practice

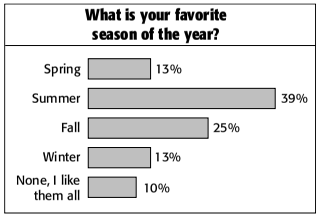
Theoretical and Experimental Probability

For Exercises 1–5, a number cube is rolled 50 times and the results are shown in the graph below.



1. Find the experimental probability of rolling a 2. $\frac{4}{25}$
2. What is the theoretical probability of rolling a 2? $\frac{1}{6}$
3. Find the experimental probability of *not* rolling a 2. $\frac{21}{25}$
4. What is the theoretical probability of *not* rolling a 2? $\frac{5}{6}$
5. Find the experimental probability of rolling a 1. $\frac{1}{5}$

For Exercises 6–9, use the results of the survey at the right.



6. What is the probability that a person's favorite season is fall? Write the probability as a fraction. $\frac{1}{4}$
7. Out of 300 people, how many would you expect to say that fall is their favorite season? **75**
8. Out of 20 people, how many would you expect to say that they like all the seasons? **2**
9. Out of 650 people, how many more would you expect to say that they like summer than say that they like winter? **169**

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9-7 Practice

Theoretical and Experimental Probability

For Exercises 1–4, a number cube is rolled 24 times and lands on 2 four times and on 6 three times.

1. Find the experimental probability of landing on a 2. $\frac{1}{6}$
2. Find the experimental probability of *not* landing on a 6. $\frac{7}{8}$
3. Compare the experimental probability you found in Exercise 1 to its theoretical probability. **The theoretical probability of landing on a 2, $\frac{1}{6}$, is the same as the experimental probability.**
4. Compare the experimental probability you found in Exercise 2 to its theoretical probability. **The theoretical probability of *not* landing on a 6, $\frac{5}{6}$, is fairly close to the experimental probability.**

ENTERTAINMENT For Exercises 5–7, use the results of the survey in the table shown.

Best Entertainment Value	
Type of Entertainment	**Percent**
Playing Interactive Games	48%
Reading Books	22%
Renting Movies	10%
Going to Movie Theaters	10%
Surfing the Internet	9%
Watching Television	1%

5. What is the probability that someone in the survey considered reading books or surfing the Internet as the best entertainment value? Write the probability as a fraction. $\frac{31}{100}$
6. Out of 500 people surveyed, how many would you expect considered reading books or surfing the Internet as the best entertainment value? **155**
7. Out of 300 people surveyed, is it reasonable to expect that 30 considered watching television as the best entertainment value? Why or why not? **No; 1% of 300 = 3, not 30.**

For Exercises 8–10, a spinner marked with four sections blue, green, yellow, and red was spun 100 times. The results are shown in the table.

Section	Frequency
Blue	14
Green	10
Yellow	8
Red	68

8. Find the experimental probability of landing on green. $\frac{1}{10}$
9. Find the experimental probability of landing on red. $\frac{17}{25}$
10. If the spinner is spun 50 more times, how many of these times would you expect the pointer to land on blue? **7**

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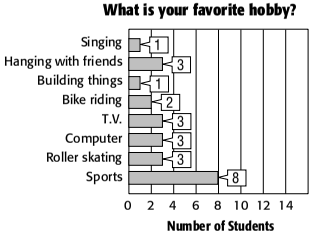
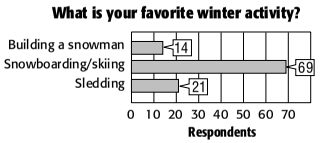
9-7 Word Problem Practice

Theoretical and Experimental Probability

HOBBIES For Exercises 1–3, use the graph of a survey of 24 seventh grade students asked to name their favorite hobby .



WINTER ACTIVITIES For Exercises 5 and 6, use the graph of a survey with 104 responses in which respondents were asked about their favorite winter activities.



