Unit 5

Statistics, Data Analysis, and Probability

Focus

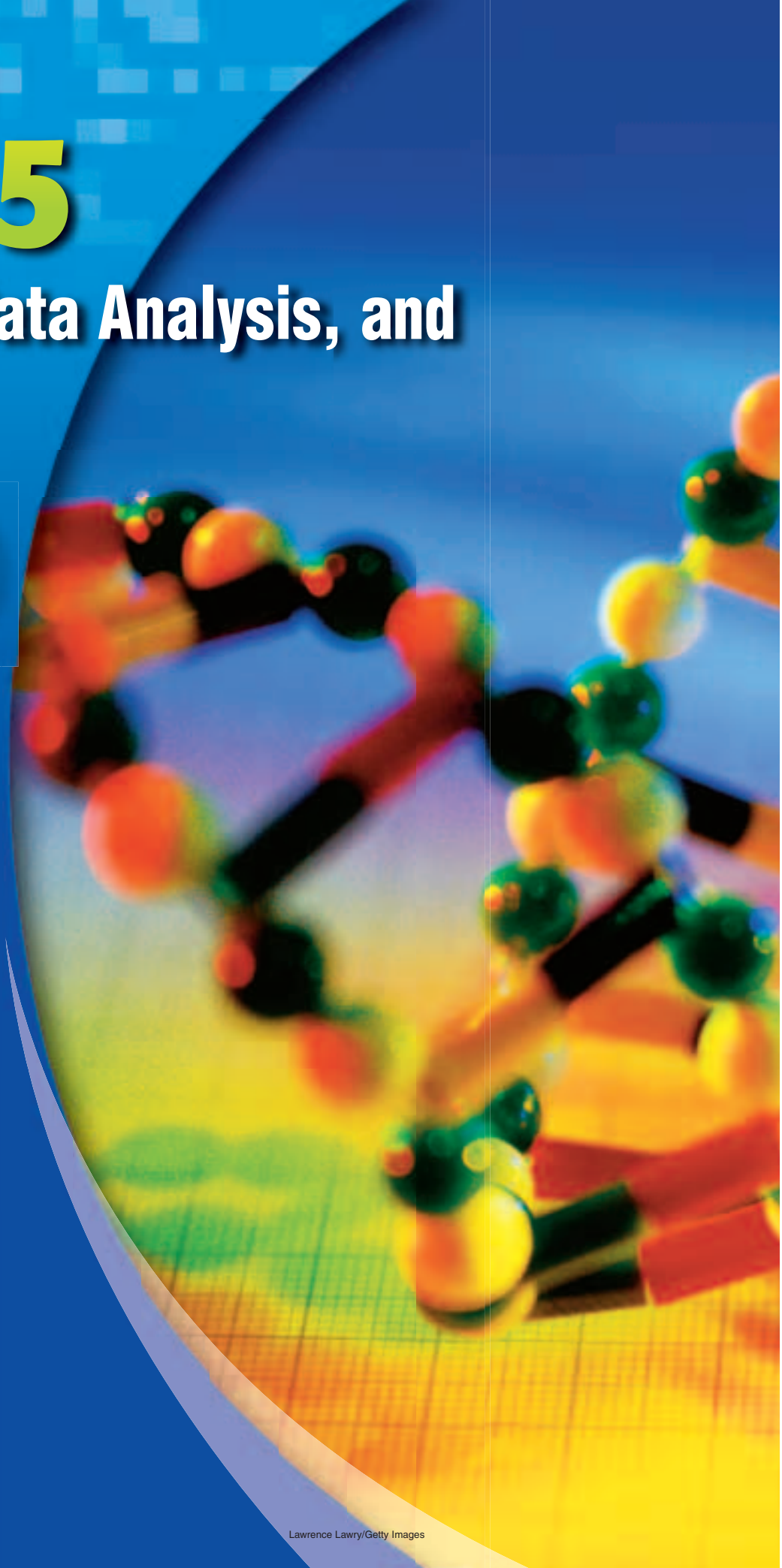
Use statistical procedures and probability to describe data and make predictions.

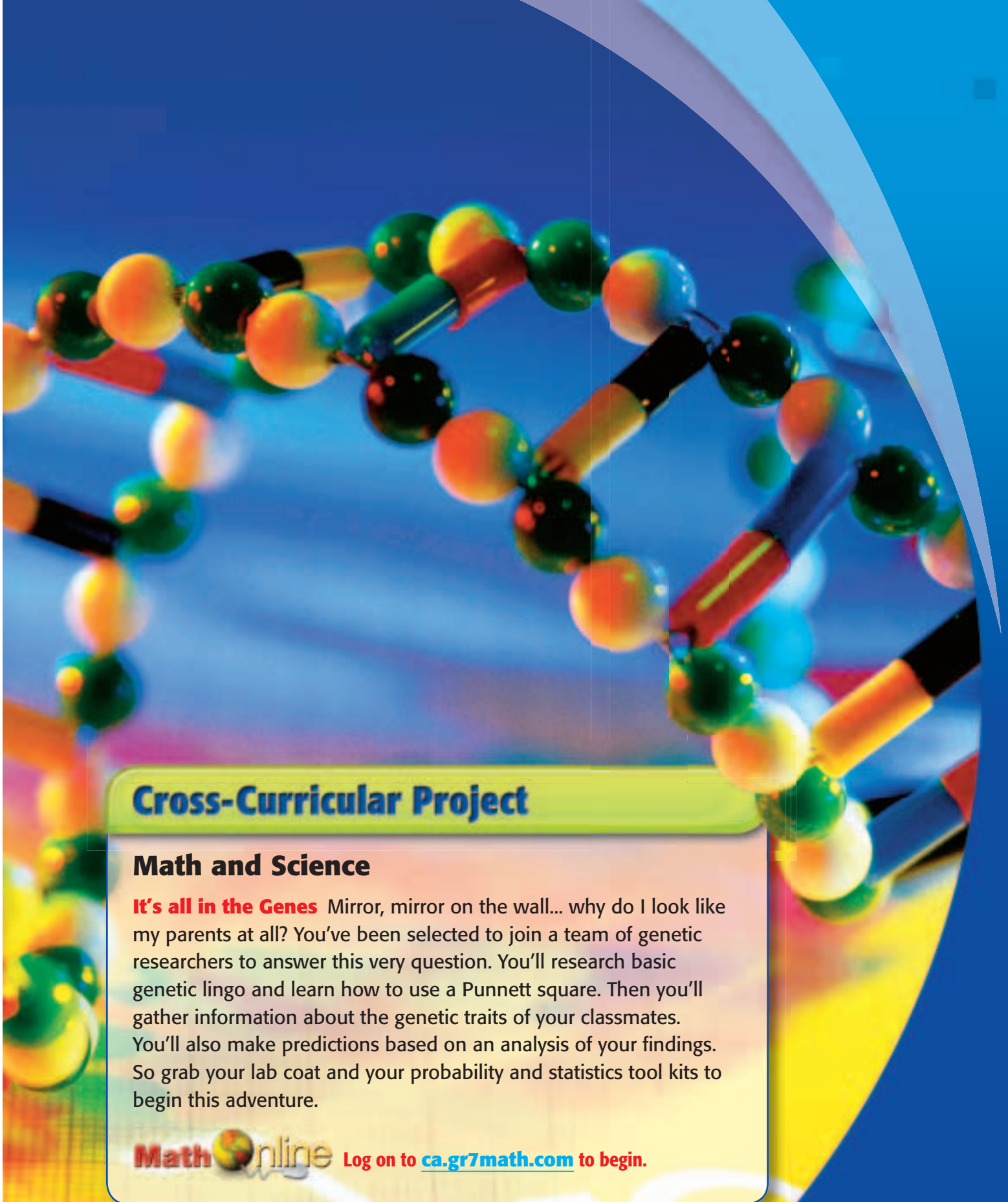
CHAPTER 11
Statistics

BIG Idea Collect, organize, and represent data sets that have one or more variables and identify relationships among variables within a data set by hand and through the use of an electronic spreadsheet.

CHAPTER 12
Probability

BIG Idea Determine theoretical and experimental probabilities and use these to make predictions about events.





