# Data Analysis and Probability

## **Unit Overview**

In this unit you will carry out several probability experiments as you learn how to find and compare theoretical and experimental probabilities. You will explore various ways to analyze data and display results as you participate in surveys that involve you and your classmates.

## **Academic Vocabulary**

As you study this unit, add these terms to your vocabulary notebook.

- outcome
- population
- probability
- sample
- survey
- variable

# **Essential Questions**

Unit

How does understanding probability help you make decisions?

Why is it important for you to understand how data is organized and presented in real-world situations?

#### EMBEDDED ASSESSMENTS

These assessments, following activities 6.2 and 6.5, will give you an opportunity to demonstrate your ability to find the sample space, probability, and complement of events; to make various graphs; and to write survey questions.

#### Embedded Assessment 1

Probability p. 351

#### Embedded Assessment 2

Data Display and Summary Statistics p. 383

# UNIT 6 Getting Ready

Write your answers on notebook paper. Show your work.

- **1.** Write *certain*, *likely*, or *impossible* for each event. Explain your reasoning.
  - **a.** The last day of school this year will be a snow day.
  - **b.** The end of every activity in this unit has a set of *Check Your Understanding* problems.
  - **c.** This week will have at least one sunny day.
- **2.** What fraction is represented by the shaded part of each whole?



a.

c.





**3.** Write each fraction in simplest form.

**a.** 
$$\frac{16}{48}$$
 **b.**  $\frac{9}{75}$  **c.**  $\frac{7}{10}$  **d.**  $\frac{26}{91}$ 

**4.** Use a protractor to draw an angle for each angle measure.

**a.** 90° **b.** 45° **c.** 135° **d.** 150°

**5.** Write each fraction as a percent.

**a.** 
$$\frac{4}{8}$$
 **b.**  $\frac{9}{16}$  **c.**  $\frac{6}{5}$ 

6. Solve each proportion.

**a.** 
$$\frac{3}{4} = \frac{c}{16}$$
  
**b.**  $\frac{d}{5} = \frac{14}{35}$   
**c.**  $\frac{6}{a} = \frac{36}{54}$   
**d.**  $\frac{9}{7} = \frac{27}{b}$ 

- 7. Find the percent of each number.
  a. 25% of 600
  b. 150% of 84
  - **c.** 36% of 150 **d.** 42% of 24
- **8.** Which of the following names four kinds of graphs?
  - **a.** bar, block, line, and circle
  - **b.** bar, picture, line, and circle
  - **c.** picture, dot-to-dot, line, and bar
  - **d.** picture, block, circle, and line

# Theoretical and Experimental Probability Toss Up!

SUGGESTED LEARNING STRATEGIES: Guess and Check, Predict and Confirm, Interactive Word Wall, Think/Pair/Share

With **probability** you use mathematics to measure how likely it is for a possible event to occur. Tossing a coin provides a simple beginning for the concept of probability.

- **1.** Using a coin, first guess whether it will land on heads or tails before you toss it. Then toss the coin.
  - **a.** Was your guess correct?
  - **b.** If you guessed the **outcome** correctly, some people would call your guess lucky. Why would they call it lucky?
- **2.** Toss your coin five more times, guessing the outcome each time before you toss it.
  - **a.** Is the outcome of a coin toss a certain event or an uncertain event?
  - **b.** Describe what is meant by an uncertain event.
- **3.** Answer the following questions about tossing a coin.
  - **a.** List all of the *outcomes* that are possible when a coin is tossed.
  - **b.** Of the outcomes listed in Part a, does one outcome have an advantage of occurring over the other? Explain your reasoning.
  - **c.** Based on your answer to Part b, is it correct to say that the outcomes are *equally likely* on a toss of a coin? Why or why not?

## My Notes

ACTIVITY

6.1

#### ACADEMIC VOCABULARY

**Probability** is the measurement of the likelihood that an event will occur. An example is a 40 percent chance that a basketball player will make the next free-throw shot. This probability could also be represented as a fraction  $\left(\frac{2}{5}\right)$  or as a decimal (0.4).

An **outcome** is the result of a probability experiment. When rolling a number cube, the outcomes are the numbers 1, 2, 3, 4, 5, 6.

#### MATH TERMS

The **sample space** of a probability experiment is all possible outcomes of the experiment. For example, the sample space for a coin toss is: heads, tails.

An **event** is any outcome or group of outcomes from a probability experiment. For example, an event for the experiment of rolling a number cube is: rolling a prime number.

# Theoretical and Experimental Probability

continued

**Toss Up!** 

## My Notes

### MATH TERMS

The **theoretical probability** of an event is the ratio of the number of outcomes in which the event can occur to the total number of outcomes in the experiment. SUGGESTED LEARNING STRATEGIES: Interactive Word Wall, Debriefing, Quickwrite

- **4.** The probability that a coin will land on heads will be represented by P(heads) or P(H). P(heads) is defined as a *ratio* of the number of ways to get heads to the total number of different outcomes that can occur on a coin toss.
  - **a.** How many sides of a coin are heads?
  - **b.** How many total outcomes can occur when you toss a coin?
  - **c.** You can write a fraction to show this probability.

 $P(H) = \frac{\text{the number of ways to get heads}}{\text{total number of possible outcomes on a toss}} =$ 

- **5.** This probability that a coin will land on heads is an example of a **theoretical probability**.
  - **a.** Write this probability as a decimal and as a percent.
  - **b.** Explain how each of these numbers measures the likelihood of heads occurring on a coin toss.
    - fraction
    - decimal
    - percent
  - **c.** *P*(tails) is the ratio that measures the likelihood of tails occurring when a coin is tossed. Find *P*(tails).
  - **d.** What do *P*(heads) and *P*(tails) indicate about the outcomes of heads and tails? Explain your reasoning.
  - **e.** Find the sum of *P*(H) and *P*(T). Explain how this sum makes sense in this situation.

Now you and a partner will conduct an experiment to test probability as a measure for predicting the outcomes of heads and tails when a coin is tossed. A single toss of the coin is an example of a **trial** for this experiment. SUGGESTED LEARNING STRATEGIES: Interactive Word Wall, Think/Pair/Share, Guess and Check, Look for a Pattern, Use Manipulatives, Debriefing

- **6.** You and your partner should each conduct 50 trials of the experiment.
  - **a.** Before you conduct your experiment, predict how many heads and how many tails will occur in 100 trials.
  - **b.** Now conduct the experiment. Use tally marks to record the results in this table. Then record your totals and the combined totals for you and your partner.

Outcomes	Heads	Tails
Tallies		
Your totals		
Partner Pair Totals		

- c. How do your results compare to your predictions?
- d. How do your results compare to your partner's results?

The **experimental probability** of a coin landing on heads is the ratio of the number of times heads actually occurs as an outcome to the total number of trials in a specific experiment.

**7.** Experimental P(H) =

You can look at your results in several ways.

- Your 50 trials of tossing a coin and recording the outcomes can be your first observation.
- Your partner's experiment of 50 trials can be your second observation.
- A third observation is the combination of the results of the experiments that you and your partner conducted.
- A fourth observation is to combine the results of the entire class.

## MATH TERMS

The **experimental probability** of an event is the ratio of the number of times the event occurs to the total number of trials of the experiment.



My Notes

ACTIVITY 6.

<u>continued</u>

**Toss Up!** 

My Notes

#### SUGGESTED LEARNING STRATEGIES: Create Representations, Think/Pair/Share

Follow the directions in Questions 8–10 to complete the table.

Toss Up Results	Number of Heads	Number of Trials	Experimental <i>P</i> (H)	Number of Tails	Number of Trials	Experimental <i>P</i> (T)
Your Trials		50			50	
Partner's Trials		50			50	
Partner Pair Total		100			100	
Class Total						

- **8.** First record the results of the experiments.
  - **a.** Record the results for heads and tails of your 50 trials.

# **b.** Then record the results for heads and tails of your partner's 50 trials.

- **c.** Enter the sum of your results and your partner's results in the row labeled "Partner Pair Total."
- **d.** With help from your teacher, in the row labeled "Class Total," record the total number of heads, the total number of tails, and the total number of trials for the entire class.
- **9.** The column "Experimental *P*(H)" is for the experimental probability of heads. Be certain you divide by the correct number of trials in each row of this column. Find the experimental *P*(H) for each observation and enter the answers in this column as *decimals*.
- **10.** In the same way, the column "Experimental P(T)" is for the experimental probability of tails. Divide by the correct number of trials to find the experimental P(T) for each observation and enter the decimal answers in this column.
- **11.** Transfer your decimal values for Experimental P(H) and Experimental P(T) from the table above Question 8 to the columns Exp P(H) and Exp P(T) in the table on the next page.

An important concept in AP Statistics is the use of experiments to explore mathematical situations related to chance and randomness.



# Theoretical and Experimental Probability Toss Up!



SUGGESTED LEARNING STRATEGIES: Think/Pair/Share, Look for a Pattern, Use Manipulatives, Create Representations, Quickwrite

Toss Up Results	<i>P</i> (H)	Exp P(H)	<i>P</i> (T)	Exp $P(T)$
Your Trials				
Partner's Trials				
Partner Pair Total				
Class Total				

- **a.** Enter the theoretical probabilities for heads and tails that you computed in Questions 4 and 5 in the columns for P(H) and P(T). Use the decimal values.
- **b.** What seems to be a trend with these probabilities as the number of trials increases?

Now do an experiment using a number cube with the numbers 1–6.