1. What is the probability that a student's favorite hobby is roller skating? $\frac{1}{8}$
2. Suppose 200 seventh grade students were surveyed. How many can be expected to say that roller skating is their favorite hobby? **25**
3. Suppose 60 seventh grade students were surveyed. How many can be expected to say that bike riding is their favorite hobby? **5**
4. **MARBLES** A bag contains 5 blue, 4 red, 9 white, and 6 green marbles. If a marble is drawn at random and replaced 100 times, how many times would you expect to draw a green marble? **25**
5. What is the probability that someone's favorite winter activity is building a snowman? Write the probability as a fraction. $\frac{7}{52}$
6. If 500 people had responded, how many would have been expected to list sledding as their favorite winter activity? Round to the nearest whole person. **101**

Answers

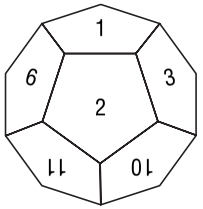
NAME _____ DATE _____ PERIOD ____

9-7 Enrichment

Rolling a Dodecahedron

A **dodecahedron** is a solid. It has twelve faces, and each face is a pentagon.

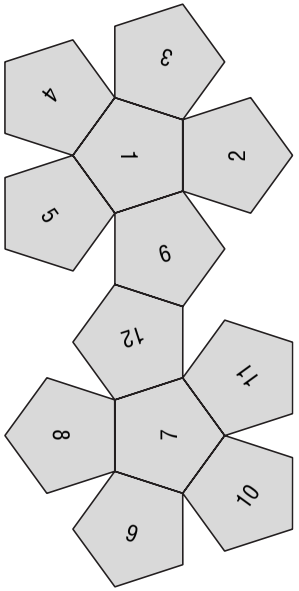
At the right, you see a dodecahedron whose faces are marked with the integers from 1 through 12. You can roll this dodecahedron just as you roll a number cube. With the dodecahedron, however, there are *twelve* equally likely outcomes.



Refer to the dodecahedron shown at the right. Find the probability of each event.

1. $P(5)$ $\frac{1}{12}$
2. $P(\text{odd})$ $\frac{1}{2}$
3. $P(\text{prime})$ $\frac{5}{12}$
4. $P(\text{divisible by 5})$ $\frac{1}{6}$
5. $P(\text{less than 4})$ $\frac{1}{4}$
6. $P(\text{fraction})$ 0

You can make your own dodecahedron by cutting out the pattern at the right. Fold along each of the solid lines. Then use tape to join the faces together so that your dodecahedron looks like the one shown above.



7. Roll your dodecahedron 100 times. Record your results on a separate sheet of paper, using a table like this.

Outcome	Tally	Frequency
1		
2		

Answers will vary.

8. Use your results from Exercise 7. Find the experimental probability for each of the events described in Exercises 1–6.
Answers will vary.

NAME _____ DATE _____ PERIOD ____

9-7 TI-73 Activity

Experimental Probability

Use your calculator to simulate flipping a coin or rolling a number cube. These features are found in the MATH PRB (probability) menu. The calculator displays a random number that represents heads or tails on a coin or the number on a number cube. The calculator calls number cubes *dice*.

Example 1 **Roll two number cubes 100 times. Calculate the experimental probability of rolling double-1, double-2, double-3, double-4, double-5, or double-6.**

Step 1 Clear Home.
2nd [MEM] 5 ENTER

Step 2 Choose the dice feature in MATH PRB.
MATH ▶ ▶ 7

Step 3 The display shows dice(. Use 2 dice.
2 ENTER

Step 4 Interpret the result and continue for 100 rolls.

The display shows an ordered pair of digits, like (3 5). This means the first cube shows a 3 and the second cube shows a 5. If a double, like (2 2) or (5 5), appears, tally it in the chart below. Continue with the next roll by pressing ENTER .

Exercises

Use your graphing calculator to complete the following.