Cross-Curricular Project

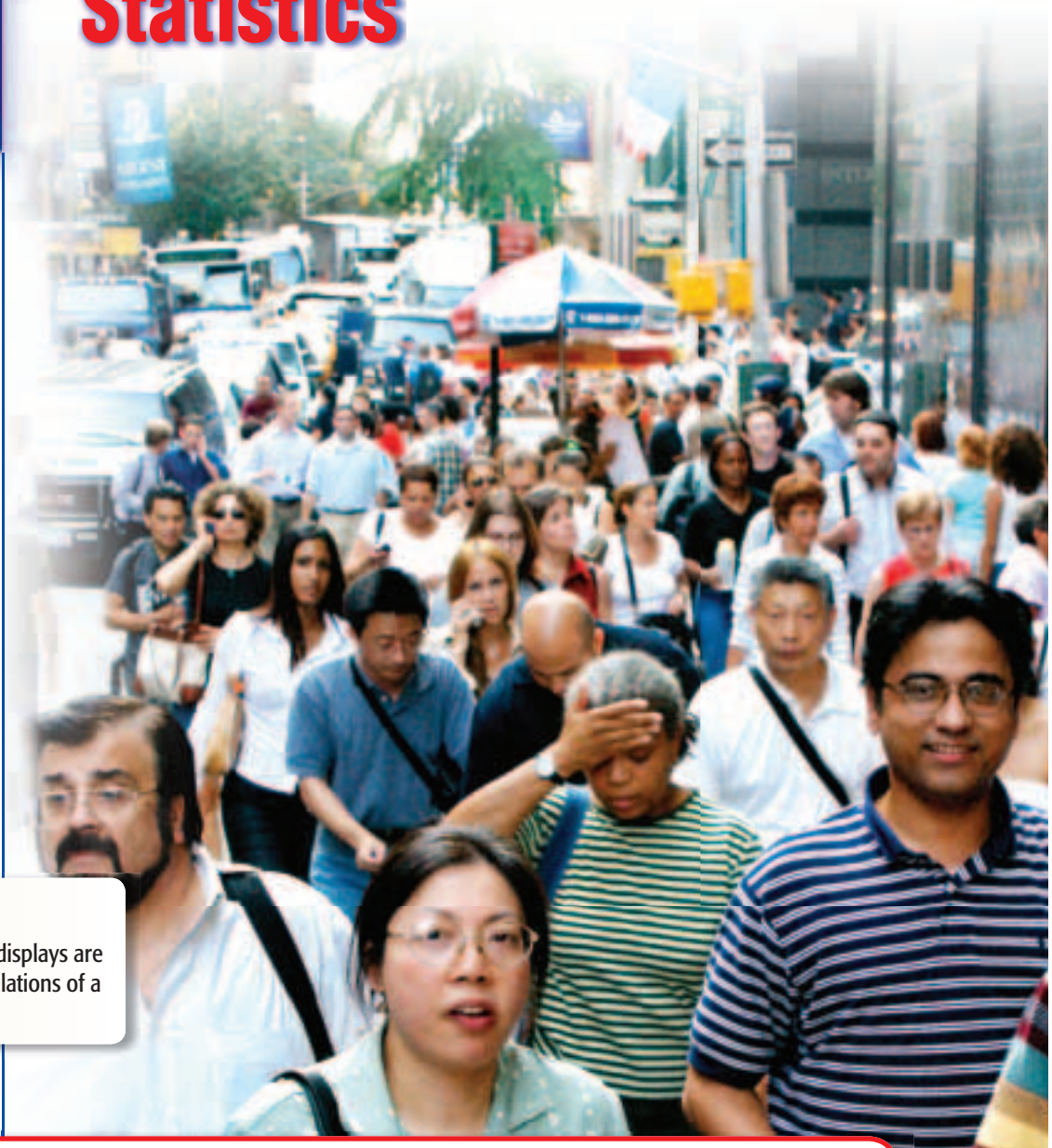
Math and Science

It's all in the Genes Mirror, mirror on the wall... why do I look like my parents at all? You've been selected to join a team of genetic researchers to answer this very question. You'll research basic genetic lingo and learn how to use a Punnett square. Then you'll gather information about the genetic traits of your classmates. You'll also make predictions based on an analysis of your findings. So grab your lab coat and your probability and statistics tool kits to begin this adventure.

MathOnline **Log on to ca.gr7math.com to begin.**

CHAPTER 11

Statistics



BIG Ideas

- **Standard 7SDAP1.0** Collect, organize, and represent data sets that have one or more variables and identify relationships among variables within a data set by hand and through the use of an electronic spreadsheet.

Key Vocabulary

circle graph (p. 576)
histogram (p. 570)
measures of central tendency (p. 585)
measures of variation (p. 593)

Real-World Link

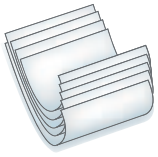
Population Statistics and statistical displays are frequently used to describe the populations of a country, state, or city.

FOLDABLES Study Organizer

Statistics Make this Foldable to help you organize your notes. Begin with five pieces of $8\frac{1}{2}'' \times 11''$ paper.

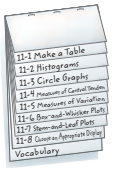
1. **Place** 5 sheets of paper $\frac{3}{4}$ inch apart.

2. **Roll** up bottom edges. All tabs should be the same size.



3. **Crease** and staple along the fold.

4. **Label** the tabs with the topics from the chapter. Label the last tab Vocabulary.



Robert Brenner/PhotoEdit

GET READY for Chapter 11

Diagnose Readiness You have two options for checking Prerequisite Skills.

Option 1

Take the Quick Check below. Refer to the Quick Review for help.

QUICK Check

Graph each set of points on a number line. (Lesson 1-3)

1. {7, 8, 10, 15, 16}
2. {15, 20, 21, 25, 30}

Add or subtract. (Lessons 1-4 and 1-5)

3. $-4 + (-8)$
4. $-5 + 2$
5. $7 + (-3)$
6. $1 - (-5)$
7. **GOLF** Gary's golf scores relative to par on two holes were 3 and −2. Find his total score relative to par for the two holes. (Lesson 1-4)

Order each set of rational numbers from least to greatest. (Lesson 2-2)

8. 0.23, 2.03, 0.32
9. 5.4, 5.64, 5.46, 5.6
10. 0.01, 1.01, 0.10, 1.10
11. **LUNCH** Horace's lunch cost $3.71, Susan's cost $3.17, and Paul's cost $3.07. Write these costs in order from least to greatest. (Lesson 2-2)

Solve each problem. (Lesson 5-7)

12. Find 52% of 360.
13. What is 36% of 360?
14. Find 14% of 360.

QUICK Review

Example 1

Graph the set {2, 4, 5, 9} on a number line.

Example 2

Find $6 + (-4)$.

$6 + (-4) = 2$ — 6 and −4 have opposite signs. Subtract the absolute values, 6 and 4. The difference, 2, has the sign of the larger absolute value, 6.

Example 3

Order 6.08, 0.68, and 8.60 from least to greatest.

Line up the decimal points.

6.08
0.68
8.60

Compare the digits in each place value position.

The order from least to greatest is 0.68, 6.08, and 8.60.

Example 4 **What is 72% of 360?**

$72\% \text{ of } 360 = 0.72 \times 360$ — Use the percent equation.

$= 259.2$ — Multiply.

Option 2

MathOnline Take the Online Readiness Quiz at ca.gr7math.com.

11-1 Problem-Solving Investigation

MAIN IDEA: Solve problems by making a table.

Standard 7MR2.5 Use a variety of methods, such as words, numbers, symbols, charts, graphs, **tables**, diagrams, and models, to explain mathematical reasoning. **Standard 7SDAP1.1 Know various forms of display for data sets**, including stem-and-leaf plot or box-and-whisker plot; **use the forms to display a single set of data or to compare two sets of data.**

P.S.I. TEAM +

e-Mail: MAKE A TABLE

YOUR MISSION: Make a table to solve the problem.

THE PROBLEM: How many acids, bases, and neutral substances were tested in science class?

DARREN: In science class, I learned that substances with pH values less than 7 are acids, those with pH values greater than 7 are bases, and substances with pH values equal to 7 are neutral. I tested several solutions and listed the pH values.