**12.** Toss the cube 24 times. Use tally marks to record your results. Next enter the number of times for each number. Then find and enter a fraction for the experimental probability for each outcome in the "Exp P(N)" column.

Number on Cube	Tallies	Number of Times	Exp P(N) (fraction)	Exp P(N) (decimal)	Exp <i>P</i> (N) (percent)
1					
2					
3					
4					
5					
6					

**13.** Using the My Notes space, make a bar graph displaying the results of your number cube tosses. Label the axes appropriately. Describe the shape of your bar graph.

My Notes

<u>continued</u>

**Toss Up!** 

My Notes

SUGGESTED LEARNING STRATEGIES: Create Representations, Think/Pair/Share, Debriefing, Look for a Pattern, Quickwrite

- **14.** With the help of your teacher, gather the data you need for this question.
  - **a.** What was the total number of times all the students in your class tossed a number cube?
  - **b.** Collect the results of the tosses from all the students in your class and complete the table, showing the class results.

Class Results for Cube Tossing							
Number on Cube	Number of Times	Exp P(Number) (fraction)	Exp P(Number) (decimal)	Exp P(Number) (percent)			
1							
2							
3							
4							
5							
6							

- **15.** Using the My Notes space, make a bar graph of the class results for cube tossing. Label the axes appropriately.
  - **a.** Describe the shape of your bar graph.
  - **b.** How does the shape of this bar graph compare to the bar graph in Question 13?
  - c. How do you account for the differences that you observe?

SUGGESTED LEARNING STRATEGIES: Create Representations, Look for a Pattern, Quickwrite, Activating Prior Knowledge, Think/Pair/Share, Debriefing

- **16.** Consider each of the outcomes 1, 2, 3, 4, 5, and 6 when rolling a number cube.
  - **a.** What is the theoretical probability of each outcome?
  - **b.** Using the My Notes space, make a bar graph showing what you would expect to get when rolling a number cube 24 times. Label the axes appropriately.
  - **c.** Describe the shape of your bar graph.
  - **d.** Why do you think it is shaped this way?
  - **e.** How does this bar graph compare to the two previous bar graphs you have made?
- 17. If an event is *impossible* we say it has a probability of \_\_\_\_\_\_. Likewise, if an event is *certain* we say it has a probability of \_\_\_\_\_\_.
- **18.** Keep your answer in question 17 in mind as you answer each question.
  - **a.** What is the probability of rolling a number less than 7 on a number cube? Justify your answer.
  - **b.** What is the probability of rolling a 9? Justify your answer.
  - **c.** Suppose a person has a number cube and tells you that the probability of the outcome of 2 on this number cube is one. What can you conclude from this and why?
  - **d.** Suppose a person has a number cube and tells you that the probability of the outcome of 2 on this number cube is zero. What can you conclude from this and why?



continued

Theore	tical and Experimental Probability
TOSS OP	
	SUGGESTED LEARNING STRATEGIES: Interactive Word Wall, Discussion Group, Group Presentation, Think/Pair/Share
Y NOTES	The <b>Law of Large Numbers</b> states that the more trials conducted in an experiment, the closer the experimental probability will be to the theoretical probability.
	<b>19.</b> Where in this activity have you seen the Law of Large Numbers demonstrated? Justify your answer.
	<ul><li>20. The complement of an event includes all possible outcomes when the event does <i>not</i> occur.</li><li>a. What are two ways to talk about the complement of "tossing a head on a coin"?</li></ul>
	<ul><li><b>b.</b> What are two ways to talk about the complement of "rolling a multiple of three" on a number cube?</li></ul>
	<b>c.</b> What relationship do you notice for the situations in Parts a and b?
	<b>21.</b> When talking about a number cube, what would be the following probabilities?
	<b>a.</b> <i>P</i> (rolling 3) <b>b.</b> <i>P</i> (not rolling a 3)
	<b>c.</b> Find the sum of your answers in Parts a and b.
	<b>d.</b> <i>P</i> (rolling less than a 5) <b>e.</b> <i>P</i> (not rolling less than a 5)
	<b>f.</b> Find the sum of your answers in Parts d and e.
	<b>g.</b> What do you notice about the sums of the probabilities of two complements?

# Theoretical and Experimental Probability Toss Up!

SUGGESTED LEARNING STRATEGIES: Interactive Word Wall, Discussion Group, Quickwrite, Debriefing

A **compound event** happens when two or more events occur at a time. A **tree diagram** is one way to draw a picture of a compound event.

**22.** Fill in the tree diagram for the compound event of tossing a nickel and a penny.



**Independent events** are compound events in which the outcome of the first event does not affect the outcome of the second event.

**Dependent events** are compound events in which the outcome of the first event limits the outcomes for the second event.

- **23.** Tell whether each event is an *independent event* or a *dependent event*. Explain your reasoning.
  - **a.** Selecting two marbles from a jar (without replacing the first marble) and getting red, then blue
  - **b.** Rolling two number cubes and getting a 1, then a 2
  - **c.** Picking letters without replacing them when guessing a word and being correct, then correct again
  - **d.** Spinning a wheel at a carnival and getting a 10, then a 20
- **24.** Give two examples of independent compound events.

**25.** Give two examples of dependent compound events.



My Notes

# ACTIVITY 6.1 Theoretical and Experimental Probability

continued

Toss Up!

# **CHECK YOUR UNDERSTANDING**

Write your answers on notebook paper or grid paper. Show your work.

- **1.** Write a brief explanation that describes the meaning of each statement.
  - **a.** The probability that a calendar is randomly opened to February is  $\frac{1}{12}$ .
  - **b.** The probability that Florida is chosen out of a deck of cards of the fifty U.S. states is  $\frac{1}{50}$ .
- **2.** Write each probability as a fraction, a decimal, and a percent.
  - **a.** June, July, and August are considered to be the summer months. What is the probability of randomly opening a calendar to a summer month?
  - **b.** What is the probability of randomly choosing Monday, Tuesday, Wednesday, Thursday, or Friday to meet a friend after school?

Sue has a bag of marbles with 6 red marbles, 4 yellow marbles, and 2 blue marbles. She will pull one marble out of the bag without looking.

- **3.** Find each probability.
  - **a.** *P*(yellow)
  - **b.** *P*(red)
  - **c.** *P*(blue)
  - **d.** *P* (not blue)
- **4.** Would picking two marbles out of the bag (without replacing the first one) and getting a blue, then a blue be an independent or dependent event?

- Suppose that a cube with the numbers 2, 2, 3, 4, 4, and 4 is rolled.
  - **a.** Copy and complete the table below with the theoretical probability for each outcome.

Number Rolled	Theoretical Probability
1	
2	
3	
4	
5	
6	

- **b.** Explain your reasoning for each answer.
- **c.** Make a bar graph for 60 tosses of this number cube based on the theoretical probability.
- **d.** What is the sum of the theoretical probabilities? Explain why.
- **6.** Suppose Ana told you that the probability of the outcome of 5 on her number cube is 1. What can you conclude and why?
- Suppose that Jake told you that the probability of the outcome of 5 on his number cube is 0. What can you conclude and why?
- **8.** Is rolling a number cube twice and getting a 1 and then a 3 an independent or dependent event?
- **9. MATHEMATICAL** Explain the difference Between *theoretical probability* and *experimental probability*. Give examples to support your explanation.

# Probability Concepts Give It a Whirl

SUGGESTED LEARNING STRATEGIES: Close Reading, Marking the Text

Amalia found several spinners belonging to some old spinner games but could not find the rules for any of the games. Four of the old spinners are shown below.



Each spinner is a square that is separated into parts A and B. A center dot shows where each arrow goes, but all the arrows are lost. Amalia decides to use a paper clip and a pencil as an arrow for Spinner 4. Follow along with her as she does this.

She places a paper clip on the base so that the dot is just inside the long loop of the clip. Then she puts the pencil point on the dot and flicks the paper clip with her index finger. The clip spins

around until it stops. The center of the outer loop should point to a section of the spinner. If it points to a line, Amalia will spin again.





ACTIVITY

6.2

# Probability Concepts Give It a Whirl

My Notes		SUGGESTED LEARNING STRATEGIES: Activating Prior Knowledge, Quickwrite, Discussion Group, Think/Pair/ Share, Predict and Confirm								
		Amalia reme player choose whenever the spin five time <b>1.</b> Spinner 1	mbers pl es A or B e arrow la es. The w has two	aying a g for all h ands on inner ha outcom	game wit is or her that lette s the gre es, like a	h these s spins an r. Player eatest nur coin. Ar	spinners ad will so s take tu mber of e these o	. Each core a point rns as they points. putcomes		
		equally lil	kely? Exp	olain you	ir reason	ing.				
		<ul> <li>2. In Amalia for each s</li> <li>a. Spinne</li> <li>b. Spinne</li> <li>c. Spinne</li> <li>d. Spinne</li> <li>3. Try five sp choice for outcome. about the</li> </ul>	i's game, pinner? er 1 er 2 er 3 er 4 pins on e the outo Finally e outcom	which le Explain y each spin come of enter the e.	etter wou why you ner. Befo the spin. number	ore each Then sp	hoose as that lett spin, ent in and e you we	ter your nter the re correct		
			Spin	Spin	Spin	Spin	Spin	Number of Correct		
		Spinner 1	1	2	3	4	5	Choices		
		Choice Before Spin								
		Outcome After Spin								
								NT 1		
			Spin	Spin	Snin	Snin	Snin	Number of Correct		
		Spinner 2	1	2	3	4	5	Choices		
		Choice								
		Before Spin								
		Outcome								
		After Spin								

#### SUGGESTED LEARNING STRATEGIES: Think/Pair/Share

Spinner 3	Spin 1	Spin 2	Spin 3	Spin 4	Spin 5	Number of Correct Choices
Choice						
<b>Before Spin</b>						
Outcome						
After Spin						

Spinner 4	Spin 1	Spin 2	Spin 3	Spin 4	Spin 5	Number of Correct Choices
Choice Before Spin						
Outcome After Spin						

- **4.** Use the results you recorded in Question 3 to answer each question.
  - **a.** For which spinner(s) were you able to make the highest number of correct guesses?
  - **b.** How did the design of the spinner make it easier or harder to predict more accurately? Justify your reasoning.
  - **c.** Is it possible to select the correct outcome of every spin on one of the faces? Explain why or why not.
  - **d.** What would a spinner need to look like in order for you to be able to be certain of the outcome. Explain your reasoning.

