Chapter 7

Name_____

Chapter 7 Probability

Dear Family,

When you plan an outdoor event like a picnic, you cannot be certain that the weather will cooperate. Almost immediately, you begin to wonder—will it be warm or cool? sunny or cloudy? dry or rainy? There is no way to be certain, so you turn to the weather forecast to find out what is likely. When weather forecasters say there is a 60% chance of rain, do you ever wonder how they know? The weather report introduces you to the concept of probability.

The National Weather Service keeps track of daily conditions. They record the temperature, humidity, air pressure, and other data, including the weather produced by those conditions. The forecasters compare this historical data with current conditions and may see that out of 100 days with similar conditions, 60 of them were rainy days.

In probability, a *favorable outcome* is the result you are looking for, such as the number of rainy days. The ratio of the favorable outcome to the total number of outcomes is the probability.

$$\frac{\text{Number of favorable outcomes}}{\text{Total number of outcomes}} = \frac{\text{days with rain}}{\text{total days}} = \frac{60}{100} = 0.6 = 60\%$$

The next time you are relying on good weather, you may want to do your own research. You and your student can think about these topics:

- *The Farmer's Almanac* provides historical weather information, such as the number of times it rained on a given date. Use this information to determine the probability that it will rain on the date of your event.
- For some events, like a pool party or a picnic by the lake, you may want to get a sense of what the temperature will be. What is the probability that the temperature will be above 70 degrees the day of your event?
- What other conditions and probabilities do you want to know?

You might revise your plans if the conditions aren't favorable.

Pick a favorable day and then enjoy your picnic! Remember to watch for ants—they are almost certain to attend!

Probability (continued)

Lesson	Learning Target	Success Criteria
7.1 Probability	Understand how the probability of an event indicates its likelihood.	• I can identify possible outcomes of an experiment. • I can use probability and relative frequency to describe the likelihood of an event. • I can use relative frequency to make predictions.
7.2 Experimental and Theoretical Probability	Develop probability models using experimental and theoretical probability.	• I can explain the meanings of experimental probability and theoretical probability. • I can find experimental and theoretical probabilities. • I can use probability to make predictions.
7.3 Compound Events	Find sample spaces and probabilities of compound events.	• I can find the sample space of two or more events. • I can find the total number of possible outcomes of two or more events. • I can find probabilities of compound events.
7.4 Simulations	Design and use simulations to find probabilities of compound events.	• I can design a simulation to model a real-life situation. • I can recognize favorable outcomes in a simulation. • I can use simulations to find experimental probabilities.

Nombre _____

Capítulo 7 Probabilidad

Querida familia:

Cuando usted planifica un evento al aire libre como un picnic, no puede estar seguro si el clima cooperará. Casi inmediatamente, usted comienza a preguntarse —¿estará cálido o frío? ¿soleado o nublado? ¿seco o lluvioso? Como no tiene manera de estar seguro, por eso consulta la predicción del clima para saber que es probable. Cuando los meteorólogos dicen que hay 60% de probabilidades de lluvia, ¿se ha preguntado alguna vez cómo lo saben? Entender los reportes del clima es una introducción al concepto de la probabilidad.

El Servicio Meteorológico Nacional hace un seguimiento de las condiciones diarias. Ellos registran la temperatura, humedad, presión del aire y otros datos, incluyendo el clima producido por esas condiciones. Los meteorólogos comparan los datos históricos con las condiciones actuales y pueden ver que de cien días con condiciones similares, 60 de ellos fueron días de lluvia.

En Probabilidad se busca el resultado más favorable que suceda, como por ejemplo el número de días lluviosos. La relación entre el resultado favorable y el número total de resultados es la probabilidad.

$$\frac{\text{Números de resultados favorables}}{\text{Número total de total}} = \frac{\text{días con lluvia}}{\text{total de días}} = \frac{60}{100} = 0.6 = 60\%$$

La próxima vez que usted crea que va a ser un buen clima, podría querer asegurarse haciendo su propia investigación. Usted junto a su estudiante podrían pensar sobre estos temas:

- El Almanaque del Agricultor proporciona información meteorológica histórica, como el número de veces que llovió en un día específico. Use esta información para determinar la probabilidad que llueva en la fecha de su evento.
- Para algunos eventos, como una piscinada o un picnic en el lago, usted querrá saber la temperatura que habrá ¿Cuál es la probabilidad que la temperatura esté por encima de 70 grados el día de su evento?
- ¿Qué otras condiciones y probabilidades usted desea conocer?

Saber que las condiciones no serán favorables, lo ayudaría a cambiar su plan.

¡Escoja un día favorable y disfrute su picnic! Recuerde estar pendiente de las hormigas — ¡es casi seguro que ellas sí se presenten!

Capítulo 7 Probabilidad (continuación)

Lección	Objetivo de aprendizaje	Criterios de éxito
7.1 Probabilidad	Entender cómo la probabilidad de un evento indica su posibilidad ocurrencia.	• Sé identificar posibles resultados de un experimento. • Sé usar probabilidad y frecuencia relativa para describir la posibilidad de que ocurra un evento. • Sé usar frecuencia relativa para hacer predicciones.
7.2 Probabilidad experimental y teórica	Desarrollar modelos de probabilidad usando probabilidad experimental y teórica.	• Sé explicar el significado de la probabilidad experimental y la teórica. • Sé hallar probabilidades experimentales y teóricas. • Sé usar probabilidad para hacer predicciones.
7.3 Eventos compuestos	Hallar espacios muestrales y probabilidades de eventos compuestos.	• Sé hallar el espacio muestral de dos o más eventos. • Sé hallar el número total de resultados posibles de dos o más eventos. • Sé hallar probabilidades de eventos compuestos.
7.4 Simulaciones	Diseñar y usar simulaciones para hallar probabilidades de eventos compuestos.	• Sé diseñar una simulación para modelar una situación de la vida real. • Sé reconocer resultados favorables en una simulación. • Sé usar simulaciones para hallar probabilidades experimentales.