EXPLORE	You have a list of the pH values. You need to know how many substances have a pH value of less than 7, greater than 7, and equal to 7.
PLAN	Make a table to show the *frequency,* or number, of pH values in each interval.
SOLVE	He tested 9 acids, 7 bases, and 4 neutral substances.
CHECK	He tested 9 + 4 + 7, or 20, substances. There are 20 values listed, so the table seems reasonable.

7	8	4	3
8	7	9	7
5	2	3	7
4	6	8	5
9	9	8	6

pH number	Tally	Frequency
Less than 7	𝍸 ||||	9
Equal to 7	||||	4
Greater than 7	𝍸 ||	7

Analyze The Strategy

1. Tell an advantage and disadvantage of listing the values in a table.
2. Describe two types of information you have seen recorded in a table.
3. WRITING IN MATH Write a problem that can be answered using a table. Then solve the problem by making a table.

Mixed Problem Solving

Solve Exercises 4 and 5. Use the *make a table* strategy.

4. **LUNCH** The list shows lunch prices of various items at a local diner. Organize the data in a table using intervals \$2.00–\$2.99, \$3.00–3.99, \$4.00–\$4.99, and so on. What is the most common interval of lunch prices?

\$2.50	\$3.00	\$3.75	\$4.25	\$4.25
\$4.50	\$4.75	\$4.75	\$5.00	\$5.00
\$5.00	\$5.00	\$5.50	\$5.50	\$5.75
\$5.80	\$6.00	\$6.00	\$6.00	\$6.50
\$6.75	\$7.00	\$8.50	\$10.00	\$10.00

5. **CARS** Dexter's brother wants to buy a used car. The list shows the model year of the cars listed in the classified ads. Which year is listed most frequently?

1998	2000	1999	1999	2001	2001
2002	1998	2000	2000	1997	2001
1998	1999	2001	2001	1999	2000
2000	1997	1999	1998	2002	1997
2000	1999	2000	2001	1999	1999

Use any strategy to solve Exercises 6–9. Some strategies are shown below.

PROBLEM-SOLVING STRATEGIES
- Use the four-step plan.
- Use logical reasoning.
- Solve a simpler problem.
- Make a table.

6. **FORESTS** About what percent of the tree diameters below are from 4 to 9.9 inches?

Sample Tree Diameters from Cumberland National Forest		
Diameter (in.)	**Tally**	**Frequency**
2.0–3.9	𝍸 |	6
4.0–5.9	𝍸 𝍸 𝍸 𝍸 𝍸 𝍸	30
6.0–7.9	𝍸 𝍸 𝍸 𝍸 𝍸 |||	28
8.0–9.9	𝍸 𝍸 𝍸 𝍸 ||||	24
10.0–11.9	𝍸 𝍸 𝍸 ||||	19
12.0–13.9	||||	4

7. **MAGAZINES** The first magazine in the United States was published in 1845. If 12 issues were published each year, including 1845, how many issues would be published through 2010?

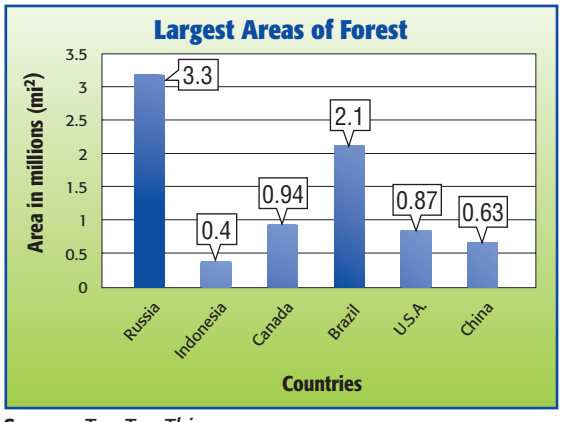
8. **SPORTS** In a recent survey of 120 students, 50 said they play basketball and 60 said they play soccer. Of those, 20 play both sports. How many students do not play either basketball or soccer?

9. **PHOTOGRAPHY** How many ways are there to arrange five French club members for a yearbook photo if the president and vice president must be seated in front with the other three members behind them?

Select the Operation

For Exercises 10 and 11, select the appropriate operation(s) to solve the problem. Justify your selection(s) and solve the problem.

10. **GEOGRAPHY** Name three countries that have a combined area of forests that is about equal to the area of forest in Russia.



Source: *Top Ten Things*

11. **BASKETBALL** The average salary of an NBA player is \$4.5 million per season. The average salary of a WNBA player is \$43,000 per season. About what percent of the average NBA player's salary is the average WNBA player's salary?

11-2 Histograms

Main IDEA

Display and interpret data in a histogram.

Standard 7SDAP1.1 Know various forms of display for data sets, including stem-and-leaf plot or box-and-whisker plot; **use the forms to display a single set of data or to compare two sets of data.**

GET READY for the Lesson

BASKETBALL Kylie researched the average ticket prices to NBA basketball games for 30 teams. The frequency table shows the results.

1. What do you notice about the price intervals in the table?
2. How many tickets were at least $20.00 but less than $50.00?

Price Interval ($)	Tally	Frequency
20.00–29.99	|	1
30.00–39.99	𝍸 𝍸 |	11
40.00–49.99	𝍸 𝍸	10
50.00–59.99	𝍸	5
60.00–69.99	|	1
70.00–79.99	||	2

NEW Vocabulary

histogram

Data from a frequency table can be displayed as a histogram. A **histogram** is a type of bar graph used to display numerical data that have been organized into equal intervals.

EXAMPLE 1 Construct a Histogram

REVIEW Vocabulary

bar graph: a graphic form using bars to make comparisons of statistics (page 662)

FOOD Choose intervals and make a frequency table of the data shown. Then construct a histogram to represent the data.

Calories of Soup-in-a-Cup				
380	225	110	176	218
241	280	160	155	180
195	166	178	207	240
239	144	212	235	221

The least value in the data is 110 and the greatest is 380. An interval size of 50 Calories would yield the frequency table at the right.

Calories	Tally	Frequency
100–149	||	2
150–199	𝍸 ||	7
200–249	𝍸 ||||	9
250–299	|	1
300–349		0
350–399	|	1

To construct a histogram, follow these steps.

READING in the Content Area

For strategies in reading this lesson, visit ca.gr7math.com.

Step 1 Draw and label a horizontal and vertical axis. Include a title.

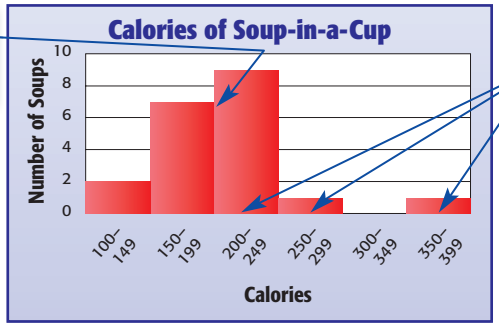
STUDY TIP

Gaps Intervals with a frequency of 0 have a bar height of 0. This is referred to as a *gap*.

Step 2 Show the intervals from the frequency table on the horizontal axis.

Step 3 For each Calorie interval, draw a bar whose height is given by its frequency.

There is no space between bars.



Because all of the intervals are equal, all of the bars have the same width.

CHECK Your Progress

a. **SCHOOL** The list at the right gives a set of test scores. Choose intervals, make a frequency table, and construct a histogram to represent the data.

Test Scores							
94	85	73	93	75	77	89	80
89	83	79	81	87	85	90	83
88	86	83	91	93	93	92	90
91	88	96	97	98	82	90	100

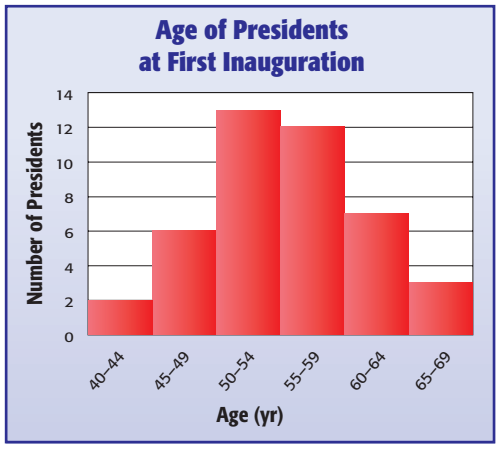
Personal Tutor

Personal Tutor at ca.gr7math.com

EXAMPLES Analyze and Interpret Data

2 **HISTORY** **How many presidents were younger than 50 years old when they were first inaugurated?**

Two presidents were 40–44 years old, and six presidents were 45–49 years old. Therefore, 2 + 6 or 8 presidents were younger than 50 when they were first inaugurated.