# My Notes

ACTIVITY 6.2

continued

## oncepts

continued

2		Pr Gi	ot ve	oal It	oi a	lit W	:y hi	C
1	Лу	N	ote	85				

#### SUGGESTED LEARNING STRATEGIES: Discussion Group, Debriefing

**5.** Complete each statement to show whether the outcome for a spinner is *more likely* to occur, *less likely* to occur, or *equally likely* to occur. Explain your reasoning for each decision.

#### Spinner 1

Outcome A is	to occur.
Outcome B is	to occur.
Explanation:	

#### Spinner 2

Outcome A is	to occur.
Outcome B is	to occur.
Explanation:	

#### Spinner 3

Outcome A is	to occur
Outcome B is	to occur.
Explanation:	

#### Spinner 4

Outcome A is	to occur.
Outcome B is	to occur.
Explanation:	

If an experiment were conducted multiple times, you would see different results, thus creating variability in the data.

- 6. For each spinner, compare the outcomes of your experiment in Question 3 with those of other students.
  - **a.** Where are your answers the same or different?

**b.** Do the results seem reasonable to you? Explain.

# **Probability Concepts** Give It a Whirl

SUGGESTED LEARNING STRATEGIES: Create Representations, Group Presentation

- **7.** Another student, Frank, is puzzled because when he flicked the paper clip using Spinner 1, his outcome was *not* the most likely outcome. Give Frank an explanation about why you do not always get the most likely outcome.
- **8.** Amalia decides to do an experiment with Spinner 1 and Spinner 3. She will spin each arrow 100 times.
  - **a.** If the arrow is spun 100 times, predict how many times it will land on each letter?

Spinner	1 A B	3 A B
Outcome of Spin	Prediction of Number of Times for the Outcome	Prediction of Number of Times for the Outcome
Α		
В		

- **b.** Explain your reasoning for these estimates.
- **c.** If the spinner is spun 400 times, how many times do you predict it will land on each letter?

Spinner	1 A B	3 A B
Outcome of Spin	Prediction of Number of Times for the Outcome	Prediction of Number of Times for the Outcome
Α		
В		



ACTIVITY 6.2 continued

# ACTIVITY 6.2 Probability Concepts

continued

Give It a Whirl

My Notes

SUGGESTED LEARNING STRATEGIES:

**d.** How do Parts a and c connect to theoretical probability?

**9.** Use these blank square spinners to draw each spinner as described in Parts a through c. Label the three squares Spinner 5, Spinner 6, and Spinner 7.







- **a.** Spinner 5: with four sections labeled A, B, C, and D and these four sections are equally likely outcomes on the spinner.
- **b.** Spinner 6: three sections labeled A, B, and C and these three sections are outcomes on the spinner with the following probabilities:

$$P(A) = \frac{1}{4}$$
  $P(B) = \frac{1}{2}$   $P(C) = \frac{1}{4}$ 

**c.** Spinner 7: with three sections labeled A, B, and C and these three sections are outcomes on the spinner with the following probabilities:

$$P(A) = \frac{1}{8}$$
  $P(B) = \frac{5}{8}$   $P(C) = \frac{1}{4}$ 

**d.** Explain the reasoning you used to construct the spinner faces in Parts a through c.

Remember *P*(A) means the probability that the arrow lands on the space with the label A.

SUGGESTED LEARNING STRATEGIES: Use Manipulatives, Discussion Group, Think/Pair/Share, Look for a Pattern

Amalia found the two spinners shown in the My Notes space with directions on how to use them to conduct an experiment. The directions are the same for each spinner:

- Spin a paper clip on the spinner.
- Tally the times each outcome occurs.
- Carry out 24 trials.
- **10.** You will use one of the spinners and your partner will use the other to conduct the experiments.
  - **a.** Write the number of your spinner in the table. Find the theoretical probability of each outcome as fraction. Next express the theoretical probability as a decimal. Then explain how you arrived at the theoretical probability.

Spinner Experiment		iment
Outcome of a Spin	Theoretical Probability as a Fraction	Theoretical Probability as a Decimal
А		
В		
Explanation:		

**b.** Carry out 24 trials of your experiment. In the table below, record the number of times each outcome occurs, the experimental probability (the number of times each outcome occurred as a fraction of the total number of trials) and the decimal equivalent of the experimental probability.

	Spinner l	Experiment	
Outcome of a Spin	Times Outcome Occurred	Experimental Probability	Decimal Equivalent
А			
В			
Total	24	24	



**Probability Concepts** Give It a Whirl

continued



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Theoretical

Probability

Expressed as

a Decimal

# **Probability Concepts** Give It a Whirl

SUGGESTED LEARNING STRATEGIES: Create Representations, Discussion Group

<b>Class Results for Spinner 9 Experiment</b>				
Outcome of a Spin	Number of Times Outcome Occurred	Experimental Probability (Fraction of the Total Trials)	Decimal Equivalent of Experimental Probability	Theoretical Probability Expressed as a Decimal
A				
В				
Total				

- **c.** Compare the decimals in the last two columns of the tables in Part b. Were your individual results or the class results closer to the theoretical probabilities?
- **d.** Why do you think it is this way?



ACTIVITY 6.2

continued

# CHECK YOUR UNDERSTANDING

Write your answers on notebook paper. Show your work.

Amalia found another square spinner face. This new square spinner face is shown below



- **1.** List all of the outcomes of a trial spin using the new square spinner face.
- **2.** Use the spinner to answer the following questions.
  - **a.** Find *P* (spinner points to A).
  - **b.** Find *P* (spinner points to B).
  - **c.** Find *P* (spinner points to C).
  - **d.** Find *P* (spinner points to D).
  - **e.** Are the outcomes of the ABCD spinner equally likely outcomes? Write a brief explanation to support your answer.

- **3.** What is the probability that the spinner will land on E? Justify your answer.
- 4. Amalia does not have the rules that go with the ABCD spinner face. But she does remember that this game is a two-player game in which each player has two letters. Each player spins the spinner six times. A player scores a point whenever the spinner lands on one of his or her letters. The player with the greatest score at the end of the game wins the game.
  - **a.** Which two letters would you choose and why?
  - **b.** Amalia remembers that the game is fair to each player. What letters should each player get to make this a fair game? Explain the reasoning used to support your answer.
- **5.** MATHEMATICAL REFLECTION Why is there variablity when conducting an experiment from one set of trials to the next?

# Probability OUT OF THE HAT

#### Write your answers on notebook paper. Show your work.

- **1.** In Xander's hat are cards numbered 1–20. He will draw out one card and replace it each time. He is interested in getting a card with an odd number (event A) or a multiple of 3 (event B).
  - **a.** Write the outcomes in each event.
  - **b.** Find the probability of each event occurring. Write the probability three ways: as a fraction, a decimal, and a percent.
  - **c.** For each probability in Part b, describe what the fraction, the decimal, and the percent mean in terms of the event.
  - **d.** Find P(not A) and P(not B).
  - **e.** Make a Venn diagram of the relationship between the outcomes of events A and B.
  - **f.** Find P(A and B) and P(not (A and B)).
- **2.** Consider a spinner GHI as shown at the right.
  - **a.** Find the following probabilities for this spinner face: *P*(Region G), *P*(Region H), and *P*(Region I).
  - **b.** This GHI spinner face will be used for a three-player game with these rules:
    - Each player chooses a different letter and spins 16 times.
    - A player scores a point whenever the spinner lands on his or her letter.

The player with the most points wins the game. Is this game fair to all the players? Explain your answer.

- **c.** This GHI spinner face will be used for another three-player game with these rules:
  - Each player chooses a different letter and spins the spinner 16 times.
  - Whenever the spinner lands on his or her letter, the player with letter H receives three points while the players with letters G and I receive two points.

The player with the most points wins the game. Is this game fair to all the players? Explain your answer.

# G I H

## Embedded Assessment 1 Use after Activity 6.2.

# Embedded Assessment 1

Use after Activity 6.2.