Lesson 7.1 Cumulative Practice

For use before Lesson 7.1

1. Factor $\frac{1}{8}$ out of $\frac{1}{8}x + \frac{7}{8}$.

2. Factor $\frac{1}{2}$ out of $\frac{1}{2}x + \frac{5}{2}$.

Lesson 7.1 Vocabulary Practice

For use before Lesson 7.1

1. Write what you know about this word.

Preview: experiment

Lesson 7.1 Prerequisite Skills Practice

For use before Lesson 7.1

Simplify the fraction.

1. $\frac{12}{50}$

2. $\frac{14}{28}$

3. $\frac{16}{20}$

4. $\frac{5}{25}$

5. $\frac{18}{30}$

6. $\frac{24}{42}$

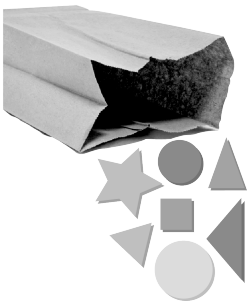
Name _____ Date _____

Lesson 7.1 Extra Practice

You randomly choose one of the tiles shown.

1. How many possible outcomes are there?
2. What are the favorable outcomes of choosing a number greater than 6?
3. In how many ways can choosing a number divisible by 2 occur?

You randomly choose one shape from the bag.
(a) Find the number of ways the event can occur.
(b) Find the favorable outcomes of the event.



4. Choosing a triangle
5. Choosing a star
6. Choosing *not* a square
7. Your friend finds the number of ways that choosing *not* a circle can occur. Is your friend correct? Explain your reasoning.

circle	***not* a circle**
circle	star, triangle, square

Choosing *not* a circle can occur in 3 ways.

Describe the likelihood of the event given its probability.

8. The probability that it will snow today is zero.
9. You make a free throw 70% of the time.
10. Your band marches in $\frac{1}{6}$ of the parades.
11. In a board game, you need to roll a 6 to place a token on the gameboard. The table shows the number of times you roll a 6 and the number of times you do *not* roll a 6. Describe the likelihood that you roll 6 on your next roll. Explain your reasoning.

6	𝍸 ||
***Not* a 6**	𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 |||

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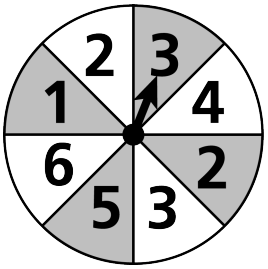
Lesson 7.1 Reteach

An **experiment** is an investigation or procedure that has varying results. The possible results of an experiment are called **outcomes**. A collection of one or more outcomes is an **event**. The outcomes of a specific event are called **favorable outcomes**.

EXAMPLE Identifying Outcomes



You spin the spinner.

a. How many possible outcomes are there?

The possible outcomes are spinning a 1, 2, 3, 4, 2, 3, 5, or 6.

So, there are eight possible outcomes.

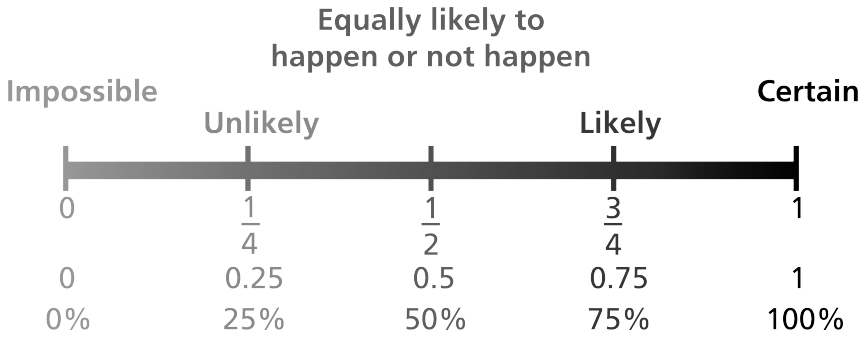
b. What are the favorable outcomes of spinning an odd number?

The favorable outcomes of spinning an odd number are 1, 3, 3, and 5.

c. In how many ways can spinning a number greater than 2 occur?

The possible outcomes of spinning a number greater than 2 are 3, 4, 3, 5, and 6. So, spinning a number greater than 2 can occur 5 ways.

The probability of an event is a number that represents the likelihood that the event will occur. Probabilities are between 0 and 1, including 0 and 1.



EXAMPLE Describing Likelihood

When you roll a number cube, there is a 17% chance you will roll a 1, a 50% chance you will roll an odd number, and an 83% chance you will roll a number less than 6. Describe the likelihood of each event.

Because 17% is between 0% and 25%, it is *unlikely* that you will roll a 1.

Because the probability is 50%, rolling an odd number is *equally likely to happen or not happen*.

Because 83% is between 75% and 100%, it is *likely* that you will roll an odd number.