Source: *The World Almanac*

3 **HISTORY** **How old was the oldest president at his first inauguration?**

This cannot be determined from the data as presented in this graph. The histogram only tells us that the oldest president was either 65, 66, 67, 68, or 69 years old.

CHECK Your Progress

b. How many presidents were 60 years old or older when they were first inaugurated?

c. Based on the data above, at what age is a president most likely to be first inaugurated?

CHECK Your Understanding

Example 1 (p. 570–571)

1. **WEATHER** The list gives the record high temperatures in degrees Fahrenheit for each state in the United States. Choose intervals and make a frequency table. Then construct a histogram to represent the data.

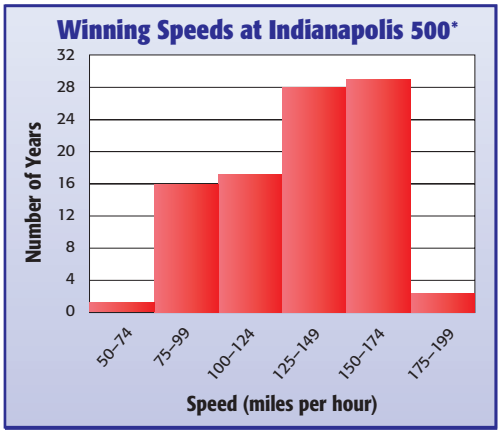
State Record High Temperatures (°F)									
112	100	128	120	134	118	106	110	109	112
100	118	117	116	118	121	114	114	105	109
107	112	114	115	118	117	118	125	106	110
122	108	110	121	113	120	119	111	104	111
120	113	120	117	105	110	118	112	114	115

Source: National Climatic Data Center

Examples 2, 3 (p. 571)

AUTO RACING **For Exercises 2–4, use the histogram at the right.**

2. How many races had winning average speeds that were at least 150 miles per hour?
3. At which range of speeds is a car finishing in first place most likely to be? Explain your reasoning.
4. What is the fastest winning speed recorded at the Indianapolis 500?



Source: indy500.com *through 2005

Exercises

HOMEWORK HELP

For Exercises	See Examples
5, 6	1
7–14	2, 3

For each problem, choose intervals and make a frequency table. Then construct a histogram to represent the data.

5.

Calories of Frozen Fruit Bars						
25	35	200	280	80	80	90
40	45	50	50	60	90	70
40	100	120	45	60	350	

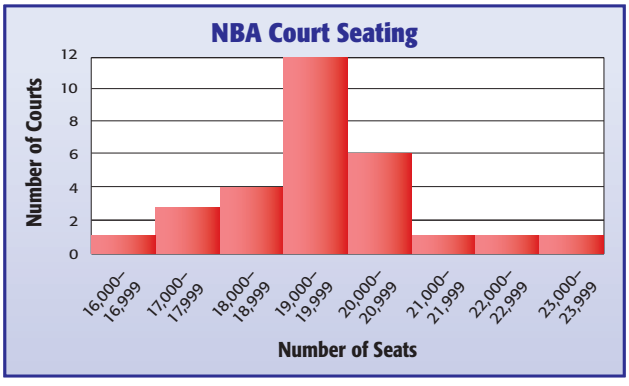
6.

Average Speed (mph), Selected Animals						
70	61	50	50	50	45	8
43	42	40	40	40	35	0.17
35	32	32	30	30	30	1.17
30	25	20	9	18	12	200

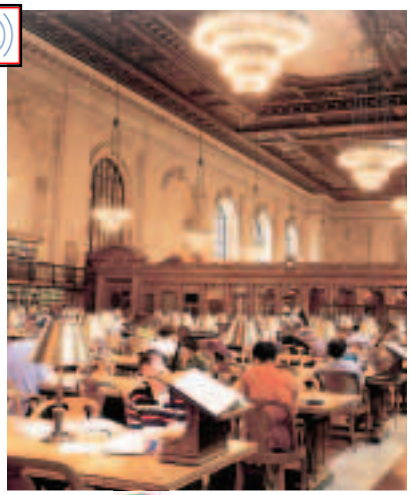
Source: *World Almanac for Kids, 2005*

BASKETBALL **For Exercises 7–10, use the histogram.**

7. How many courts have fewer than 19,000 seats?
8. How many courts have 18,000–19,999 seats?
9. How likely is it that any given NBA court will seat more than 21,000 people?
10. Which court has the fewest seats?



Source: *The World Almanac*

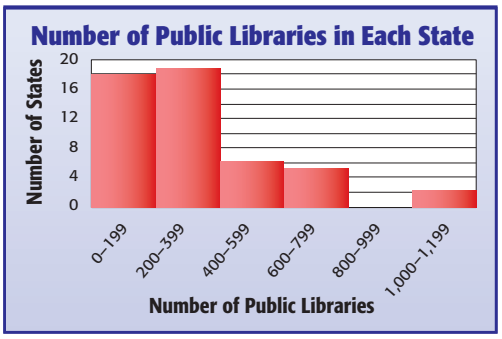


Rafael Macia/Photo Researchers

Real-World Link . . . . .
There are 16,486 public libraries in the United States. The state with the most public libraries is New York (1,088) followed by California (1,074), and then Texas (848).
Source: *World Almanac 2005*

LIBRARIES **For Exercises 11–14, use the histogram at the right.**

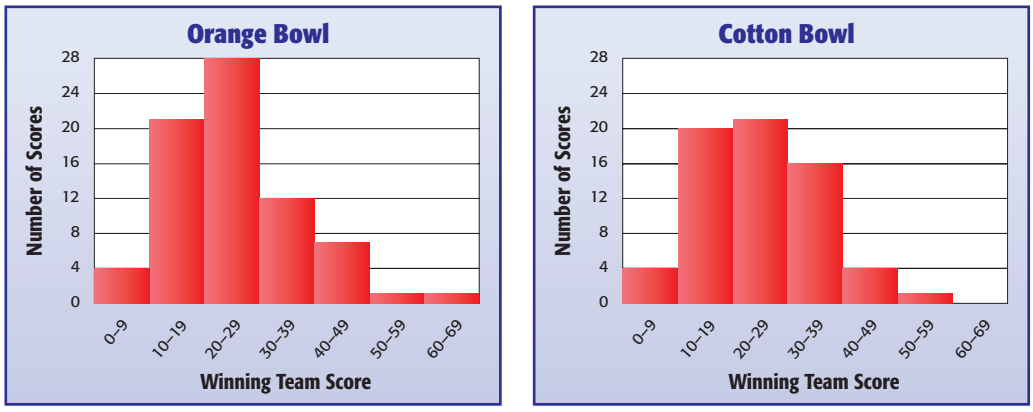
11. How many states have at least 600 public libraries?
12. Which state has the fewest public libraries?
13. How many public libraries does a typical U.S. state have? Explain your reasoning.
14. How many states have between 400 and 800 public libraries?



Source: Public Libraries Survey

FOOTBALL **For Exercises 15–18, use the histograms shown.**

Scores of Winning Teams through 2005



Source: *The World Almanac*

15. Which bowl had the highest winning team score?
16. In which bowl game was the winning team score in the interval 30 and 49 points the most?
17. Determine which bowl game has had a winning team score of at least 40 points more often.
18. What was the lowest winning team score in each bowl game?

19. **COLLECT THE DATA** Conduct a survey of your classmates to determine the number of hours each person spends on the Internet during a typical week. Then choose intervals, make a frequency table, and construct a histogram to represent the data.