# **Probability** OUT OF THE HAT

	Exemplary	Proficient	Emerging
Math Knowledge #1a, 1d, 1f, 2a	The student correctly: • Writes the events (1a), • Finds the probabilities (1d, 1f, 2a).	The student attempts all four of the items but only two are correct and complete.	The student attempts at least three of the items but only one is correct and complete.
Problem Solving #2b, 2c	The student correctly determines the fairness of each game with correct supporting information (2b, 2c).	The student attempts to determine the fairness of each game but the supporting information is correct and complete for only one item.	The student attempts to support a correct determination in the fairness of at least one of the two items.
Representations #1b, 1e	The student correctly: • Provides three equivalent representations for each probability (1b), • Creates a Venn diagram to show the relationship between events A and B (1e).	The student attempts to answer both items and correctly: • Provides at least four of the equivalent representations (1b), • Gives a Venn diagram that correctly represents event A or B (1e).	<ul> <li>The student:</li> <li>Provides at least four of the equivalent representations (1b),</li> <li>OR</li> <li>Gives a Venn diagram that correctly represents event A or B (1e).</li> </ul>
Communication #1c, 2b, 2c	The student: • Correctly describes each representation in terms of the event (1c), • Provides explanations consistent with their conclusions about fairness (2b, 2c).	Explanations are complete and correct for only two of the items.	The explanation is complete and correct for only one of the items.

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# Data Representations <mark>When Were You Born?</mark>

SUGGESTED LEARNING STRATEGIES: Close Reading, Marking the Text, Summarize/Paraphrase/Retell, Visualize, Debriefing, Use Manipulatives, Create Representations

Claire read that more people are born in August than in any other month. Work with your classmates to form a single line in order of your birth months so you can see whether what Claire read is true.

- **1.** Record the birth-month data for your class using each of the three methods given below.
  - **a. Method 1:** Count the number of students in your class born each month and record the data in the table below.

Month	Number of Members
January	
February	
March	
April	
May	
June	
July	
August	
September	
October	
November	
December	

#### Class Member Birthday Months

**b.** Method 2: Line up again by birth month. Now form a circle, standing shoulder-to-shoulder. Your teacher will provide the tools that you need. Follow your teacher's directions for marking the circle and labeling the sectors of the circle for each birth month.

# ACTIVITY 6.3

My Notes

# **Data Representations**

continued

# When Were You Born?

My Notes

#### MATH TERMS

A **sector** of a circle is a pie-shaped part of a circle formed by two radii and an arc of the circle. SUGGESTED LEARNING STRATEGIES: Marking the Text, Summarize/Paraphrase/Retell, Visualize, Debriefing, Use Manipulatives, Create Representations

You have represented the birth-month data in a *circle graph* or *pie chart*. Sketch the graph on the circle below. Give it a title and label each **sector** with its month.



**c.** Method 3: Now line up in 12 columns by birth month, the first column of people being those born in January, the second column being those born in February, and so on. These columns are the data needed to create a bar graph.

Have someone mark a horizontal axis, a vertical axis, and rectangles around the columns of people. Title the graph. Label the month for by each rectangle along the horizontal axis. Mark off an appropriate scale on the vertical axis. Copy the bar graph and labels on the axes below.



# **Data Representations**

When Were You Born?

SUGGESTED LEARNING STRATEGIES: Quickwrite, Debriefing, Think/Pair/Share, Self Revision/Peer Revision

- **2.** What are the three methods you used to represent the birth-month data?
  - **a.** Method 1
  - **b.** Method 2
  - **c.** Method 3
- **3.** For each of the three methods, how would you determine in what month (or months) the most number of people were born?
  - **a.** Method 1
  - **b.** Method 2
  - **c.** Method 3

Suppose another middle-school class gave your class a table with the birth-month data of the students in that class.

**4.** Do you think it would be easier to draw a bar graph or a circle graph more accurately for the new data? Explain your thinking.

#### Now look at some other birthday data.

The *Incredible Ice Cream Shop* has a birthday club. Each month they send a card with a coupon for a free ice cream treat to members born in that month. The table on the next page shows the number of members with birthdays each month.

**5.** Complete the table by finding the fraction and the percent of members born each month.

My Notes

ACTIVITY 6.3 continued

continued

# Data Representations

When Were You Born?



SUGGESTED LEARNING STRATEGIES: Debriefing, Group Presentation, Think/Pair/Share, Create Representations, Quickwrite, Self/Peer Revision

1 /			
Month	Number of Members	Fraction of Members	Percent of Members
January	20	$\frac{20}{360} = \frac{1}{18}$	5.6%
February	22	$\frac{22}{360} = \frac{11}{180}$	6.1%
March	30		
April	18		
May	60		
June	30		
July	24		
August	36		
September	25		
October	40		
November	10		
December	45		

#### Incredible Ice Cream Shop Birthday Club

**6.** Draw a bar graph to represent the *Incredible Ice Cream Shop* birth-month data. Title your graph and label each axis.

<b>4E</b> -	
05	
60 -	
55 -	
55	
50 -	
45 -	
~~	
40 -	
35 -	
20	
30 -	
25 -	
20 -	
20	
15 -	•
10 -	
10	
5-	

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

# **Data Representations**

When Were You Born?

#### SUGGESTED LEARNING STRATEGIES: Look for a Pattern, Debriefing, Think/Pair/Share, Create Representations, Identify a Subtask

- 7. Consider the *Incredible Ice Cream Shop* birthday club.
  - **a.** Write two statements about the graph you just drew.
  - **b.** What is the total number of members in the club? How does that number compare to the number of degrees in a circle?
  - c. How many people would each degree of a circle represent?
- **8.** Suppose that members of the *Incredible Ice Cream Shop* birthday club lined up by birth month and formed a circle. How many degrees of the circle would be needed to represent the number of people in the birthday club who were born in:
  - **a.** January? \_\_\_\_\_ **b.** October? \_\_\_\_
- **9.** Complete the table. Use information from the table in Question 5 for the first two columns. Then calculate the percent of 360° and the number of degrees for each sector of the circle graph.

Month	Number of Members	Fraction of Members	Percent of Members	Percent	Number
January	20			01000	orbegiees
February	22				
March	30				
April	18				
May	60				
June	30				
July	24				
August	36				
September	25				
October	40				
November	10				
December	45				

#### My Notes

ACTIVITY 6.3 continued

**Data Representations** 

continued



SUGGESTED LEARNING STRATEGIES: Look for a Pattern, Create Representations, Marking the Text, Summarize/ Paraphrase/Retell, Debriefing, Quickwrite, Self/Peer Revision

- **10.** Which two pairs of columns in the previous table have the same values in them?
- **11.** Make a circle graph for the birth-month data shown in Question 9. Be sure to title the circle graph and label each sector with the correct month and percent.



For this year, the Incredible Ice Cream Shop has budgeted \$1080 for the birthday club expenses. The manager wants to spend the same amount of money on each member.

# Data Representations

When Were You Born?

SUGGESTED LEARNING STRATEGIES: Quickwrite, Debriefing

**12.** Complete the table below to show the amounts you would recommend to the manager to spend each month. Be sure to explain to the manager how you arrived at your decision.

Incredible Ice Cream Shop Monthly Birthday Club Budget Recommendation										
Month	Amount									
January										
February										
March										
April										
May										
June										
July										
August										
September										
October										
November										
December										

Explain how you determined your recommendation.



ACTIVITY 6.3

continued

**Data Representations** When Were You Born?

continued

		SUG Debi	GESTED LEA riefing, Crea	ARNING STR Ite Represer	ATEGIES: TIntations	nink/Pair/	Share,
MIY	NOTES	<b>13.</b> Now loo	ok back at th	ne birthday d	lata from yo	our class.	
		<b>a.</b> What birth	at is the total 1-month dat	l number of a?	people in yc	our class	
		<b>b.</b> For a one Expl	the data fror degree repre ain below.	n your class esent one pe	, would it be rson in mak	e appropria ing a circl	ate to let e graph?
		<b>14.</b> Copy th and con	ne Number of nplete the re	of Members : st of the tab	from your ta le.	able on pa	ge 353
			Class	Member Bir	thday Mont	ths	
		Month	Number of Members	Fraction of Members	Percent of Members	Percent of 360° in a Circle Graph	Degree in a Circle Graph
		January					
		February					
		March					
		April					
		May					
		June					
		July					
		August					
		September					
		October					
		November					
		December					

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Degrees in a

Circle

Graph

# **Data Representations**

When Were You Born?

SUGGESTED LEARNING STRATEGIES: Debriefing, Think/Pair/Share, Identify a Subtask, Marking the Text, RAFT, Self Revision/Peer Revision

**15.** Draw a circle graph for your class birth-month data. Be sure to title and label your graph.



**16.** About how many people are in your entire school?

- **17.** Assume that the percent of birthdays each month is about the same for the entire school as for your class and tell how many people in your school would have been born in:
  - **a.** January? \_\_\_\_\_ b. June?
  - **c.** Show your work on Parts a and b.
- **18.** Your principal would like to send out birthday cards at the beginning of each month to each student in your school who has a birthday that month. She put you in charge of deciding how many cards she should order each month. On separate paper, write a letter telling her:
  - How many cards you suggest she order each month
  - Your explanation of how you determined the numbers
  - Whether you think that using the percents from your class will give valid predictions for the entire school and why.

My Notes

ACTIVITY 6.3 continued

continued

# CHECK YOUR UNDERSTANDING

# Write your answers on notebook paper. Show your work.

**1.** Micah kept track of how he spent his hours during a typical weekday. Here are categories and hours he identified.

School – 8	Study – 2	Family – 3
Television – 1	Sleep – 6	Fun – 4

- **a.** Create a table with these column headings: Category, Hours, Fraction of the Day, and Percent of the Day.
- **b.** Fill in the first two columns with the data above. Then calculate the last two columns.
- **c.** Create a bar graph and a circle graph using this data. Be sure to include a title and labels for your graphs.
- The animals housed at the shelter are classified into five groups: small dogs (weighing less than 20 pounds), medium dogs (weighing more than 20 but less than 50 pounds), large dogs (weighing more than 50 pounds), cats, and other animals.
  - **a.** The data in the table are for March. Create a circle graph for March.