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Lesson 7.1 Reteach (continued)

EXAMPLE Using Relative Frequencies

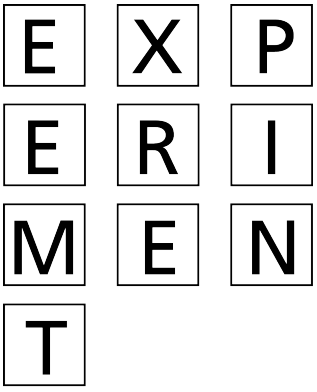
You toss a ball towards a basket and record the numbers of times it does and does not go in the basket. Describe the likelihood that the ball will go in the basket on your next toss.

In the basket	𝍸 ||
Not in the basket	|||

$$\text{relative frequency} = \frac{\text{number of times the event occurs}}{\text{total number of times you conduct the experiment}} = \frac{7}{10}$$

▶ The relative frequency is $\frac{7}{10}$, or 70%. So, it is likely that the ball will go in the basket on your next toss.

You randomly choose one of the tiles from a bag.



1. How many possible outcomes are there?
2. What are the favorable outcomes of choosing a vowel?
3. In how many ways can choosing a consonant occur?
4. What are the favorable outcomes of *not* choosing an E?

Describe the likelihood of the event given its probability.

5. The probability that you will have homework today is 100%.
6. The probability that the next car to enter a parking lot is an SUV is $\frac{1}{2}$.
7. The probability that it will rain tomorrow is 30%.
8. You toss a beanbag toward a target and record the numbers of times the beanbag hits and misses the target. Describe the likelihood of each event.

Hit the Target	𝍸 ||||
Miss the Target	𝍸 𝍸

   a. You hit the target on your next toss.

   b. You miss the target on your next toss.

9. A bag contains only red balls and yellow balls. You randomly draw a ball from the bag and replace it. The table shows the results of repeating this experiment. Describe the likelihood of each event.

Red	𝍸 ||
Yellow	𝍸 𝍸 𝍸 |||

   a. The next ball you draw is red.

   b. The next ball you draw is yellow.

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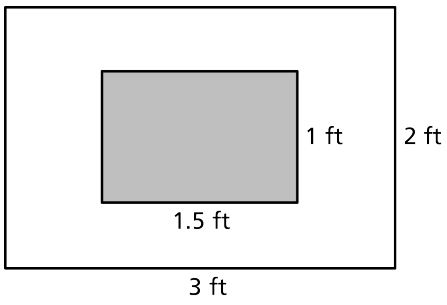
Lesson 7.1 Enrichment and Extension

Geometric Probability

Assume that a dart thrown at the target is equally likely to hit anywhere on the target. The probability *P* that the dart lands in the shaded region is $P = \frac{\text{area of shaded region}}{\text{total area of target}}$. Find the probability that the dart lands in the shaded region.

1.



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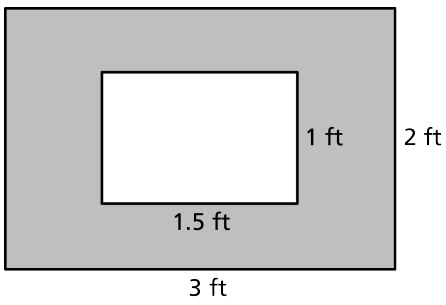

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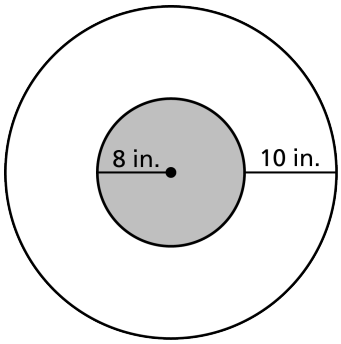

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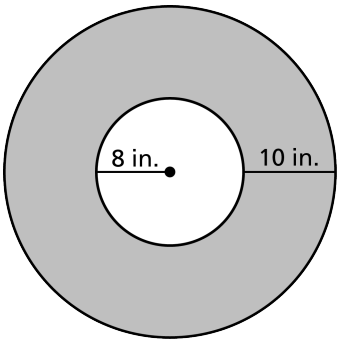

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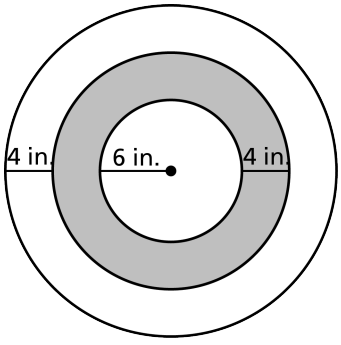

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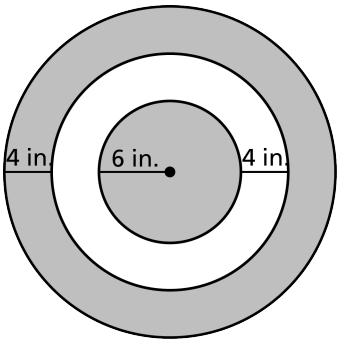

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7.1 Puzzle Time

Did You Hear About The…

A	B	C	D	E	F
G	H	I	J	K	L
M	N				

Complete each exercise. Find the answer in the answer column. Write the word under the answer in the box containing the exercise letter.

Describe the likelihood of the event given its probability.