Double	Tally	Number	Fraction	Percent
(1, 1)	II	2	$\frac{2}{100}$	2%
(2, 2)	IIII	4	$\frac{4}{100}$	4%
(3, 3)	II	2	$\frac{2}{100}$	2%
(4, 4)	IIII	4	$\frac{4}{100}$	4%
(5, 5)	𝍸 II	7	$\frac{7}{100}$	7%
(6, 6)	III	3	$\frac{3}{100}$	3%

1. Complete the table for 100 rolls. Calculate the Fraction and Percent columns. **See sample data.**
2. The theoretical probability of rolling double-1 (or any other double) is 1/36 or about 3%. Compare this theoretical probability with your experimental results.
Most of the experimental probabilities are close to the theoretical.

3. Do another experiment, but use the coin feature of MATH PRB. Explore the probability of a family with three children having all girls. Flip 3 coins. Each coin stands for one child. If the result is a 1, then the child is a boy; if it is 0, then the child is a girl. Flip the three coins 100 times. Tally the results of 3 girls and of 3 boys. Describe your results.

	Tally	Number	Fraction	Percent
All girls (0, 0, 0)	𝍸 𝍸 I	11	$\frac{11}{100}$	11%
All boys (1, 1, 1)	𝍸 𝍸	10	$\frac{10}{100}$	10%

Students' results and descriptions will vary.

NAME _____ DATE _____ PERIOD ____

9-8 Lesson Reading Guide

Compound Events

Get Ready for the Lesson

Read the introduction at the top of page 492 in your textbook. Write your answers below.

1. If Reginald picks one quarter without looking, what is the probability it is from Colorado? $\frac{1}{3}$
2. Suppose he tosses the coin. What is the probability it lands heads up? $\frac{1}{2}$
3. Make a tree diagram to find the probability of choosing a Colorado quarter that lands heads up.

4. How are the answers to Exercises 1, 2, and 3 related? **The answer to Exercise 3 is the product of the answers to Exercise 1 and Exercise 2.**

Read the Lesson

Use the introduction to the lesson to answer Exercises 5–8.

5. What does a compound event consist of? **It consists of two or more simple events.**
6. Define independent events. **They are two events in which the outcome of one, does not affect the outcome of the other.**
7. Write the probability of independent events in symbols. **P(A and B) = P(A) × P(B)**
8. How can you find the probability of two independent events? **Sample answer: Multiply the probability of the first event by the probability of the second event.**

Remember What You Learned

9. List several independent compound events. Explain why you consider the events to be independent. **Sample answer: spinnning a spinner and flipping a coin. They have no effect on each other.**

NAME _____ DATE _____ PERIOD ____

9-8 Study Guide and Intervention

Compound Events

A **compound event** consists of two or more simple events. If the outcome of one event does not affect the outcome of a second event, the events are called **independent events**. The probability of two independent events can be found by multiplying the probability of the first event by the probability of the second event.

Example 1 **A coin is tossed and a number cube is rolled. Find the probability of tossing tails and rolling a 5.**

$P(\text{tails}) = \frac{1}{2}$ $P(5) = \frac{1}{6}$

$P(\text{tails and } 5) = \frac{1}{2} \cdot \frac{1}{6}$ or $\frac{1}{12}$

So, the probability of tossing tails and rolling a 5 is $\frac{1}{12}$.

Example 2 **MARBLES A bag contains 7 blue, 3 green, and 3 red marbles. If Agnes randomly draws two marbles from the bag, replacing the first before drawing the second, what is the probability of drawing a green and then a blue marble?**

$P(\text{green}) = \frac{3}{13}$ 13 marbles, 3 are green

$P(\text{blue}) = \frac{7}{13}$ 13 marbles, 7 are blue

$P(\text{green, then blue}) = \frac{3}{13} \cdot \frac{7}{13} = \frac{21}{169}$

So, the probability that Agnes will draw a green, then a blue marble is $\frac{21}{169}$.