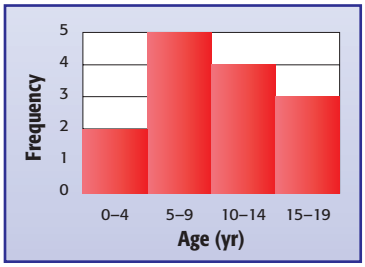
20. **RESEARCH** Use the Internet or other resource to find the populations of each county, census division, or parish in your state. Make a histogram using your data. How does your county, census division, or parish compare with others in your state?

21. **OPEN ENDED** Construct a histogram that has a vertical line of symmetry and two gaps. Then construct a histogram that has a vertical line of symmetry and one gap.

EXTRA PRACTICE
See pages 704, 718.
MathOnline
Self-Check Quiz at ca.gr7math.com

H.O.T. Problems

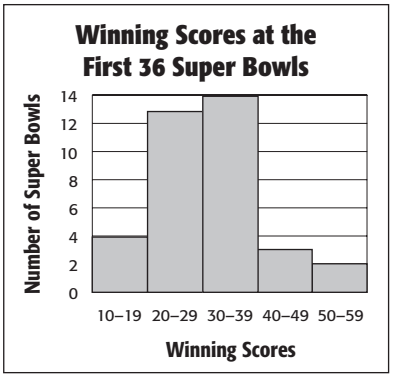
22. **CHALLENGE** Describe how the histogram at the right would change if larger intervals, such as 0–9 and 10–19, were used. Describe how it would change if smaller intervals, such as 0–2, 3–5, 6–8, and so on, were used.



23. **WRITING IN MATH** Describe when a histogram might be more useful than a table with individual data. Then describe when a table with individual data might be more useful than a histogram.

STANDARDS PRACTICE

24. Which statement can be concluded from the histogram?



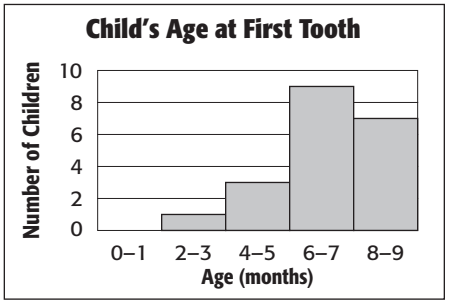
A The lowest winning score was 10.

B The highest winning score was 59.

C Most of the winning teams scored between 10 and 29 points.

D Most of the winning teams scored between 20 and 39 points.

25. A group of mothers reported when their children got their first tooth.



What fraction of the number of children reported got their first tooth when they were six months old or older?

F $\frac{9}{20}$

G $\frac{7}{20}$

H $\frac{4}{5}$

J $\frac{1}{5}$

Spiral Review

26. **THEME PARKS** The list gives the annual attendance in millions of persons for various theme parks in the United States. Use the *make a table* strategy to organize the data into intervals. (Lesson 11-1)

14.0	12.7	8.6	7.9	7.3	6.9
6.1	5.3	5.2	4.6	4.3	4.3
4.0	3.5	3.3	3.3	3.2	3.2
3.1	3.0	2.6	2.6	2.6	2.5

Source: *World Almanac,* 2005

27. **GEOMETRY** Express the length of one side of a cube whose volume is $64x^3$ cubic units as a monomial. (Lesson 10-8)

GET READY for the Next Lesson

PREREQUISITE SKILL **Solve each problem.** (Lessons 5-3 and 5-7)

28. Find 26% of 360.

29. What is 53% of 360?

30. Find 73% of 360.

Extend 11-2

Graphing Calculator Lab
Histograms

Main IDEA

Use a graphing calculator to make histograms.

Standard 7SDAP1.1 Know various forms of display for data sets, including stem-and-leaf plot or box-and-whisker plot; **use the forms to display a single set of data** or to compare two sets of data. **Standard 7MR2.5 Use a variety of methods, such as** words, numbers, symbols, **charts,** graphs, **tables,** diagrams, and models, **to explain mathematical reasoning.**

You can make a histogram using a graphing calculator.

ACTIVITY

Mr. Yamaguchi's second period class has listed the distance each student lives from the school. Make a histogram.

Distance from School (miles)											
4	2	6	1	10	3	19	5	20	1	1	9
22	15	2	4	12	8	1	4	16	3	6	7

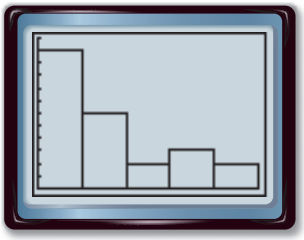
STEP 1 Clear any existing data in list L1 by pressing STAT ENTER ▲ CLEAR ENTER.

Then enter the data in L1. Input each number and press ENTER.

STEP 2 Turn on the statistical plot by pressing 2nd [STAT PLOT] ENTER ENTER.

Select the histogram and L1 as the Xlist by pressing ▼ ▶ ▶ ENTER ▼ 2nd L1 ENTER.

STEP 3 Press WINDOW. To set the viewing window to be [0, 25] scl: 5 by [0, 12] scl: 1, press WINDOW 0 ENTER 2.5 ENTER 5 ENTER 0 ENTER 12 ENTER 1 ENTER GRAPH.



STEP 4 Press GRAPH to create the histogram.

Analyze the Results

1. Press TRACE. Find the frequency of each interval using the right arrow key.
2. Explain why the x-values for this data set were chosen as 0 to 25.
3. **COLLECT THE DATA** Use the graphing calculator to make a histogram of your classmates' heights in inches.

11-3 Circle Graphs

Main IDEA

Construct and interpret circle graphs.

Standard 7SDAP1.1 Know various forms of display for data sets, including stem-and-leaf plot or box-and-whisker plot; **use the forms to display a single set of data** or to compare two sets of data.

NEW Vocabulary

circle graph

GET READY for the Lesson

Concepts in Motion
Interactive Lab ca.gr7math.com

MOVIES The graphic shows the results of a recent survey of 1,100 U.S. movie-goers.

Behaviors Americans Find Most Annoying at a Movie Theater

Someone talking on a cell phone during a movie	73%
A cell phone ringing during a movie	10%
Someone talking to their seatmate during a movie	10%
Someone who saves seats in a crowded theater	4%
Someone loudly eating popcorn or some other snack during a movie	3%

Source: Braun Research

1. What percent of U.S. movie-goers found a ringing cell phone the most annoying behavior at a movie theater?
2. What percent of U.S. movie-goers were annoyed with some kind of noise disturbance?
3. Which behavior was reported as the most annoying?
4. Are all the behaviors surveyed accounted for in the graphic? Explain.

A **circle graph** can be used to compare parts of a data set to the whole set of data. The entire circle represents the whole set, so the percents in a circle graph add up to 100.

EXAMPLE 1 Construct a Circle Graph from Percents

MOVIES **Construct a circle graph using the information above.**

Step 1 There are 360° in a circle. So, multiply each percent written as a decimal by 360° to find the number of degrees for each section of the graph.

Talking on a cell phone: 73% of $360° = 0.73 \cdot 360° \approx 263°$

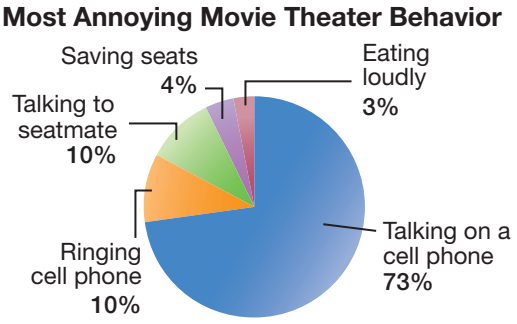
Ringing cell phone: 10% of $360° = 0.10 \cdot 360°$ or $36°$

Talking to seatmate: 10% of $360° = 0.10 \cdot 360°$ or $36°$

Saving seats: 4% of $360° = 0.04 \cdot 360° \approx 14°$

Eating loudly: 3% of $360° = 0.03 \cdot 360° \approx 11°$

Step 2 Use a compass to draw a circle and a radius. Then use a protractor to draw an 11° angle. This section represents someone eating loudly. From the new radius, draw the next angle. Repeat for each of the remaining angles. Label each section. Then give the graph a title.



CHECK Your Progress

a. **CELL PHONES** The table gives the percentage share of the top five wireless-subscribing countries in the world. Construct a circle graph to represent the data.