A. You take the bus home from school $\frac{1}{4}$ of the time.

B. The probability your favorite show is on tonight is 0.

C. 50% of the time you flip a coin you flip tails.

D. Your team wins the swim meets $\frac{4}{5}$ of the time.

E. The probability that the cafeteria will have milk is 1.

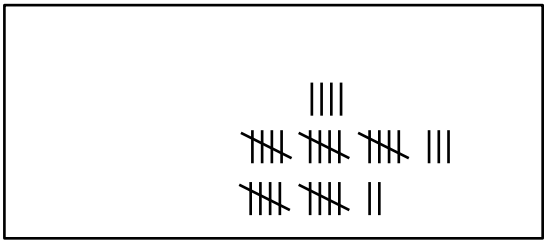
You listen to 60 randomly selected songs on an MP3 player and record the type of each song played. Find the relative frequency of songs played that are of each given type.

F. rock

G. rap

H. dance

I. country



J. other than rock

K. dance or rap

L. rock or country

M. other than country

N. rock, pop, dance, or country

$\frac{3}{4}$ SHE	$\frac{1}{100}$ WHERE
Likely WENT	$\frac{1}{5}$ SO
$\frac{1}{4}$ BYTE	Impossible STAR
$\frac{3}{20}$ COMPUTER	1 GIG
$\frac{11}{20}$ GET	Certain TO
0 BECAUSE	$\frac{3}{10}$ STORE
Unlikely ROCK	$\frac{9}{20}$ COULD
$\frac{13}{20}$ HE	$\frac{9}{10}$ MUSIC
$\frac{1}{20}$ HOW	Equally Likely to Happen or Not Happen WHO
$\frac{7}{20}$ THE	$\frac{4}{5}$ A

Lesson 7.2 Cumulative Practice

For use before Lesson 7.2

Graph the solution of the inequality.

1. $x - 5 < 2$

2. $x - 5 \leq 3$

Lesson 7.2 Vocabulary Practice

For use before Lesson 7.2

1. Write what you know about this word.

Preview: probability

Lesson 7.2 Prerequisite Skills Practice

For use before Lesson 7.2

A number cube is rolled. Find the number of ways the event can occur.

1. rolling a 5

2. rolling an even number

3. rolling a 3 or 4

4. rolling a 6

5. rolling a 1, 5, or 6

6. rolling an odd number

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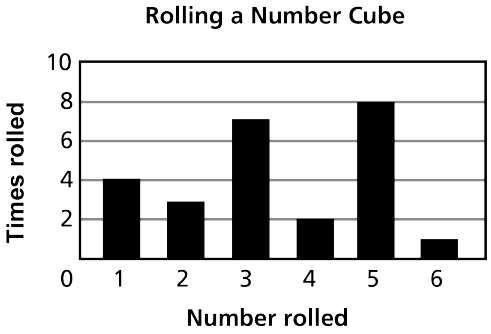
Lesson 7.2 Extra Practice

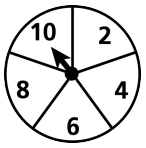
Use the bar graph to find the experimental probably of the event.



1. rolling a number greater than 4
2. rolling a 1 or a 4
3. *not* rolling a 5
4. Your friend uses the bar graph to find the experimental probability of rolling a 3. Is your friend correct? Explain your reasoning.

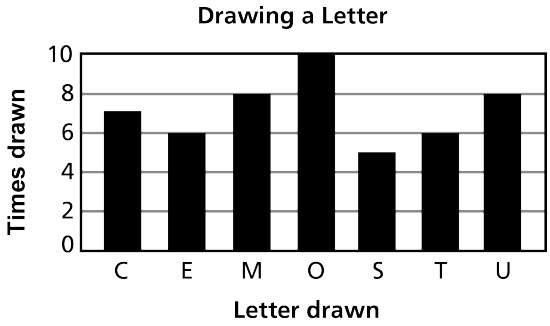
> There is 1 favorable outcome and 6 possible outcomes. So, the experimental probability of rolling a 3 is $\frac{1}{6}$.

Use the spinner to find the theoretical probability of the event.



5. spinning a number greater than 5
6. spinning a factor of 6
7. spinning an odd number

A bag contains the letters shown. You randomly draw a tile, record it, and then return it to the bag. The bar graph shows the results of drawing a letter 50 times. Compare the theoretical and experimental probabilities of the event.



8. drawing an S
9. drawing a vowel
10. Should you use *theoretical* or *experimental* probability to predict the number of times you will draw an M in 2,000 draws? Explain.
11. In a class, 5 students own smartphones and 11 students do not.
    - **a.** What is the theoretical probability that a randomly chosen student owns a smartphone?
    - **b.** Out of 144 students, how many do you expect to own a smartphone?

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Lesson 7.2 Reteach

Probability that is based on repeated trials of an experiment is called **experimental probability**.

$$P(\text{event}) = \frac{\text{number of times the event occurs}}{\text{total number of trials}}$$

EXAMPLE Finding an Experimental Probability

The table shows the results of spinning a spinner 50 times. What is the experimental probability of landing on an odd number?

Numbers Landed On	1	2	3	4
Frequency	13	8	17	12

The table shows that the number 1 was spun 13 times and the number 3 was spun 17 times. So, an odd number was spun 13 + 17 = 30 times in a total of 50 spins.

$$P(\text{event}) = \frac{\text{number of times the event occurs}}{\text{total number of trials}}$$

$P(\text{odd}) = \frac{30}{50}$ ← An odd number was spun 30 times. ← There was a total of 50 spins.