Exercises

1. Find the probability of rolling a 2 and then an even number on two consecutive rolls of a number cube.
   $\frac{1}{12}$
2. A penny and a dime are tossed. What is the probability that the penny lands on heads and the dime lands on tails?
   $\frac{1}{4}$
3. Lazlo's sock drawer contains 8 blue and 5 black socks. If he randomly pulls out one sock, what is the probability that he picks a blue sock?
   $\frac{8}{13}$

NAME _____ DATE _____ PERIOD ____

9-8 Skills Practice

Compound Events

1. Four coins are tossed. What is the probability of tossing all heads?
$\frac{1}{16}$

2. One letter is randomly selected from the word PRIME and one letter is randomly selected from the word MATH. What is the probability that both letters selected are vowels?
$\frac{1}{10}$

3. A card is chosen at random from a deck of 52 cards. It is then replaced and a second card is chosen. What is the probability of getting a jack and then an eight?
$\frac{1}{169}$

For Exercises 4–6, use the information below.

A standard deck of playing cards contains 52 cards in four suits of 13 cards each. Two suits are red and two suits are black. Find each probability. Assume the first card is replaced before the second card is drawn.

4. P(black, queen) $\frac{1}{26}$

5. P(black, diamond) $\frac{1}{8}$

6. P(jack, queen) $\frac{1}{169}$

7. What is the probability of spinning a number greater than 5 on a spinner numbered 1 to 8 and tossing a tail on a coin?
$\frac{3}{16}$

8. Two cards are chosen at random from a standard deck of cards with replacement. What is the probability of getting 2 aces?
$\frac{1}{169}$

9. A CD rack has 8 classical CDs, 5 pop CDs, and 3 rock CDs. One CD is chosen and replaced, then a second CD is chosen. What is the probability of choosing a rock CD then a classical CD?
$\frac{3}{32}$

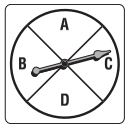
10. A jar holds 15 red pencils and 10 blue pencils. What is the probability of drawing one red pencil from the jar?
$\frac{3}{5}$

NAME _____ DATE _____ PERIOD ____

9-8 Practice

Compound Events

A number cube is rolled and a spinner like the one shown is spun. Find each probability.



1. P(6 and D) $\frac{1}{24}$

2. P(multiple of 2 and B) $\frac{1}{8}$

3. P(not 6 and not A) $\frac{5}{8}$

A set of 7 cards is labeled 1–7. A second set of 12 cards contains the following colors: 3 green, 6 red, 2 blue, and 1 white. One card from each set is selected. Find each probability.

4. P(6 and green) $\frac{1}{28}$

5. P(prime and blue) $\frac{2}{21}$

6. P(odd and red) $\frac{2}{7}$

7. P(7 and white) $\frac{1}{84}$

8. P(multiple of 3 and red) $\frac{1}{7}$

9. P(even and white) $\frac{1}{28}$

A coin is tossed, a number cube is rolled, and a letter is picked from the word *framer*.

10. P(tails, 5, m) $\frac{1}{72}$

11. P(heads, odd, r) $\frac{1}{12}$

12. P(heads, 6, vowel) $\frac{1}{36}$

13. P(tails, prime, consonant) $\frac{1}{6}$

14. P(not tails, multiple of 3, a) $\frac{1}{36}$

15. P(not heads, 2, f) $\frac{1}{72}$

16. **TOLL ROAD** Mr. Espinoza randomly chooses one of five toll booths when entering a toll road when driving to work. What is the probability he will select the middle toll booth on Monday and Tuesday? $\frac{1}{25}$

MARBLES For Exercises 17–20, use the information in the table shown to find each probability. After a marble is randomly picked from a bag containing marbles of four different colors, the color of the marble is observed and then it is returned to the bag.