Global Wireless Subscribers	
Country	**Percentage Share**
China	19.3
U.S.A.	9.9
Russia	5.6
Japan	4.6
Brazil	4.1
Other	56.5

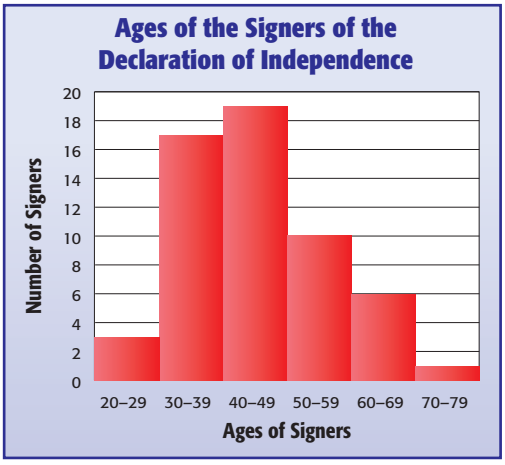
Source: *Computer Industry Almanac*

Real-World Link
Ben Franklin was the oldest signer of the Declaration of Independence. He was 70 years old.
Source: *The World Almanac*

When percents are not known, you must first determine what part of the whole each item represents.

EXAMPLE Construct a Circle Graph from Data

2 **HISTORY** **Construct a circle graph of the data in the histogram at the right.**



Source: *The World Almanac*

Step 1 Find the total number of signers of the Declaration of Independence.

$3 + 17 + 19 + 10 + 6 + 1 = 56$

Step 2 Find the ratio that compares the number in each age group to the total number of signers. Round to the nearest hundredth.

20 to 29: $3 \div 56 \approx 0.05$
30 to 39: $17 \div 56 \approx 0.30$
40 to 49: $19 \div 56 \approx 0.34$
50 to 59: $10 \div 56 \approx 0.18$
60 to 69: $6 \div 56 \approx 0.11$
70 to 79: $1 \div 56 \approx 0.02$

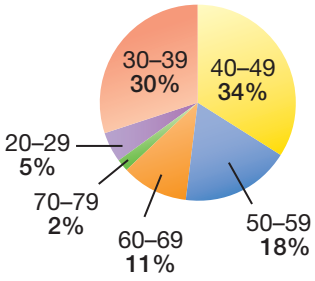
"Benjamin Franklin", 1789. Charles Wilson Peale. Oil on canvas. Historical Society of Pennsylvania, Philadelphia/Francis G.

Step 3 Use these ratios to find the number of degrees of each section. Round to the nearest degree if necessary.

20 to 29: $0.05 \cdot 360 = 18$
30 to 39: $0.30 \cdot 360 = 108$
40 to 49: $0.34 \cdot 360 = 122.4$ or about 122
50 to 59: $0.18 \cdot 360 = 64.8$ or about 65
60 to 69: $0.11 \cdot 360 = 39.6$ or about 40
70 to 79: $0.02 \cdot 360 = 7.2$ or about 7

Step 4 Use a compass and a protractor to draw a circle and the appropriate sections. Label each section and give the graph a title. Write the ratios as percents.

Ages of the Signers of the Declaration of Independence

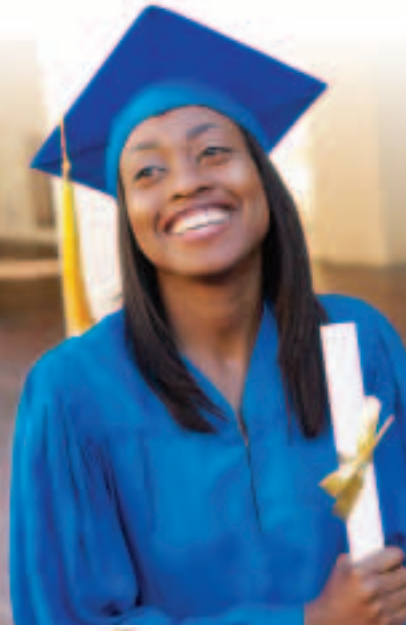


CHECK Your Progress

b. **BIRTHPLACES** The table gives the region of birth and number of people living in the United States who were born in a different country. Construct a circle graph of the data.

Foreign-Born Residents of the United States	
Region of Birth	**Number of People**
Europe	4,915,557
Asia	8,226,254
Africa	881,300
Oceania	168,046
Latin America	16,086,974
North America	829,442

Source: U.S. Census Bureau

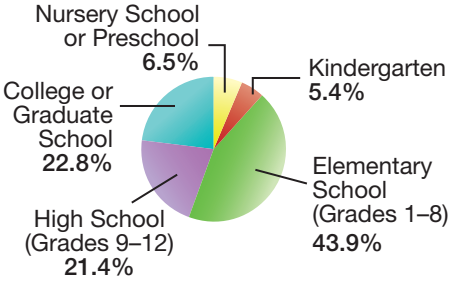


Real-World Link In the academic year 2003–2004, 57% of all degrees awarded by 4-year institutions and 62% of all degrees awarded by 2-year institutions were awarded to women.
Source: National Center for Education Statistics

EXAMPLE 3 Analyze and Interpret Data

SCHOOL Use the circle graph at the right to describe the makeup of the school enrollment of persons 3 years or older who are enrolled in school in the United States.

School Enrollment of Persons 3 Years or Older Enrolled in School



Source: U.S. Census Bureau

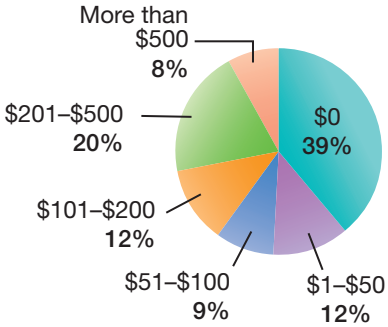
More persons were enrolled in elementary school than in any other category. More than $\frac{3}{4}$ of the total enrolled are in a preK-12 program. The number of persons enrolled in high school and the number of persons enrolled in college or graduate school are about the same.

Peter Griffith/Masterfile

CHECK Your Progress

c. **PETS** Use the circle graph at the right to describe the makeup of the dollar amount Americans pay for their pets.

How Much Did You Pay For Your Pet?



Source: American Animal Hospital Association

Personal Tutor

Personal Tutor at ca.gr7math.com

CHECK Your Understanding

Examples 1, 2 (p. 576–578)

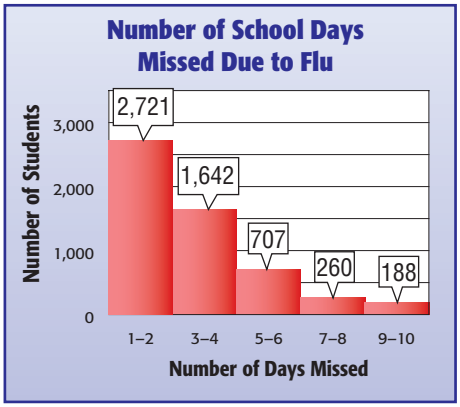
Construct a circle graph for each set of data.

1.

Frequency of Exercise	
Several Times a Day or Once a Day	32%
Several Times a Week	33%
Several Times a Month or Once a Month	15%
A Few Times a Year or Never	19%
Not Sure	1%

Source: FOX News

2.

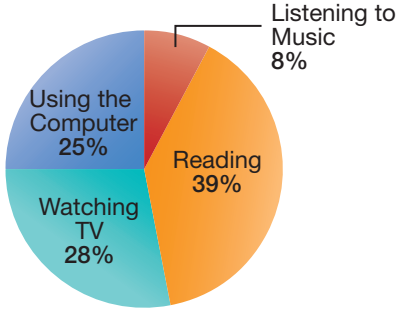


Source: pbskids.org

Example 3 (p. 578)

3. **ACTIVITIES** Use the circle graph to describe the activities teens say they are willing to give up.