$= \frac{3}{5}$

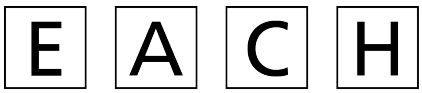
▶ The experimental probability of spinning an odd number is $\frac{3}{5}$, 0.6, or 60%.

When all possible outcomes are equally likely, the **theoretical probability** of an event is the quotient of the number of favorable outcomes and the number of possible outcomes.

$$P(\text{event}) = \frac{\text{number of favorable outcomes}}{\text{number of possible outcomes}}$$

EXAMPLE Finding a Theoretical Probability

You randomly choose one of the letters shown. What is the theoretical probability of choosing a vowel?



$$P(\text{event}) = \frac{\text{number of favorable outcomes}}{\text{number of possible outcomes}}$$

$P(\text{vowel}) = \frac{2}{4}$ ← There are 2 vowels. There is a total of 4 letters.

$= \frac{1}{2}$

▶ The theoretical probability of choosing a vowel is $\frac{1}{2}$, 0.5, or 50%.

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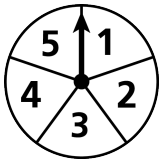
Lesson 7.2 Reteach (continued)

EXAMPLE Comparing Probabilities

The table shows the results of spinning the spinner 100 times. How does the experimental probability of spinning a 5 compare with the theoretical probability?



Number Landed On	1	2	3	4	5
Frequency	17	19	21	18	25

Step 1: Find the experimental probability of spinning a 5.

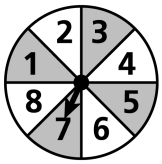
$$P(5) = \frac{\text{number of times 5 was spun}}{\text{total number of spins}} = \frac{25}{100} = \frac{1}{4}, \text{ or } 25\%$$

Step 2: Find the theoretical probability of spinning a 5.

$$P(5) = \frac{\text{number of favorable outcomes}}{\text{number of possible outcomes}} = \frac{1}{5}, \text{ or } 20\%$$

▶ The experimental probability of spinning a 5 is 25%, which is close to the theoretical probability of 20%.

The table shows the results of spinning the spinner 25 times. Compare the theoretical and experimental probabilities of the event.



Number Landed On	1	2	3	4	5	6	7	8
Frequency	2	5	5	3	1	5	2	2

1. spinning a 7

2. spinning a 3 or a 6

3. spinning a number less than 5

4. *not* spinning a 2

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Lesson 7.2 Enrichment and Extension

What's the Difference?

Many card games involve making choices based on how likely it is to choose a certain card. By performing an experiment with a regular deck of cards, you will be finding the probability of certain outcomes when cards are chosen at random. A deck of cards has 4 suits. Each suit has 13 cards: a Jack, Queen, King, Ace, and the numbers 2 through 10. For this experiment, the Ace is worth 1, the Jack is worth 11, the Queen is worth 12, and the King is worth 13.

Experiment Directions: Put all of the cards face down and spread them out. Choose two cards at random. Find the absolute value of the difference between the values of the cards. Replace the two cards. Mix the cards and repeat.

Answer Exercises 1 and 2 *before* performing the experiment.

1. Make a list of all the possible outcomes and design a frequency table to record your results.
2. Make some predictions. Will all the outcomes be equally likely? If not, what outcomes will be most likely? least likely? Explain your reasoning.
3. Perform the experiment at least 60 times. Record the results in your frequency table from Exercise 1.
4. Make a bar graph of your results. Compare your results with your classmates. Were they similar? Explain.
5. Describe any patterns you notice. Did they fit your predictions? What outcomes are most likely? least likely? Explain.
6. Explain why it would be difficult to find theoretical probability for this situation.
7. What is the advantage to doing a large number of trials? Explain why doing more trials is especially important for this experiment.
8. You want to change the experiment. Instead of taking the absolute value of the difference, this time you will take the value of the first card minus the value of the second card. How would this change your results? Explain.
9. A friend asks you to play the following game. Two cards are chosen at random. If the absolute value of the difference is between 1 and 6, Player 1 gets a point. If the absolute value of the difference is between 7 and 12, Player 2 gets a point. If the difference is zero, both players get a point. Replace the cards, shuffle, and repeat. The first person to get 10 points wins. Explain why this game is not fair. Rewrite the rules to make the game more fair.

Name _____ Date _____

7.2 Puzzle Time

Who Kept Tom Sawyer Cool In The Summertime?

Write the letter of each answer in the box containing the exercise number.

You randomly pick a nut from a can of mixed nuts 20 times and record the results: 5 almonds, 6 peanuts, 2 hazelnuts, 3 pecans, and 4 cashews. Find the experimental probability of the event.

1. choosing an almond

2. choosing a peanut

3. choosing a peanut or cashew

4. choosing *not* an almond

5. choosing *not* a peanut

6. choosing a walnut

You pour 50 nuts into a bowl. Use the results from the example above to make the following predictions.

7. How many peanuts would you expect to be in the bowl?

8. How many almonds and pecans would you expect to be in the bowl?

9. How many nuts that are *not* a peanut would you expect to be in the bowl?

Answers

C. $\frac{3}{4}$	**E.** 0
B. $\frac{1}{3}$	**A.** 2
U. 15	**Y.** 20
E. $\frac{1}{4}$	**R.** $\frac{1}{6}$
K. $\frac{1}{12}$	**H.** 35
L. $\frac{3}{10}$	**F.** $\frac{5}{6}$
R. $\frac{1}{2}$	**N.** $\frac{7}{10}$

You and your friends decide to play hide-and-seek. In a plastic container, there are 2 blue flashlights, 4 green flashlights, 1 red flashlight, 3 white flashlights, and 2 black flashlights. Find the theoretical probability of the event.