Marbles	
Color	**Number**
White	6
Green	2
Red	1
Blue	3

17. P(red) $\frac{1}{12}$

18. P(green, blue) $\frac{1}{24}$

19. P(red, white, blue) $\frac{1}{96}$

20. P(blue, blue, blue) $\frac{1}{64}$

NAME _____ DATE _____ PERIOD ____

9-8 Word Problem Practice

Compound Events

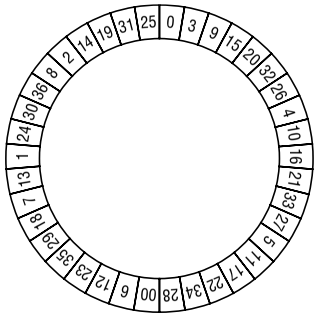
1. SAFETY Eighty percent of all California drivers wear seat belts. If three drivers are pulled over, what is the probability that all would be wearing their seat belts? Write as a percent to the nearest tenth. **51.2%**	**2. VEGETABLES** A nationwide survey showed that 65% of all children in the United States dislike eating vegetables. If three children are chosen at random, what is the probability that all three dislike eating vegetables? Write as a percent to the nearest tenth. **27.5%**
3. QUALITY In a shipment of 50 calculators, 4 are defective. One calculator is randomly selected and tested. What is the probability that it is defective? **$\frac{2}{25}$**	**4. MARBLES** A bag contains 6 green marbles, 2 blue marbles, and 3 white marbles. Gwen draws one marble from the jar and replaces it. Jeff then draws one marble from the jar. What is the probability that Gwen draws a blue marble and Jeff draws a white marble? **$\frac{6}{121}$**
5. DEMONSTRATION Ms. Morris needs a student to help her with a demonstration for her class of 12 girls and 14 boys. She randomly chooses a student. What is the probability that she chooses a girl? **$\frac{6}{13}$**	**6. SURVEY** Ruben surveyed his class and found that 4 out of 22 students walk to school. If one of the 22 students is selected at random, what is the probability that the chosen student DOES NOT walk to school? **$\frac{9}{11}$**

NAME _____ DATE _____ PERIOD ____

9-8 Enrichment

Compound Events

The game of roulette is played by dropping a ball into a spinning, bowl-shaped wheel. When the wheel stops spinning, the ball will come to rest in any of 38 locations.



On a roulette wheel, the eighteen even numbers from 2 through 36 are colored red and the eighteen odd numbers from 1 through 35 are colored black. The numbers 0 and 00 are colored green.

To find the probability of two independent events, the results of two spins, find the probability of each event first.

$P(\text{red}) = \frac{18}{38}$ or $\frac{9}{19}$

$P(\text{black}) = \frac{18}{38}$ or $\frac{9}{19}$

Then multiply.

$P(\text{red, then black}) = \frac{9}{19} \times \frac{9}{19}$ or $\frac{81}{361}$

Find each probability.

1. black, then black
   $\frac{81}{361}$

2. prime number, then a composite number
   $\frac{66}{361}$

3. a number containing at least one 0, then a number containing at least one 2
   $\frac{65}{1,444}$

4. red, then black
   $\frac{81}{361}$

5. the numbers representing your age, month of birth, and then day of birth
   $\frac{1}{54,872}$

Answers

NAME _____ DATE _____ PERIOD ____

9-8 TI-73 Activity

Probability and Percents

When you solve probability problems, use your calculator to express fractions as decimals and percents.

Example 1 **Two number cubes are rolled. Find the probability that both cubes show an odd number. Report the probability as a percent.**

The probability of a cube showing an odd number is $\frac{1}{2}$. To find the probability that both first and second cubes are odd, multiply $\frac{1}{2}$ by $\frac{1}{2}$.

Keys:	Display:
1 $b\frac{c}{}$ 2 ▶ × 1 $b\frac{c}{}$ 2 ENTER	$\frac{1}{2}*\frac{1}{2}$ $\frac{1}{4}$
F↔D ENTER	$\frac{1}{4}$ F↔D .25
× 100 ENTER	Ans*100 25

The probability that both cubes show odd numbers is 25%.

Example 2 **There are 3 red marbles and 5 blue marbles in a bag. Two marbles are drawn and the first marble is replaced before the second is drawn. What is the probability of drawing 2 blue marbles? Report the probability as a percent.**

Keys:	Display:
5 $b\frac{c}{}$ 8 ▶ × 5 $b\frac{c}{}$ 8 ENTER	$\frac{5}{8}*\frac{5}{8}$ $\frac{25}{64}$
F↔D ENTER	$\frac{25}{64}$ F↔D 0.390625
× 100 ENTER	Ans*100 0.390625

The probability of drawing 2 blue marbles is 39.06%.

Find each probability. Report your answer as a percent. Round percents to the nearest hundredth when necessary.