Catagony	Degrees for	Number of			
Calegory	the sector	animals			
Small dogs	60°				
Medium dogs	80°				
Large dogs	120°				
Cats	90°				
Other animals	10°				

**b.** There were 900 animals at the shelter in March. Copy and complete the table

to show the number of animals of each type housed at the shelter in March.

- **c.** Create a bar graph for the March shelter data.
- **3.** Sherita worked with her Mom on the family budget. They found the following percentages were typical of their weekly spending.

Food 36%	Entertainment 9%
Rent 24%	Savings 6%
Clothing 18%	Other ?

- **a.** Create a table using these column headings: Category, Percent, Amount, and Degrees.
- b. Fill in the first two columns with the family budget data. For column 3, calculate how much they spent in each category if the family typically has \$750 to spend each week. For column 4, calculate how many degrees should be used for each category's sector in a circle graph.
- **c.** Create a circle graph and a bar graph for the family's budget.
- 4. MATHEMATICAL REFLECTION instead of a bar graph and when would it be better to create a bar graph instead of a circle graph when representing data? Give examples to support your views.

# Summarize Data and Make Conclusions Taking a Class Picture

SUGGESTED LEARNING STRATEGIES: Look for a Pattern, Create Representations

**1.** Try to read the message on the grid below.

						]																												I	
•	•	•	•	·/	Ŷ	``	<	÷		•	•	•	•	·/	Ŷ	``	•	•	•	•	•	•	•	•				··	/.	•	•	•		Ż	/.
:		•		:	:		:		:	—	•		:	:			:		•		:	:	:		•		:	:	:	—	•		:	:	•
:	:	:	:				:	:	:	-		_	:			-	:	_	_	_			_			-	:	:	:	-		_	:	:	•
:	÷		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	÷	:	:	:	:	:	:	:	:	÷	:	:	:	•	:		:	:

- 2. Complete the following actions on the grid above.
  - a. Redraw all vertical lines by moving them down three spaces.
  - **b.** Redraw all horizontal lines by moving them up four spaces.
- **3.** Read the message on the grid and write it in the space below.
- **4.** All of the pieces of the letters were in the original grid. Why was it so difficult to read the message at first?

Your class has a new math project: to describe your classmates using the results of a survey.

Kai is a new student in your class. He often talks about his old school and seems to know many facts about his former classmates. Kai tells you that students at his old school did a survey to learn about their classmates. Collecting the data was only the first half of the project. The second half was to summarize the findings to make conclusions about the class. Data from a survey are like the pieces in the grid—difficult to draw meaningful conclusions from in their original form.

**5.** Your teacher asks Kai to share the data he collected on the genders of his former classmates. What conclusion can you reach immediately just by looking at these data?

boy	boy	girl	boy	girl	boy	boy	girl	boy
boy	boy	girl	girl	girl	boy	girl	girl	girl

## CONNECT TO AP

My Notes

Key concepts in AP Statistics include summarizing data, creating graphical displays of different types of data, and recognizing the difference between quantitative and categorical variables.



Summarize Data and Make Conclusions

**Taking a Class Picture** 

continued



SUGGESTED LEARNING STRATEGIES: Quickwrite, Debriefing, Self Revision/Peer Revision, Close Reading, Marking the Text, Summarize/Paraphrase/Retell, Think/Pair/Share

- 6. The pie charts for Kai's data are shown at the left.
  - **a.** What does the pie chart *immediately* tell you about the students in Kai's former math class?
  - **b.** What does this pie chart tell you about the students in Kai's former English class?
  - **c.** Can the number of boys in this class be determined from the pie chart? Explain your reasoning.
  - **d.** There were 20 students in Kai's former English class. How many of the students were girls? Show how you arrived at your answer.

Your teacher will provide directions for a completing survey of you and your classmates. On page 365 is a list of the data to be collected for the class survey. Your teacher will determine how you will collect the data and share the results.

# Summarize Data and Make Conclusions Taking a Class Picture



My Notes

#### **Taking a Class Picture Survey**

Please answer the following questions about yourself to the best of your ability. This survey is anonymous; **do not** put your name on it.

<b>1.</b> Gender (boy or girl)	
<b>2.</b> Eye color	
<b>3.</b> Height (rounded off, in inches)	
<b>4.</b> Shoe size	
<b>5.</b> Total ounces of water that you drank yesterday	
6. Number of brothers and sisters that you have	
<b>7.</b> Number of the month in which you were born (January = 1, February = 2, and so on)	
8. Where you sit in this class (front, middle, back)	
9. Total number of letters in your full name	
<b>10.</b> Minutes it took you to get ready for school today	
<b>11.</b> Number of hours of sleep you had last night	
<b>12.</b> Favorite school subject	
<b>13.</b> Minutes it took you to travel to school today	
<b>14.</b> Number of hours you spent last week watching television or movies or playing video games	
Think about other questions you might ask your class question below that you would include in a class surve	mates. Write a ey.

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## **Summarize Data and Make Conclusions** Taking a Class Picture

SUGGESTED LEARNING STRATEGIES: Create Representations, Debriefing, Summarize/Paraphrase, Retell, Quickwrite

- 7. Use the results of the class survey to complete the following:
  - **a.** List the eye colors of the students in your math class.
  - **b.** Create a pie chart that represents the data in Part a. Remember to label your graph.



You can also create a graphical display of information using a *bar graph*, also called a *bar chart*. In a bar graph, each bar represents a different category of information. The height of each bar corresponds to the related data. The scale for the bar heights can be labeled with the *count* or the *percent* for each category. The following bar graphs represent the genders of the students in Kai's former math class.



**8.** Which bar graph above gives you more information than the pie chart in Question 7? Explain your reasoning.



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Unit 6 • Data Analysis and Probability

ACTIVITY 6.4 continued

My Notes

Summarize Data and Make Conclusions

continued



A **variable** is any characteristic that can be measured by collecting and analyzing data. Examples are a job applicant's eye color or shoe size.

SUGGESTED LEARNING STRATEGIES: Debriefing, Create **Representations, Group Presentation** 

9. Using the results of your class survey, create a bar graph below for the genders of the students in your math class. Mark the vertical axis with percents.



**10.** Create a bar graph below for the eye colors of the students in your math class. Mark the vertical axis with counts.



The topic of each question in your class survey represents a variable, or characteristic, to study about the *individuals* in your math class. Gender and eye color are examples of **categorical variables** because the data is organized by placing each individual into a category.

Another type of variable used in studying data is a **numerical** variable. Numerical variables occur when data is organized by numerical values that can be measured. Weight and age are examples of numerical variables.

# Summarize Data and Make Conclusions Taking a Class Picture

SUGGESTED LEARNING STRATEGIES: Create Representations, Marking the Text, Think/Pair/Share, Summarize/Paraphrase/ Retell, Debriefing, Self Revision/Peer Revision, Group Presentation

**11.** Identify the topic of each question in your class survey as *categorical* (C) or *numerical* (N).

Торіс	C	N	Торіс
1. Gender			8. Where you sit in class
2. Eye color			9. Letters in name
3. Height			10. Minutes to get ready
4. Shoe size			11. Hours of sleep last
			night
5. Ounces of water			12. Favorite subject
6. Brothers and sisters			13. Travel to school
7. Birth month			14. TV/game hours

A variable represented by a number is not automatically a numerical variable. Numerical variables have values for which numerical calculations, such as averages or addition, would make sense. If either of those operations does not make sense, the variable is categorical.

- **12.**Look at your list of numerical variables in Question 11 and determine whether any of the numerical variables should be moved to your list of categorical variables.
- **13.** At the end of the class survey, you were asked to write a question to be included in the survey.
  - **a.** Write your question below and indicate whether it measures a categorical variable or a numerical variable.
  - **b.** If your question measured a numerical variable, write a question to gather data about a categorical variable. If your question gathered categorical data, write a question below to measure a numerical variable.



My Notes

CN

## ΜΑΤΗ ΤΓΡ

A survey might ask students to list the room number of their favorite teacher. Although an average room number can be computed, it does not have any real-world meaning. Room numbers are categorical variables.

# Summarize Data and Make Conclusions

continued

# Taking a Class Picture

ΜΑΤΗ ΤΡ

In selecting one value to represent a typical data item for a set of data, three *measures of center* the *mean*, the *median*, and the *mode*—are commonly used.

My Notes

To find the mean, find the average of the data items by taking the sum of the data values and dividing by the total number of data items. SUGGESTED LEARNING STRATEGIES: Marking the Text, Summarize/Paraphrase/Retell, Think/Pair/Share, Debriefing, Quickwrite, Self Revision/Peer Revision, Create Representations

Graphical displays help you quickly observe and understand both categorical and numerical data. You can summarize categorical data by giving the proportions or counts of the data that fall into each category. Categorical data are best displayed by pie charts and bar graphs.

For numerical data, you can use mathematical operations to determine the *center* and *spread* of the data, and to look for *outliers* as a way to provide a descriptive summary or to use displays like stem plots and dot plots to provide a visual summary.

The 2008 US Olympic Swimming Team for Women contained eleven members who swam relays. Their ages are listed below.

21 25 19 22 21 22 18 22 20 41 24

To find the *median*, arrange all of the data items in order from smallest to largest. The *median* is the number that is exactly in the middle position of the list.

- If a list has an odd number of data items, the median is a member of the list.
- If a list has an even number of data items, the median is the mean of the middle two data items.