10. choosing a green flashlight

11. choosing a black flashlight

12. choosing a red flashlight

13. choosing a flashlight that is *not* blue

14. The theoretical probability of choosing a green marble is $\frac{1}{3}$. If there are 6 marbles in the bag, how many marbles would you expect to be green?

9	7	4	12	2	6	10	1	11	3	8		13	14	5

Lesson 7.3 Cumulative Practice

For use before Lesson 7.3

Find the unit rate.

1. A person jogs $\frac{1}{2}$ mile in $\frac{1}{12}$ hour.

2. A person runs $\frac{1}{5}$ mile in $\frac{1}{40}$ hour.

Lesson 7.3 Vocabulary Practice

For use before Lesson 7.3

1. Write what you know about this phrase.

Preview: compound event

Lesson 7.3 Prerequisite Skills Practice

For use before Lesson 7.3

Multiply.

1. $3 \times 4 \times 5$

2. $7 \times 3 \times 6$

3. $5 \times 5 \times 4$

4. $9 \times 10 \times 12$

5. $15 \times 10 \times 9$

6. $7 \times 6 \times 12$

Name _____ Date _____

Lesson 7.3 Extra Practice

Use a tree diagram to find the sample space and the total number of possible outcomes.

1.

Pet	
Animal	Hamster, Guinea pig, Snake
Name	Lucky, Shadow, Smokey, Max

2.

Ice Cream	
Cone	Waffle, Sugar
Flavor	Chocolate, Vanilla, Strawberry

Use the Fundamental Counting Principle to find the total number of possible outcomes.

3.

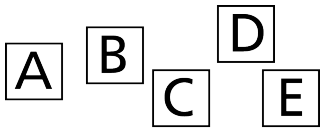
Pizza	
Size	Small, Medium, Large
Crust	Thin, Thick, Regular

4.

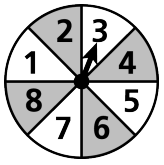
Car	
Transmission	Automatic, Manual
Doors	2-door, 4-door
Color	Red, Blue, Black, White

5. A test has three true-false questions. Find the total number of ways you can answer the three questions.

6. You randomly choose one of the letter tiles. Without replacing the first letter, you choose a second letter. Find the total number of possible outcomes.



You spin the spinner and flip a coin. Find the probability of the compound event.



7. spinning a 3 and flipping heads

8. spinning an odd number and flipping tails

9. spinning a number greater than 5 and flipping heads

10. *not* spinning a 2 and flipping tails

Name _____ Date _____

Lesson 7.3 Reteach

A **sample space** is the set of all possible outcomes of one or more events.

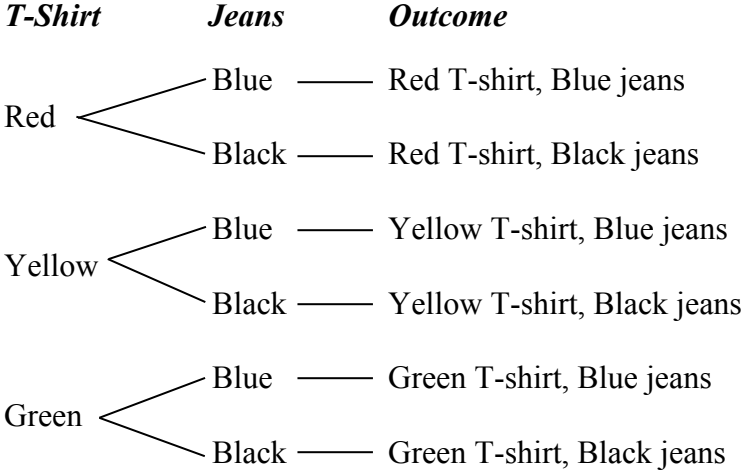
EXAMPLE Finding a Sample Space

You randomly choose a T-shirt and a pair of jeans. Find the sample space. How many different outfits are possible?

T-Shirt
- Red
- Yellow
- Green

Jeans
- Blue
- Black

Use a tree diagram to find the sample space.



▶ There are 6 different outcomes in the sample space. So, there are 6 different outfits possible.

You can use the sample space or the **Fundamental Counting Principle** to find the total number of possible outcomes of two or more events.

Fundamental Counting Principle

An event M has m possible outcomes. An event N has n possible outcomes. The total number of outcomes of event M followed by event N is $m \times n$.

Name _____ Date _____

Lesson 7.3 Reteach (continued)

EXAMPLE Finding the Total Number of Possible Outcomes

How many different options are there for ordering a T-shirt? Use the fundamental counting principle. Identify the number of possible outcomes for each event.

T-Shirt Options	
Size	Small, Medium, Large
Color	White, Blue, Yellow, Green
Sleeve Type	Long sleeves, Short sleeves

Event 1: Choosing a size has 3 possible outcomes.
Event 2: Choosing a color has 4 possible outcomes.
Event 3: Choosing a sleeve type has 2 possible outcomes.

$3 \times 4 \times 2 = 24$ Fundamental Counting Principle

▶ So, there are 24 different options.