1. You draw 2 marbles from a bag replacing the first marble before drawing the second. The bag contains 4 yellow marbles, 2 white marbles, and 6 red marbles.
   - **a.** What is the probability that your first marble is red and the second is yellow? **16.67%**
   - **b.** What is the probability that both marbles are white? **2.78%**
   - **c.** What is the probability that neither marble is red? **25%**
   - **d.** What is the probability that both marbles are red? **25%**
2. You have three number cubes.
   - **a.** What is the probability that you will roll all even numbers? **12.5%**
   - **b.** What is the probability that you will roll only numbers less than 3? **3.70%**
   - **c. CHALLENGE** What is the probability that you will roll a 1 on only one number cube? **34.72%**

Chapter 9 Assessment Answer Key

Quiz 1 (Lessons 9-1 and 9-2)
Page 61

1. $\frac{1}{2}$
2. $\frac{1}{2}$
3. $\frac{13}{16}$
4. See students' work. There are 24 arrangements.
5. C

Quiz 2 (Lessons 9-3 and 9-4)
Page 61

1. 24
2. 8
3. 756
4. 120
5. 40,320

Quiz 3 (Lessons 9-5 and 9-6)
Page 62

1. 126
2. 210
3. 84
4. 6
5. 30

Quiz 4 (Lessons 9-7 and 9-8)
Page 62

1. $\frac{1}{3}$
2. $\frac{2}{5}$
3. $\frac{1}{6}$; Sample answer: The theoretical probability is less than the experimental probability.
4. $\frac{5}{12}$
5. $\frac{1}{20}$

Mid-Chapter Test
Page 63

1. B
2. G
3. B
4. F
5. B
6. J
7. 4
8. 6
9. 30
10. 120
11. 8
12. 9
13. 140

Chapter 9 Assessment Answer Key

Vocabulary Test
Page 64

1. outcome
2. experimental probability
3. independent event
4. sample space
5. complementary event
6. permutation
7. probability
8. combination
9. disjoint events
10. compound event
11. Sample answer: If event *M* can occur in *m* ways and is followed by event *N* that can occur in *n* ways, then event *M* followed by *N* can occur in $m \times n$ ways.
12. Sample answer: The outcome of one event affects the outcome of a second event.