6	10	13	17	20		6	10	13	18	20	24
		↑							≙		
	median = 13						m	ediar	n = 1	5.5	

- **14.**List the ages of the women's relay swimmers from youngest to oldest.
- **15.**Determine the median of the ages for the women's relay swimmers.
- **16.**Calculate the *mean* age for the women's relay swimmers.

To find the *mode*, look for the data item that occurs most often.

**17.** Determine the mode of the ages of the women's relay swimmers.

# Summarize Data and Make Conclusions Taking a Class Picture

SUGGESTED LEARNING STRATEGIES: Quickwrite, Debriefing, Self Revision/Peer Revision, Think/Pair/Share, Look for a Pattern, Close Reading, Create Representations

The *range* shows how far apart the data items are and is the easiest *measure of spread* to calculate. The range is equal to the highest data value minus the lowest data value.

**18.** Find the mean, median, and range of the following data sets.

	Data Set	Mean	Median	Range
a.	6, 8, 10			
b.	8, 8, 8			
с.	2, 8, 14			

**19.** The centers of the three data sets might lead one to believe that the three data sets are identical. What do the ranges of the data sets tell you that the measures of center do not?

The final piece in a summary for a numerical variable is to determine if there are any **outliers**. Not all data sets will contain outliers.

- **20.** Using the women's relay swimmers' ages, determine the range of the data set and identify any outliers.
- **21.** If the outlier were removed from the data set containing the women's relay swimmers' ages, calculate and then describe how each measure of center would change by comparing the results to the previous values from Questions 15–17.

**a.** median

**b.** mean

**c.** mode



#### MATH TERMS

My Notes

**Outliers** are individual data points that do not fit the overall pattern of the data set.

continued

6.4 Summarize Data and Make Conclusions

Taking a Class Picture

My Notes

#### SUGGESTED LEARNING STRATEGIES: Marking the Text, Summarize/Paraphrase/Retell, Think/Pair/Share

Displaying data using measures of center and spread helps a reader make observations and draw conclusions about the data. *Dot plots* and *stem plots* are appropriate graphical displays for numerical data.

The following is a list of the shoe sizes of the students in Kai's former math class.



Kai used the shoe size data to create the following *dot plot*.



- **22.** Answer each question about the shoe sizes of the students in Kai's former math class. Indicate whether the *list* of the shoe sizes or the *dot plot* is more helpful to answer each question.
  - **a.** What is the most common shoe size?
  - **b.** If a measure of center is selected in Part a, state which one you chose and explain why. If not, explain your choice.
  - c. Estimate the typical shoe size for students in this class.
  - **d.** If a measure of center is selected in Part c, state which one you chose and explain why. If not, explain your choice.
  - **e.** Give the range of shoe sizes and any outliers. What does this tell you about the students in the class?

# **Summarize Data and Make Conclusions** Taking a Class Picture

ACTIVITY 6.4 continued

My Notes

SUGGESTED LEARNING STRATEGIES: Marking the Text, Look for a Pattern, Think/Pair/Share, Create Representations

- **23.** All of the answers in Question 22 could have been determined using only Kai's list of shoe sizes. Explain why it was better to use the dot plot.
- **24.** Use your class survey to complete the following.
  - **a.** Make a list of the shoe sizes of the students in your math class.
  - **b.** Use the shoe size data in Part a to create a dot plot in the space below. Remember to label your graph.



**c.** Write a brief summary of what the dot plot in Part b tells you about the shoe sizes of the students in your math class. Be sure to include measures of center, range and possible outliers in your summary.

## **ACTIVITY 6.4** Summarize Data and Make Conclusions

continued

Taking a Class Picture

# My Notes

### MATH TIP

Be sure to include all three parts of a summary (a center, the spread, and possible outliers) for a numerical variable. SUGGESTED LEARNING STRATEGIES: Quickwrite, Debriefing, Think/Pair/Share

**25.** Create a dot plot for the "Total number of letters in your full name" data from your class survey. Write a summary of what the dot plot tells you about the students in your math class.

#### **26.** The results from Kai's former math class for the question, "Minutes that it took you to get ready for school today" data are shown below.

48	90	35	10	45	10	20	53	20
30	30	10	52	12	60	25	5	45

Explain why it would be difficult to create a dot plot for the data above.

# Summarize Data and Make Conclusions Taking a Class Picture

SUGGESTED LEARNING STRATEGIES: Create Representations, Quickwrite, Think/Pair/Share, Debriefing

Your teacher used the "Minutes it took to get ready for school today" data from Kai's former math class to create the stem plot to the right. The legend shows that the number 90 is shown as  $9 \mid 0$  where 9 is the stem and 0 is the leaf. Also,  $5 \mid 2 3$  represents both 52 and 53.

- **27.** Answer each question about the time it took the students in Kai's former math class to get ready for school.
  - **a.** Find and identify the measure of center that represents the most common amount time that it took students from Kai's class to get ready for school. Explain your reasoning.
  - **b.** Find and identify the measure of center to use as the typical amount time that it took students in Kai's class to get ready for school. Explain your reasoning.
  - **c.** What is the range of times that it took for students to get ready for school?
  - **d.** What time represents an outlier that does not fit in the pattern of the rest of the class data? Explain your reasoning.
  - **e.** If the outlier in Part (d) were omitted, which measures of center would remain unchanged?
  - **f.** Omit the outlier in Part d and recalculate the measure of center that changes as a result of this omission.
- **28.** In the My Notes space, create a stem plot for the "Time that it took you to get ready for school today" data from the students in your math class.



### My Notes

Minutes It Took to Get Ready for School Today					
0	5				
1	0002				
2	005				
3	005				
4	558				
5	23				
6	0				
7					
8					
9	0				
Le	gend: 9 0 = 90				

#### ΜΑΤΗ ΤΓΡ

Sometimes *stem plots* are called stem-and-leaf plots.



Summarize Data and Make Conclusions

Taking a Class Picture

continued

#### Suggested Learning Strategies: Think/Pair/Share, Quickwrite, Debriefing

**29.** Write a descriptive summary for the "Time that it took you to get ready for school today" data from the students in your math class. Select, calculate and justify the measure of center, then calculate the range, and identify any outliers in the data set.

# **CHECK YOUR UNDERSTANDING**

My Notes

Write your answers on notebook paper. Show your work.

- **1.** Create a circle graph for your class data for the item "Number of the month in which you were born."
- **2.** Create a bar graph for your class data for the item "Number of brothers and sisters you have."
- **3.** A class set of data from Kai's old school was gathered in response to the item "Total ounces of water that you drank yesterday."

8 16 20 0 32 24 32 8 16 16 56 48 0 24 32 28 16 36 72 40 48 24 40 32

- **a.** Find the mean, median, and mode for this data.
- **b.** Give the range for this data.
- **c.** Identify any outliers in the data set.
- **4.** Make a dot plot for the class data to display results for the item "Height (rounded off, in inches)."

- **5.** Prepare a stem plot from the class data for responses to the item "Total ounces of water that you drank yesterday."
- **6.** A data set from a class at Kai's old school was collected in answer to the item "Minutes it took you to get ready for school today."
  - 52 12 48 22 20 30 24 25 43 35 78 48 5 8 26 11 50 20 15 30 30 47 32 35
  - **a.** Create a stem plot for this data with the appropriate labels and titles.
  - **b.** Write a descriptive summary for this data set.
- 7. MATHEMATICAL REFLECTION Make a list of the graphical displays for data that you have studied. Categorize each display as to type according to the data (categorical or numerical) that can be visualized using that particular display. For each type of graphical display, identify what can be learned about the group being studied by using this type of display.

# Data Collection and Representation **Questions and Answers**

SUGGESTED LEARNING STRATEGIES: Quickwrite, Think/Pair/Share

People use data to help them make informed decisions. Knowing how to collect, analyze, and represent data is an important skill in today's data-oriented world.

Jaycee wants to form a walking group. She decides to start by conducting a **survey**.

- **1.** Jaycee wants to ask only one question, but is not sure exactly what words to use. Write a question for her to use. Be sure that your question is neutral and does not support one of the choices.
- **2.** What are the possible answers to your question? How will those answers help Jaycee?

Next Jaycee needs to decide whom she will survey. All the people who can be selected to take the survey are the **population**. She would like the walking group to include people of all ages.

- 3. What population could Jaycee use for her survey?
- **4.** Based on the population you suggest in Question 3, describe who might become members of the walking group.
- **5.** Choose a topic for a simple survey that you would like to conduct and write the topic here.
  - **a.** What is your topic?
  - **b.** Write the question that you will use.
  - c. Describe the population for your survey.

# ACTIVITY 6.5

## My Notes

### ACADEMIC VOCABULARY

A **survey** is a method of collecting data from a sample or an entire population. It can be written, such as a print or online questionnaire, or oral, such as an in-person interview. A **population** is a set of members for which data are to be collected and analyzed with the purpose of drawing conclusions about some feature of the population. An example of a population is all the sixth graders who attended a movie within the last month.



continued

# (6.5) Data Collection and Representation

**Questions and Answers** 

# My Notes

#### ACADEMIC VOCABULARY

A **sample** is a portion or segment of a population that is assumed to represent the whole population. An example is 10 percent of the students in a school.



# SUGGESTED LEARNING STRATEGIES: Marking the Text, Quickwrite

Mr. Vincent is planning to paint the walls in the gym. There are four colors of paint that he can use. He wants to choose a color that both teachers and students like. He thinks it will take too long to question all 1200 students and 60 teachers and staff members, but he wants them to help choose the paint color.