1. Use a tree diagram to find the sample space and the total number of possible outcomes.

Activities	
Outdoor	Dodgeball, Four square, Soccer, Basketball
Indoor	Art, Band, Coding

Use the Fundamental Counting Principle to find the total number of possible outcomes.

2.

Bicycle	
Speed	5-speed, 10-speed
Color	While, Black, Yellow, Red

3.

Sandwich	
Bread	Whole wheat, Rye, Four grain
Meat	Turkey, Roast beef, Ham
Cheese	Swiss, Provolone, American

4.

Phone	
Screen Size	4 inches, 5 inches, 6 inches, 7 inches
Color	Silver, White, Black
Case	Light, Medium, Heavy

Name _____ Date _____

Lesson 7.3 Enrichment and Extension

Sandwich Shop

A local sandwich shop is running a sandwich special for lunch. A customer can build his or her own sandwich using the choices in the table. The customer selects one item from each category.

Use the menu board to answer the questions.

1. How many different sandwiches can you make from the choices on the menu board?
2. The sandwich shop has several customers that are vegetarians. In place of the fillings listed on the menu, the sandwich shop uses a vegetable spread on these orders. How many different vegetarian sandwiches can you make from the choices on the menu board?
3. Customers at the sandwich shop have the option of making their sandwiches into combo platters by adding their choice of chips, pretzels, or an apple.
   a. How will the addition of the side choices change the total number of combinations calculated in Exercise 1?
   b. How many combo platters are possible using the choices on the menu board?
4. A customer orders a ham sandwich on wheat bread. Draw a tree diagram that illustrates the possible sandwiches that could result from the order.
5. What is the probability of a customer ordering a ham sandwich on wheat bread with ketchup and no cheese?

Name _____ Date _____

7.3 Puzzle Time

What Animal Goes "Baa-Baa-Woof?"

Write the letter of each answer in the box containing the exercise number.

Answers

P. $\frac{5}{33}$

E. $\frac{1}{504}$

D. $\frac{1}{225}$

E. $\frac{1}{6}$

G. $\frac{7}{44}$

A. $\frac{5}{12}$

H. $\frac{35}{132}$

S. $\frac{1}{189}$

O. $\frac{1}{225}$

You roll a number cube once and flip a coin. Find the probability of the compound event.

1. rolling a factor of 12 and flipping tails
2. rolling a perfect square and flipping heads

You have a bag that contains 7 red marbles and 5 blue marbles. You randomly choose one of the marbles. Without replacing the first marble, you choose a second marble. Find the probability of the compound event.

3. choosing a red marble and then a blue marble
4. choosing a blue marble and then another blue marble
5. Without replacing the first and second marble, you choose a blue marble, a red marble, and then another red marble.

You are playing a treasure hunt card game that includes 8 treasure chests, 7 pirates, and 9 islands. Each player is dealt 5 cards. Before seeing any of the cards, you randomly make a guess as to which treasure chest is hidden, which pirate buried the treasure, and on which island the treasure is buried.

6. What is the probability that you got all three correct before looking at your cards?
7. You look at your cards and are able to eliminate 2 of the treasure chests, 1 of the pirates, and 2 of the islands. Now you try to guess the correct treasure chest, pirate, and island. What is the probability that you get all three correct?
8. One of your opponents looks at her cards and is able to eliminate 3 treasure chests and 2 pirates, but none of the islands. She tries to guess the correct treasure chest, pirate, and island. What is the probability that she gets all three correct?
9. Another of your opponents looks at his cards and is able to eliminate 5 treasure chests, but no pirates and no islands. He tries to guess the correct treasure chest, pirate, and island. What is the probability that he gets all three correct?

1		9	3	6	2	4	8	7	5

Lesson 7.4 Cumulative Practice

For use before Lesson 7.4

Graph the solution of the inequality.

1. $\frac{10}{3}x < 10$

2. $\frac{5}{2}x \geq 5$

Lesson 7.4 Vocabulary Practice

For use before Lesson 7.4

1. Write what you know about this word.

Preview: simulation

Lesson 7.4 Prerequisite Skills Practice

For use before Lesson 7.4

Write the fraction as a percent.

1. $\frac{3}{4}$

2. $\frac{17}{20}$

3. $\frac{1}{2}$

4. $\frac{33}{50}$

5. $\frac{21}{25}$

6. $\frac{7}{10}$

Name _____ Date _____

Lesson 7.4 Extra Practice

Design and use a simulation to find the experimental probability.

1. You and your friend enjoy playing chess. You are equally matched players, so each time you play together, there is a 50% chance that you will win. What is the experimental probability that you will win exactly 3 of the next 4 games?

2. There is a 40% chance that it will rain tomorrow morning and a 30% chance that it will snow tomorrow evening. What is the experimental probability that it will rain and snow tomorrow?

3. Two beakers are used in a lab test. What is the experimental probability that there are reactions in both beakers during the lab test?

Probability of Reaction	
Beaker 1	60%
Beaker 2	40%

4. At a pizza shop, 60% of customers order a thin crust pizza and 50% of customers order a pepperoni pizza. What is the probability that a customer orders a thin crust pizza with pepperoni?

Design and use a simulation with number cubes to estimate the probability.

5. One out of every six visitors to an electronics store leaves without buying anything. Estimate the probability that exactly 1 of the next 3 visitors do not buy anything.

6. A bag contains 6 marbles. Three of these marbles are red. Each time you draw a marble out of the bag at random, you replace it. You do this 4 times. Estimate the probability that at least 2 of the marbles are red.