Form 1
Page 65

1. D
2. G
3. A
4. G
5. A
6. H
7. C
8. J
9. D
10. G
11. C
12. H

Page 66

13. C
14. J
15. C
16. F
17. B
18. F
19. D
20. F

B: $\frac{1}{35}$

Chapter 9 Assessment Answer Key

Form 2A

Page 67

1. D
2. G
3. A
4. H
5. B
6. J
7. B
8. F
9. A
10. G
11. D
12. H

Page 68

13. A
14. J
15. B
16. H
17. C
18. H
19. C
20. G

B: $\frac{1}{20}$

Form 2B

Page 69

1. D
2. H
3. C
4. H
5. B
6. J
7. C
8. F
9. B
10. J
11. A

Page 70

12. J
13. B
14. J
15. B
16. F
17. B
18. G
19. B
20. G

B: $\frac{1}{15}$

Chapter 9 Assessment Answer Key

Form 2C

Page 71

1. See students' work. There are 24 possibilities.

2. See students' work. There are 12 possible ornaments.

3. $\frac{1}{2}$

4. $\frac{1}{4}$

5. 1,512

6. 240

7. 144

8. permutation; 210

9. combination; 15

10. combination; 126

11. permutation; 720

Page 72

12. 136,080

13. 91

14. $\frac{3}{7}$

15. $\frac{4}{7}$

16. $\frac{5}{9}$

17. It is less than the experimental probability.

18. $\frac{1}{34}$

19. $\frac{1}{256}$

20. $\frac{4}{115}$

B: 3,276,000

Chapter 9 Assessment Answer Key

Form 2D

Page 73

1. See students' work. There are 24 arrangements.

2. See students' work. There are 6 possible orders.

3. $\frac{1}{2}$

4. $\frac{1}{4}$

5. 450

6. 12

7. 18

8. combination; 120

9. permutation; 56

10. permutation; 120

11. combination; 35

Page 74

12. 544,320

13. 165

14. $\frac{3}{5}$

15. $\frac{2}{5}$

16. $\frac{1}{3}$

17. It is less than the experimental probability.

18. $\frac{1}{14}$

19. $\frac{1}{12}$

20. $\frac{2}{11}$

B: 468,000

Chapter 9 Assessment Answer Key

Form 3

Page 75

1. See students' work. There are 6 possible arrangements.
2. See students' work. There are 8 possible song types.
3. $\frac{1}{2}$
4. $\frac{5}{8}$
5. 441
6. 480
7. 24
8. permutation; 720
9. combination; 70
10. combination; 35
11. permutation; 15,600

Page 76

12. 3,276,000
13. 220
14. $\frac{3}{5}$
15. $\frac{3}{5}$
16. $\frac{3}{8}$
17. It is less than the experimental probability.
18. $\frac{4}{25}$
19. $\frac{1}{114}$
20. $\frac{1}{5,525}$

B: 7,862,400

Chapter 9 Assessment Answer Key

Page 77, Extended-Response Test
Scoring Rubric

Level	Specific Criteria
4	The student demonstrates a **thorough understanding** of the mathematics concepts and/or procedures embodied in the task. The student has responded correctly to the task, used mathematically sound procedures, and provided clear and complete explanations and interpretations. The response may contain minor flaws that do not detract from the demonstration of a thorough understanding.
3	The student demonstrates an **understanding** of the mathematics concepts and/or procedures embodied in the task. The student's response to the task is essentially correct with the mathematical procedures used and the explanations and interpretations provided demonstrating an essential but less than thorough understanding. The response may contain minor errors that reflect inattentive execution of the mathematical procedures or indications of some misunderstanding of the underlying mathematics concepts and/or procedures.
2	The student has demonstrated only a **partial understanding** of the mathematics concepts and/or procedures embodied in the task. Although the student may have used the correct approach to obtaining a solution or may have provided a correct solution, the student's work lacks an essential understanding of the underlying mathematical concepts. The response contains errors related to misunderstanding important aspects of the task, misuse of mathematical procedures, or faulty interpretations of results.
1	The student has demonstrated a **very limited understanding** of the mathematics concepts and/or procedures embodied in the task. The student's response to the task is incomplete and exhibits many flaws. Although the student has addressed some of the conditions of the task, the student reached an inadequate conclusion and/or provided reasoning that was faulty or incomplete. The response exhibits many errors or may be incomplete.
0	The student has provided a **completely incorrect** solution or uninterpretable response, or no response at all.

Chapter 9 Assessment Answer Key

Page 77, Extended-Response Test
Sample Answers

In addition to the scoring rubric found on page A33, the following sample answers may be used as guidance in evaluating extended-response assessment items.

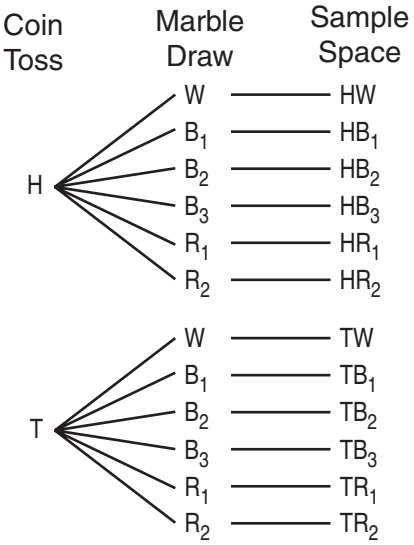
1. a. There are 4 possible outcomes having an equal chance of occurring.

$P(1) = \frac{1}{4}$ ← *number of ways to spin a* 1
← *number of possible outcomes*

b. Spin spinner B 100 times and tally the number of times you spin W.