When a population is too large to survey everyone, then a **sample** is used. A sample is a small group chosen from the population that represents everyone in that population.

- **6.** If Mr. Vincent asks all the students, teachers, and staff members for their preferences, how much data will he have?
- **7.** What would you do if Mr. Vincent asked you to conduct the survey for him? Would you use a sample or question everyone? Explain your reasoning.
- **8.** Eve suggested that Mr. Vincent use 2 teachers and 4 students for his sample. Do you agree or disagree? Is this a **representative** sample? Justify your answer.
- **9.** What sample would you use to give Mr. Vincent the information he needs to choose a color? Describe its size and who is in it. Explain why it is representative.

Jackson, one of Mr. Vincent's students, volunteered to survey 6 teachers and 60 students. He thinks that 5% of the students and 10% of the staff would be a representative sample. Miss Templeton, the assistant principal, decided to see how well Jackson's survey reflected the views of everyone in the school, so she actually surveyed all 1260 people. SUGGESTED LEARNING STRATEGIES: Look for a Pattern, Quickwrite

**10.** The tables below show the results of the two surveys.

Jackson's Data

Color	Students	Staff	Totals
Beige	6	4	10
Blue	27	1	28
Gray	6	0	6
Green	21	1	22
Totals	60	6	66

Miss Templeton's Data

Color	Students	Staff	Totals
Beige	140	30	170
Blue	600	20	620
Gray	100	4	104
Green	360	6	366
Totals	1200	60	1260

- **a.** What color should Mr. Vincent paint the gym? Explain whether you think that the results for both the sample and the entire population agree.
- **b.** Was Jackson's sample representative? Explain your reasoning.

**11.**Look back at your answers to Question 5.

- **a.** Describe the sample you will use for your survey. Include the number of people you will ask to take the survey.
- **b.** Is the sample representative of the population you described in Question 5? Explain your reasoning.
- **c.** Carry out your survey and record your data. Think about how you can organize your data so that you can more easily find the answer to your question.

ACTIVITY 6.5 continued

My Notes

**6.5** Data Collection and Representation

continued

**Ouestions and Answers** 

My Notes

# SUGGESTED LEARNING STRATEGIES: Debriefing, Create Representations

Raeanna helped her grandmother survey 19 women and 17 men in her retirement community. The question and survey results are shown below. Raeanna wrote a W for a woman's choice and an M for a man's.

- **12.** One or two classes will be offered, depending on how many people indicate interest. What decision can be made by looking at Raeanna's record sheet?
- **13.** Raeanna decided that she needed to organize the data for her grandmother. Is it important that Raeanna consider whether the answer came from a woman or a man? Should she consider the number of people who are not interested? Help Raeanna organize the data by writing a plan for her.

14. Use your plan to organize the data for Raeanna.

## Data Collection and Representation Questions and Answers

SUGGESTED LEARNING STRATEGIES: Create Representations, Quickwrite

- **15.** Raeanna's grandmother wants to present these data at a meeting of the retirement community where a decision about which crafts classes to offer will be made.
  - **a.** Make a graph that she can use at the meeting.

- **b.** Explain why you chose the kind of graph you made in Part a.
- **c.** Predict what the decision about the crafts classes will be.
- **16.** On separate paper, organize the data you collected for your survey (Questions 5 and 11). Use graph paper to make a graph of your data.

Paolo read an article about a proposed youth center. He told his father he was pleased that so much of the community was in favor of spending more money to add a swimming pool. Paolo showed him a graph from the newspaper. Paolo's father cut it out of the paper.





My Notes

# ACTIVITY 6.5 Data Collection and Representation

**Questions and Answers** 

continued

		Му	No	ote	25	

# SUGGESTED LEARNING STRATEGIES: Predict and Confirm, Quickwrite

**17.** Paolo's father suggested that the graph might be misleading. He gave it to Paolo and told him to look carefully at it. Give at least two reasons that his father said this.

- **18.** What does the graph really show about community support for spending extra money for a swimming pool?
- **19.** Look in newspapers and magazines for graphs or visual displays that may be misleading. For each one tell why it is misleading and how it should be fixed to represent the true situation.

# **CHECK YOUR UNDERSTANDING**

Write your answers on notebook paper. Show your work.

- **1.** Write a question that can used to decide if there is interest in forming a group to play word games during lunchtime.
- **2.** What is the population for the question you just wrote? What would be a good sample for this question?
- **3.** The following data are responses about driving habits and the cost of fuel.

Driving less often	24
No changes	18

Driving more often

Make a graph to show these results.

6

- **4.** Write two sentences about the graph you made in Question 3.
- 5. Explain why this graph is misleading.



**6.** MATHEMATICAL Explain why it is important to examine representations of data carefully.

# **Data Display and Summary Statistics** BASEBALL HALL OF FAME

#### Write your answers on notebook paper or grid paper. Show your work.

The Baseball Hall of Fame is located in Cooperstown, NY. Induction ceremonies for new members occur each July. Quentin gathered data from the website that indicated 228 players were members of the Baseball Hall of Fame.

- **1.** Quentin organized the Hall of Fame members according to what position they played on the field. In the My Notes space is his data showing the position [and abbreviation] with the number of Hall of Famers who had that position.
  - **a.** Calculate the number of catchers inducted into the Hall of Fame.
  - **b.** Copy and complete Quentin's chart shown below.
    - In the first two columns of the chart enter the Hall of Fame data that Quentin found.
    - In Column 3 give the fraction of total number of players each category represents.
    - In Column 4 show the percent of the total that is represented by each position.
    - In Column 5 give the number of degrees needed for the sector in a circle graph.

Position Abbreviation	Number of Members	Fraction	Percent	Degrees in the Sector
Ρ	71	$\frac{71}{228}$	31.10%	112°
OF/DH				
1B				
2B				
3B				
SS				
C				

- **c.** Create a circle graph for this data.
- **d.** Make a bar graph of this data.
- **e.** Compare and contrast the circle graph and bar graph.

# Embedded Assessment 2

Use after Activity 6.5.

#### Positions Represented in Baseball Hall of Fame

Pitchers [P] 71 First Base [1B] 21 Second Base [2B] 18 Short Stop [SS] 23 Catcher [C] <u>??</u> Third Base [3B] 13 Outfielders and Designated Hitters [OF/DH] 66

# Embedded Assessment 2

Use after Activity 6.5

# Data Display and Summary Statistics BASEBALL HALL OF FAME

**2.** Baseball Hall of Famer Lou Gehrig played for the New York Yankees from 1923–1936. The number of homeruns that he hit each year of his major league career (except for his last year) are listed below.

 $1 \quad 0 \quad 20 \quad 16 \quad 47 \quad 27 \quad 35 \quad 41 \quad 46 \quad 34 \quad 32 \quad 49 \quad 30 \quad 49 \quad 37 \quad 29$ 

- **a.** Create a stem plot for this data with a legend and a title.
- **b.** Write a summary of the graphical display using the median as the measure of center. Be sure to include each of the three important elements of a numerical display summary.
- **c.** If Gehrig had not become ill and had played one more year, hitting 50 homeruns that year, how would that have affected the mean, median and mode of his yearly homerun data?
- **3.** Think about your favorite sport.
  - **a.** Write two questions to gather information about your favorite sport and people who participate in the sport. One question should produce categorical data and one question should produce numeric data. Identify which of your questions will collect each type of data.
  - **b.** What population would you survey to collect data about these questions?
- **4.** Mr. Holcomb's homeroom was surveyed on the question: *Should the class picnic be held on Monday or Friday afternoon?* The results for the twenty-eight students who responded showed that 16 favored Friday afternoon and 12 preferred Monday afternoon.
  - **a.** Create a bar graph that exaggerates the difference in the two results.
  - **b.** Explain what you did to create the misleading impression.

# **Data Display and Summary Statistics**

## **BASEBALL HALL OF FAME**

## **Embedded Assessment 2** *Use after Activity 6.5.*

	Exemplary	Proficient	Emerging
Math Knowledge #1a, 1b, 3a, 3b	The student correctly: • Determines the number of catchers (1a), • Fills in the four columns of the chart (1b), • Writes 2 questions and identifies them as to type (3a), • Describes the population (3b).	The student attempts all four of the items but only three are correct and complete.	The student attempts at least three of the items but only two are correct and complete.
Representation #1c, 1d, 2a, 4a	The student correctly: • Creates a circle graph (1c), • Creates a bar graph (1d), • Creates a stem plot (2a), • Creates a bar graph (4a).	The student attempts all four of the items but only three are correct and complete.	The student attempts three of the items but only two are correct and complete.
Communication #1e, 2b, 2c, 4b	The student: • Correctly compares and contrasts the circle and bar graphs (1e), • Summarizes the graphical display using the three elements (2b), • Explains the effects of adding data points (2c), • Describes the false impression created with the graph (4b).	The student attempts all four of the items but only three are correct and complete.	The student attempts three of the items but only two are correct and complete.