Name _____ Date _____

Lesson 7.4 Reteach

A **simulation** is an experiment that is designed to reproduce the conditions of a situation or process. Simulations allow you to study situations that are impractical to create in real life.

EXAMPLE Simulating Outcomes That Are Equally Likely

A bowler has five frames left to bowl. He makes a spare 50% of the time.

a. Design a simulation involving 20 trials that you can use to model the next five frames.

The bowler makes a spare 50% of the time. So, he is equally likely to make a spare or *not* make a spare. Choose an experiment that has two equally likely outcomes for each event, such as flipping five coins. Let heads (H) represent making a spare and tails (T) represent *not* making a spare.

b. Use your simulation to find the experimental probability that the bowler will make a spare in exactly three of the next five frames.

To find the experimental probability, perform 20 trials of the simulation. The table shows the results. Find the number of outcomes that represent making exactly 3 spares (3 heads).

HHHHH	THHTH	HHTHT	TTTHH	HTTTT	THHHT	THHTT	HHTTH	HHHHT	THTHT
HHTHH	TTTHH	TTTTH	THTHT	THTHT	HTHHH	HTHTT	THTTH	HHHTT	THHTH

Exactly 3 heads occurred 6 times.

$$P(\text{exactly 3 spares}) = \frac{6}{20} = \frac{3}{10}$$

There is a total of 20 trials.

▶ The experimental probability is $\frac{3}{10}$, 0.3, or 30%.

Name _____ Date _____

Lesson 7.4 Reteach (continued)

EXAMPLE Simulating Outcomes That Are Not Equally Likely

Your friend has an 80% chance of having math homework and a 30% chance of having science homework today. Design and use a simulation involving 25 randomly generated numbers to estimate the experimental probability that your friend will have math and science homework today.

Use a simulation with randomly generated numbers from 0 to 99. There are 10 different digits. 80% of 10 is 8, so let 8 digits (1 to 8) in the tens place represent having math homework. 30% of 10 is 3, so let 3 digits (1 to 3) in the ones place represent having science homework.

Use the random number generator on a graphing calculator to generate the numbers. The table shows the results. Find the number of outcomes that represent having math and science homework.

83	16	72	94	16
29	73	40	45	86
80	66	43	60	21
55	94	52	22	99
56	70	49	53	87

P(math and science homework) $= \frac{8}{25}$

8 numbers meet the criteria.

There is a total of 25 trials.

▶ The experimental probability is $\frac{8}{25}$, 0.32, or 32%.

1. In one round of a video game, your friend scores more than 1000 points 50% of the time. Design and use a simulation to find the experimental probability of your friend scoring more than 1000 points in exactly two of the next four rounds.

2. The probability that a student walking into your school is in seventh grade is 20%. The probability that a student walking into your school is a girl is 60%. Design and use a simulation involving 50 randomly generated numbers to estimate the experimental probability that the next student to walk into your school is a seventh-grade girl.

Name _____ Date _____

Lesson 7.4 Enrichment and Extension

Sandwich Shop

Suppose you are the manager of a souvenir stand at an amusement park. On Saturday, you sell 200 shirts. You record the information about the shirts you sold in the table.

Style	Color	Size
T-shirt: 160 Sweatshirt: 40	White: 40 Pink: 40 Grey: 120	Small: 20 Medium: 20 Large: 60 Extra large: 100

1. Draw a tree diagram to represent the different possible shirts.

2. Based on Saturday's sales, find the experimental probability of a customer buying each shirt.

a. T-shirt **b.** sweatshirt **c.** white shirt

d. pink shirt **e.** gray shirt **f.** small shirt

g. medium shirt **h.** large shirt **i.** extra large shirt

3. Use the experimental probabilities in Exercise 2 to design a simulation that you can use to model the style, color, and size of shirt a customer buys.

4. Perform 100 trials of your simulation in Exercise 3. Use your results to estimate the experimental probability that a customer buys a small, pink T-shirt.

5. You need to order more shirts to sell at your souvenir stand. How can the results of your simulation help you decide which shirts you should order?

Name _____ Date _____

7.4 Puzzle Time

What Is An Ant Dictator?

Write the letter of each answer in the box containing the exercise number.

Your friend makes a free throw 50% of the time. Your friend attempts four free throws. You design and perform a simulation that involves tossing four coins. Heads (H) represents making the free throw, and tails (T) represents *not* making the free throw.

Which outcome does *not* represent a favorable outcome?

1. making at least two free throws

A. TTTH **B.** HTHT **C.** TTHH **D.** HHTH

2. making exactly two free throws

A. HHHT **B.** THTH **C.** THHT **D.** TTHH

3. making at least two free throws in a row

L. HHTT **M.** HHHT **N.** HTHT **O.** TTHH

A meteorologist predicts that there is a 60% chance of rain each day for the next three days. You design and perform a simulation that involves randomly generating numbers from 0 to 999. The digits 1 through 6 represent rain.

Which outcome does *not* represent a favorable outcome?

4. exactly one day with rain

O. 968 **P.** 727 **Q.** 579 **R.** 111

5. exactly three days with rain

T. 789 **U.** 456 **V.** 333 **W.** 123

6. rain on the first and last days only

W. 101 **X.** 374 **Y.** 456 **Z.** 595

7. exactly three days with no rain

S. 000 **T.** 678 **U.** 789 **V.** 888

2		7	6	4	1	3	5