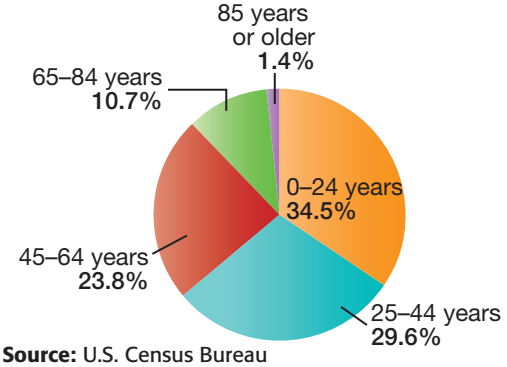
Activity Teenagers Are Most Willing to Give Up



Source: National Education Association

4. **POPULATION** Use the circle graph to describe the population of North Carolina by age.

Percent of North Carolina Population by Age



Source: U.S. Census Bureau

Exercises

HOMEWORK HELP

For Exercises	See Examples
5–8	1
9–12	2
13–16	3

Construct a circle graph for each set of data.

5.

Major Influences for Teens on Music Choices	
Radio	43%
Friends	30%
Television	16%
Parents	7%
Concerts	3%
Magazines	1%

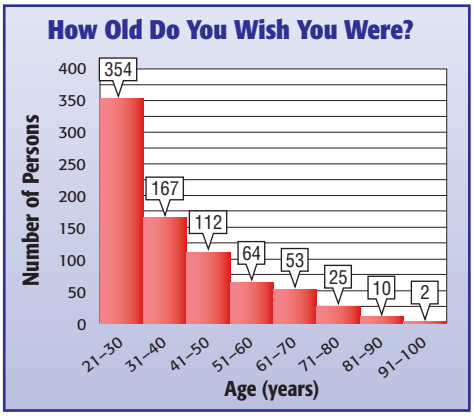
Source: *USA WEEKEND*

6.

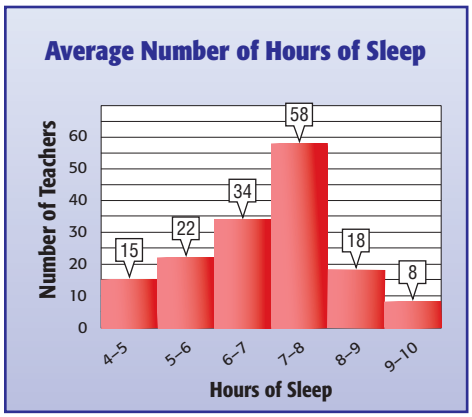
Types of Flowers and Plants Purchased for Mother's Day	
Garden Plants	37%
Cut Flowers	36%
Flowering Plants	18%
Green Plants	9%

Source: California Cut Flower Commission

7.

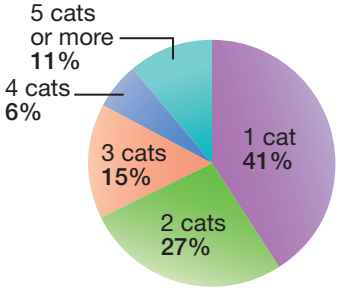


8.



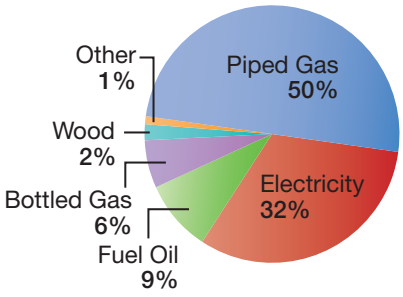
Describe the data in each circle graph.

9. **How Many Cats Do Cat Owners Own?**



Source: American Animal Hospital Association

10. **Type of Fuel Used to Heat Homes**



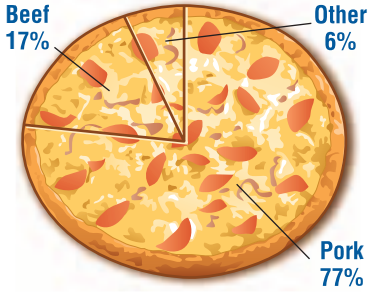
Source: U.S. Census Bureau

Real-World Link . . . . .

Americans eat about 100 acres of pizza daily, which averages to about 350 slices per second.

Source: thepizzajoint.com

11. **Most Popular Meat Pizza Toppings**



Source: The National Pork Board

12. **Number of Alarms Set**

Source: serta.com

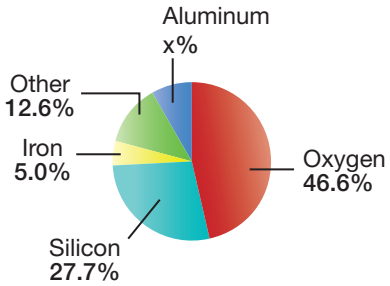
Real-World Link

The Eastern Hemisphere includes Asia, Africa, Europe, and Oceania while the Western Hemisphere includes North and South America.

Source: geography.about.com

13. **EARTH SCIENCE** Use the circle graph at the right to determine the percent of aluminum in Earth's crust. Then find the measure in degrees of the angle of the aluminum section of the circle graph.

Elements in Earth's Crust

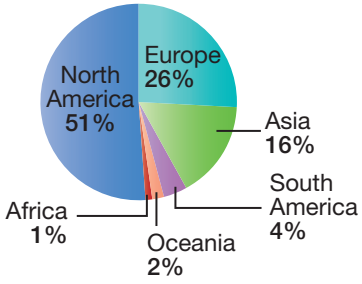


Source: Texas A&M University

14. **COLLECT THE DATA** Conduct a survey of your classmates to determine the number of hours they watch TV in a particular week. Construct a histogram of the data. Then construct a circle graph of the data.

15. **TOURISM** Use the information at the left and the circle graph at the right to determine the percent of foreign visitors to the United States from the Eastern Hemisphere. Then find the number of visitors from the Eastern Hemisphere if there was a total of 50 million foreign visitors to the United States.

Place of Origin for Foreign Visitors to the U.S.



Source: Office of Travel and Tourism Industries

BASKETBALL **For Exercises 16–18, use the table at the right.**

Favorite NBA Team	
Los Angeles Lakers	12%
Chicago Bulls	6.3%
Philadelphia 76ers	3.7%
New York Knicks	3.3%
Boston Celtics	2.1%
None	56%

Source: ESPN

16. Construct a circle graph of the data.

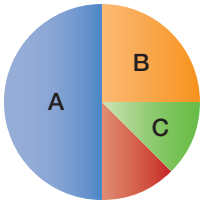
17. Conduct a survey of your classmates to determine their favorite NBA team, if any. Then construct a circle graph of the data.

18. Describe any similarities and differences between the two circle graphs you made.

EXTRA PRACTICE
See pages 705, 718.
MathOnline
Self-Check Quiz at ca.gr7math.com.

H.O.T. Problems

19. **NUMBER SENSE** What percent of the circle graph at the right is represented by Section A? by Section B? by Section C?



20. **OPEN ENDED** Construct a circle graph with five categories showing how you spend 24 hours in a typical weekday.

21. **REASONING** Explain why a circle graph could *not* be made of the data in the table at the right.

Most Popular Newspaper Section Read by Teens	
Comics	56%
Entertainment	51%
Sports	45%
Advertising	42%
Local News	35%
Classifieds	28%

Source: Newspaper Association of America

22. **WRITING IN MATH** Write a word problem about a real-world situation in which you could construct a circle graph to solve the problem. Explain why the circle graph would be helpful.

NASA

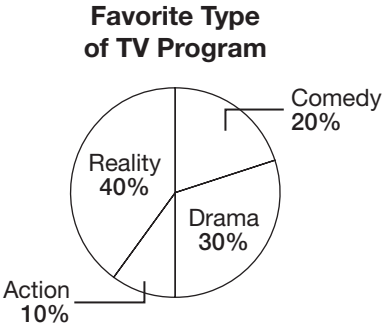
STANDARDS PRACTICE

23. Ms. Horace surveyed the students in the 8th grade about their favorite type of television program. The table shows the results of the survey. Which circle graph best represents the data in the table?