#### **ACTIVITY 6.1**

UNIT 6

- **1.** Write a brief explanation that describes the meaning of the following statements.
  - **a.** The probability that Monday is randomly chosen out of all of the days of the week is  $\frac{1}{7}$ .
  - **b.** The probability that Mars is randomly chosen from all of the planets in our solar system is  $\frac{1}{8}$ .
- **2.** Consider the digits 1 through 9. Write each probability as a fraction, a decimal, and a percent.
  - **a.** Randomly choosing a multiple of 3 from these digits.
  - **b.** Randomly choosing a prime number from these digits.
- **3.** Sam has a pocket full of coins with 7 quarters, 6 dimes, 5 nickels, and 4 pennies. He pulls one coin out of his pocket. Find the following.
  - **a.** P(quarter) =
  - **b.** P(nickel) =
  - **c.** P(dime) =
  - **d.** P(penny) =
  - **e.** Are these events equally likely? Justify your answer.
  - **f.** P(complement of a dime) =
  - **g.** Find the sum of P(dime) and P(complement of a dime).
  - **h.** Explain why this sum makes sense.
- **4.** You need to choose two planets for a science report. Is the compound event of getting Mars then Earth independent or dependent? Explain your reasoning.

- **5.** Suppose that a person had a bag of marbles and made statements about the marbles in the bag. Explain what you can conclude from each statement and tell why.
  - **a.** The probability of pulling a green marble out of the bag is 1.
  - **b.** The probability of pulling a green marble out of the bag is 0.
- **6.** Suppose you were to toss a number cube with the numbers 2, 2, 3, 4, 4, and 6.
  - **a.** Copy and complete the table with the theoretical probability for each outcome.

Number on Cube	Theoretical Probability
1	
2	
3	
4	
5	
6	

- **b.** Explain below how you determined your answers in the above table.
- **c.** Make a bar graph for 42 tosses of this number cube.
- **d.** What is the sum of the theoretical probabilities? Explain why you get this sum.

**UNIT 6** 

#### ACTIVITY 6.2

Amalia has some more questions about Spinner #2.



Spinner 2

- **7.** List all of the outcomes of a trial spin using the square spinner face.
- **8.** Use the spinner to answer the following questions.
  - **a.** Find P(A).
  - **b.** Find *P*(B).
  - **c.** Find P(C).
  - **d.** Find P(A or B).
  - **e.** Are the outcomes of the spinner equally likely outcomes? Write a brief explanation to support your answer.
- **9.** If the spinner were spun 60 times, how many times would you expect for it to land on each outcome. Justify your answer.

#### ACTIVITY 6.3

- 10. The Student Council has 36 members. Each member serves on one of the five committees. The committees and number of members are Homecoming: 12, Elections: 9, Open House: 6, Spring Dance: 6, Field Day: 3.
  - **a.** Create a table with the following column headings: Committee, Number of Members, Fraction of the Council, and Percent of the Council.
  - **b.** Fill in the first two columns with the data above. Then calculate the last two columns.
  - **c.** Create a bar graph using this data. Be sure to include a title and labels for your graphs.
  - **d.** Create a circle graph using this data.
- **11.** Delilah is researching the cost of college. She measured a circle graph with sectors for six cost categories and made the chart below.

Category	Degrees in Sector
Tuition	
Room	70°
Board	45°
Transportation	35°
Fees	20°
Books	15°

- **a.** How many degrees of the circle will remain for the sector representing Tuition?
- **b.** Create your own circle graph based on Delilah's research on costs for college.
- **c.** If the cost for one semester of school this year will be \$12,600, make a table showing the Dollars Needed for each category.

UNIT 6

12. Yvette is gathering data about used cars. She notices that many cars listed for sale are white or silver and decides to gather data. Here are the percentages of used cars by color that she found.

Silver – 12%	White – 25%
Red/orange – 18%	Black – 5%
Other – 30%	Blue/green – 10%

- **a.** Create a table using the following column headings: Color, Percent, Fraction, and Degrees.
- **b.** Fill in the chart using the data above to fill the first two columns. Column 3 represents what fraction of the used cars Yvette found had that color. Column 4 gives the degrees for the sector of a circle graph. Make calculations to fill in the chart.
- **c.** Create the circle graph for this data.
- **d.** Create a bar graph for this data using percent for the vertical axis.
- **13.** Phillipa works at a store that sells athletic footwear. The data below represents the number of pairs of shoes sold last week.

Running – 18	Cross Trainer – 12
Triathalon – 10	Walking – 15
Long Distance – 9	Other – 8

- **a.** How many pairs of shoes were sold last week?
- **b.** Create a chart for Last Week's Shoe Sales with the following column headings: Shoe Type, Number, Fraction, Percent, Degrees.
- **c.** Fill in the first two columns with the data above. Column 3 gives the fraction of total pairs sold. Column 4 gives the percent of total pairs sold. Column 5 gives the degrees for a circle graph. Calculate to complete the chart.
- **d.** Create a circle graph and a bar graph for this data.

## ACTIVITY 6.4

- **14.** Create a circle graph for your class data for the question "Where do you sit in this class (front, middle, back)?"
- **15.** Create a bar graph for your class data for the item "Favorite school subject."
- **16.** A class set of data from Kai's old school shows responses to the item "Number of hours of sleep that you had last night."

8	8	$7\frac{1}{2}$	6	7	$6\frac{1}{2}$	$8\frac{1}{2}$	9	$9\frac{1}{2}$	8
7	7	6	5	$6\frac{1}{2}$	8	7	$6\frac{1}{2}$	5	$7\frac{1}{2}$
8	9	7	9	6	$5\frac{1}{2}$	8	6		

- **a.** Find the mean, median, and mode data.
- **b.** Give the range.
- **c.** Identify any outliers in the data set.
- **d.** Compare this data with the data from your class. Explain the similarities and differences that you notice.
- **17.** Make a dot plot for the class data to display results for the item "Number of hours of sleep that you had last night."
- **18.** Prepare a stem plot from the class data for responses to the item "Minutes that it took you to travel to school today."
- **19.** A data set from a class at Kai's old school gives answers to the item "Minutes it took you to travel to school today."

45	22	40	51	54	45	19	11	42
71	8	5	21	14	29	47	7	15
56	18	48	17	21	34			

- **a.** Create a stem plot for this data with the appropriate labels and titles.
- **b.** Write a descriptive summary of the data set.
- **c.** Compare this data with the data from your class. Explain the similarities and differences that you notice.

**UNIT 6** 

## ACTIVITY 6.5

- **20.** Write a question that can used to decide if there is interest in forming a Theater Club that would put on two plays a year.
- **21.** What is the population for the question you just wrote? What would be a good sample for this question?
- **22.** The following data are average number of times people eat during a day.

Less than 3 times	30
3 times	90
More than 3 times	60

Make a graph to show these results.

**23.** Write two sentences about the graph you made in Question 22.

**24.** Draw a circle graph to show why this graph with data from 360 surveys is misleading.



**25.** Explain at least two ways that a graph can be misleading.

An important aspect of growing as a learner is to take the time to reflect on your learning. It is important to think about where you started, what you have accomplished, what helped you learn, and how you will apply your new knowledge in the future. Use notebook paper to record your thinking on the following topics and to identify evidence of your learning.

#### **Essential Questions**

- 1. Review the mathematical concepts and your work in this unit before you write thoughtful responses to the questions below. Support your responses with specific examples from concepts and activities in the unit.
  - How does understanding probability help you make decisions?
  - Why is it important for you to understand how data is organized and presented in real-world situations?

#### **Academic Vocabulary**

2. Look at the following academic vocabulary words:

- outcomepopulation
- probability sample
- survey variable

Choose three words and explain your understanding of each word and why each is important in your study of math.

#### Self-Evaluation

**3.** Look through the activities and Embedded Assessments in this unit. Use a table similar to the one below to list three major concepts in this unit and to rate your understanding of each.

Unit Concepts	Is Your Understanding Strong (S) or Weak (W)?
Concept 1	
Concept 2	
Concept 3	

- a. What will you do to address each weakness?
- **b.** What strategies or class activities were particularly helpful in learning the concepts you identified as strengths? Give examples to explain.
- **4.** How do the concepts you learned in this unit relate to other math concepts and to the use of mathematics in the real world?

**1.** When analyzing the measures of central tendency for a data **1.**  $\bigcirc$   $\bigcirc$   $\bigcirc$   $\bigcirc$ set, which measure is always found in the data set itself?

F. range	H. median
<b>G.</b> mode	I. mean

**2.** Find the range of the data set.

373.7, 262.8, 124.3, 385.6, 143.9

3. Robert numbered a cube with 1, 1, 2, 3, 3, and 6. He rolled it 18 times and recorded the results. Then he made a bar graph of the results.

Solve Explain

Read



**Part A:** Find both the theoretical and experimental probabilities for the events of rolling 1, 2, 3, and 6.

Event	Theoretical Probability	Experimental Probability
Rolling 1		
Rolling 2		
Rolling 3		
Rolling 6		

Part B: Compare the theoretical and experimental probabilities for the events of rolling 1, 2, 3, and 6. Predict how the experimental probabilities would change if Robert rolled the cube 216 times. Use a mathematical law to justify your answer.

#### Solve and Explain

$\odot$				$\overline{\bigcirc}$	$\overline{\bigcirc}$
4) (5) (6)	456	456	456	4) (5) (6)	456
7 8 9	7 8 9	7 8 9	7 8 9	7 8 9	7 8 9

2.

**Math Standards** 

Review

Unit 6



Explain

Read	4.	Cynthia's parents pay her weekly for chores. She receives
Solve		\$1.00 per chore.

Week	Chores Completed
1	24
2	26
3	24
4	26
5	24
6	28
7	25
8	23

**Part A:** Make a dot plot of this data.

**Part B:** Find the mean, median, mode, and range for the chores Cynthia completed. Explain which measure best describes these data.

#### Solve and Explain

**Part C:** Suppose that in week 9 Cynthia does 25 chores. How does this change the data set?

#### Solve and Explain