$P(\text{W}) = \frac{n}{100}$ ← *number of times you spin W*

2. a.



b. If the outcome of one event does not influence the outcome of a second event, the events are called independent events.

c. To find the probability of tossing a head and drawing a red marble, write the number of ways to toss a head and draw a red marble (2) over the number of possible outcomes.
$P(\text{H, R}) = P(\text{H}) \cdot P(\text{R}) = \frac{1}{2} \cdot \frac{2}{6} = \frac{1}{6}$,
since they are independent events.

d. $P(\text{B, then B}) = \text{P(B)} \cdot P(\text{B after B})$
$= \frac{1}{2} \cdot \frac{2}{5} = \frac{1}{5}$
The probability of the first event is $\frac{1}{2}$ because $\frac{1}{2}$ of the marbles are blue.
The probability of the second event is $\frac{2}{5}$ because the blue marble drawn was not replaced. Two of the remaining five marbles are blue.

3. a. Each time Rayna chooses one of each type of relative is an event. The event of choosing a niece can occur in 8 ways, choosing a nephew can occur in 9 ways, and so on. So, Rayna could choose a possible
$8 \times 9 \times 6 \times 3 \times 5 = 6{,}480$ teams.

b. $8 \cdot 7 \cdot 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 = 40{,}320$;
The order of the arrangement of the nieces is important, so a permutation, is used.

c. $$\frac{31 \times 30 \times 29 \times 28 \times 27 \times 26 \times 25 \times 24 \times 23 \times 22}{10 \times 9 \times 8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1}$$

$= 44{,}352{,}165$

The order of their arrangement is not important, so a combination is used.

Chapter 9 Assessment Answer Key

Standardized Test Practice

Page 78

1. Ⓐ ● Ⓒ Ⓓ
2. Ⓕ Ⓖ Ⓗ ●
3. Ⓐ Ⓑ ● Ⓓ
4. Ⓕ Ⓖ ● Ⓙ
5. Ⓐ ● Ⓒ Ⓓ
6. ● Ⓖ Ⓗ Ⓙ
7. Ⓐ Ⓑ ● Ⓓ
8. Ⓕ Ⓖ Ⓗ ●
9. Ⓐ Ⓑ ● Ⓓ
10. Ⓕ ● Ⓗ Ⓙ
11. Ⓐ ● Ⓒ Ⓓ
12. Ⓕ Ⓖ Ⓗ ●

Page 79

13. ● Ⓑ Ⓒ Ⓓ
14. Ⓕ Ⓖ ● Ⓙ
15. Ⓐ ● Ⓒ Ⓓ
16. ● Ⓖ Ⓗ Ⓙ
17. Ⓐ ● Ⓒ Ⓓ
18. Ⓕ Ⓖ ● Ⓙ
19. Ⓐ ● Ⓒ Ⓓ

Chapter 9 Assessment Answer Key

Standardized Test Practice
Page 80

20. 20

21. $\frac{4}{25}$

22. $1\frac{3}{8}$

23. 13%

24. 1,716

25a. Order is important, so this is a permutation. There are 3 women, 3 men, and 2 children so the number of ways to arrange them is $(3!)(3!)(2!) = 72$.

25b. There are 8 people, so the number of arrangements is $8! = 40{,}320$.

Chapter 9 Assessment Answer Key

Unit 4 Test

Page 81

1. 16

2. 72 mph

3. Sample answer: Cluster 69–76; gaps 65–69, 76–78; no outliers

4. Sample answer: 110 mm

5. $8; $7; $5

6.

Stem	Leaf
2	5 9
3	5 8
4	0 3 5 7
5	0 6

3|2 = 32

7. 15

8. Sample answer: The vertical axis does not start at zero. Therefore, it exaggerates the number of televisions for the USA. It looks double that of Japan.

Page 82

9. $\frac{1}{4}$

10. $\frac{13}{51}$

11. $\frac{1}{6}$

12. $\frac{1}{3}$

13. $\frac{1}{2}$

14. $\frac{1}{6}$

15. $\frac{2}{3}$

16. See students' tree diagrams; 18 outcomes

17. 1,360

18. combination; 3,003

19. permutation; 39,916,800

20. independent; $\frac{1}{200}$