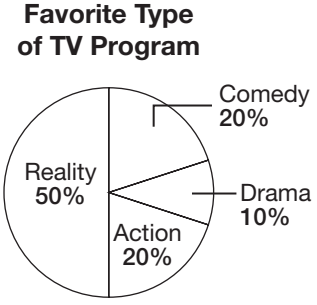
Type of Program	Number of Students
Comedy	120
Drama	180
Reality	240
Action	60

A

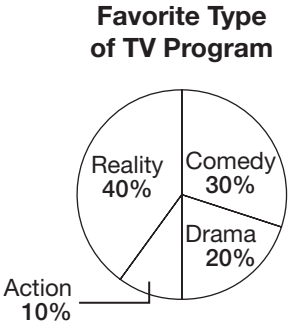
B



C



D



Spiral Review

24. **FOOD** The numbers of Calories for several different single-serving frozen pizzas are listed below. Construct a histogram of the data. (Lesson 11-2)

200, 270, 290, 300, 310, 320, 330, 350, 360, 380, 380, 390, 390, 420, 440, 450

25. Find the length of a side of a square with an area of $36x^2y^6$. (Lesson 10-8)

26. **SKYDIVING** The distance d a skydiver falls in t seconds is given by the function $d = 16t^2$. Graph this function and estimate how far a skydiver will fall in 5.5 seconds. (Lesson 10-2)

Find the volume of each prism or cylinder. Round to the nearest tenth, if necessary. (Lesson 7-5)

27. rectangular prism: length 4 cm, width 8 cm, height 2 cm

28. cylinder: diameter 1.6 in., height 5 in.

GET READY for the Next Lesson

PREREQUISITE SKILL **Evaluate each expression.**

29. $\dfrac{57 + 25 + 32 + 46}{4}$ **30.** $\dfrac{14(107) + 342 + 10(13)}{3}$ **31.** $\dfrac{500 - 125 + 205 - 20}{8}$

Extend 11-3

Spreadsheet Lab
Line, Bar, and Circle Graphs

Main IDEA

Use technology to create line, bar, and circle graphs.

Standard 7SDAP1.1 Know various forms of display for data sets, including stem-and-leaf plot or box-and-whisker plot; **use the forms to display a single set of data** or to compare two sets of data. **Standard 7MR2.5 Use a variety of methods, such as** words, numbers, symbols, **charts**, graphs, **tables**, diagrams, and models, **to explain mathematical reasoning.**

A computer spreadsheet is useful to construct line, bar, and circle graphs.

ACTIVITY

1 The table gives the number of Bachelor's degrees awarded to women by U.S. colleges and universities.

Year	'69–'70	'79–'80	'89–'90	'99–'00
Degrees (in thousands)	341.2	455.5	559.6	707.5

Source: Postsecondary Education Opportunity

To construct a line graph of the data, follow these steps.

STEP 1 Set up a spreadsheet, with the years in column A and the number of degrees in column B.

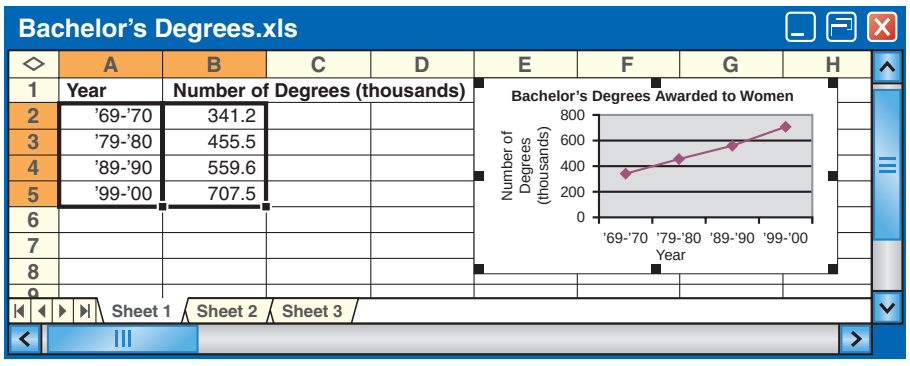
STEP 2 Highlight the data in column B, from B2 through B5. This tells the spreadsheet to read the data in column B.

STEP 3 Click on the Chart Wizard icon, choose the line graph, and click Next.

STEP 4 To set the *x*-axis, choose the Series tab and press the icon next to the Category (X) axis labels.

STEP 5 On the spreadsheet, select the data in column A, from A2 through A5. Press the icon on the bottom of the Chart Wizard box to automatically paste the data.

STEP 6 Click Next and enter the chart title and labels for the *x*- and *y*-axes. Click Next again and then Finish.

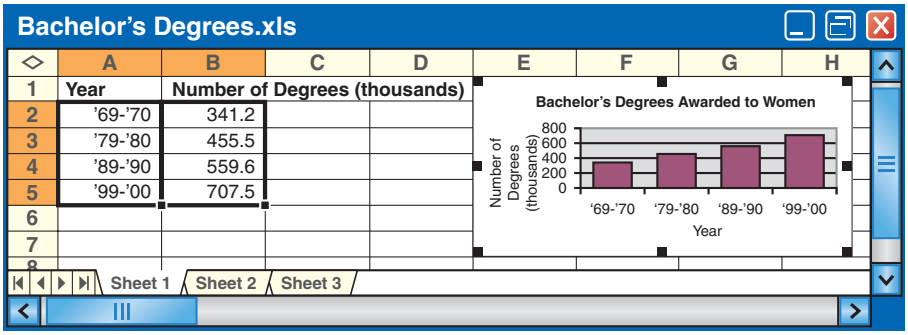


ACTIVITY

2 **STEP 1** To make a bar graph, highlight the data in B2 through B5.

STEP 2 Click on the Chart Wizard and choose the vertical bar graph.

STEP 3 Complete steps 3–5 from Activity 1.

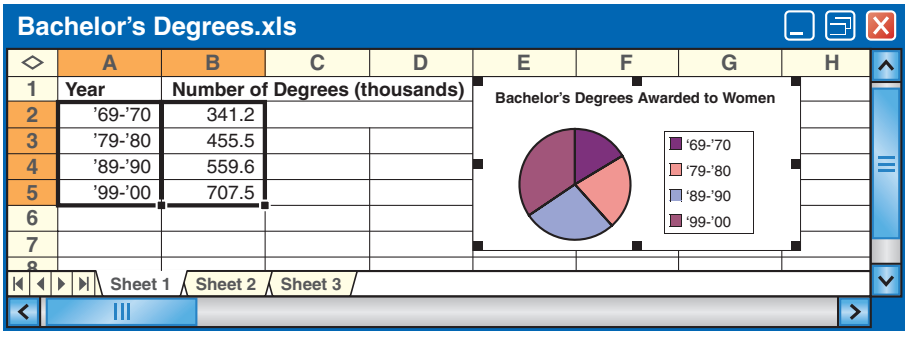


ACTIVITY

3 **STEP 1** To make a circle graph, highlight the data in A2 through B5.

STEP 2 Click on the Chart Wizard and choose Pie.

STEP 3 Click Next to enter the chart title. Then click Next and Finish.



Analyze the Results

1. **MAKE A CONJECTURE** Use one of the graphs to predict the approximate number of bachelor's degrees that would be awarded to women from U.S. colleges and universities in the year 2019–2020. Which graph(s) did you use to make this conjecture? Justify your selection(s).
2. **COLLECT THE DATA** Collect some data that can be displayed in a line, bar, and circle graph. Use a spreadsheet to construct each graph.

11-4 Measures of Central Tendency and Range

Main IDEA

Find the mean, median, mode, and range of a set of data.

Standard 7SDAP1.3 **Understand the meaning of, and be able to compute,** the minimum, the lower quartile, **the median,** the upper quartile, and the maximum **of a data set.**

NEW Vocabulary

measures of central tendency
mean
median
mode
range

GET READY for the Lesson

VACATION DAYS Use the table to answer each question.

1. What is the *average* number of days for these nine countries?
2. Order the numbers from least to greatest. What is the middle number in your list?
3. What number(s) appear more than once?
4. Which numbers from Questions 1–3 might be representative of the data? Explain.

Average Number of Vacation Days Per Year for Selected Countries

Country	Vacation Days
Brazil	34
Canada	26
France	37
Germany	35
Italy	42
Japan	25
Korea	25
United Kingdom	28
United States	13

Source: World Tourism Organization

Measures of central tendency are numbers that describe the center of a set of data. The most common measures are **mean**, **median**, and **mode**. The **range** is also used to describe a set of data.

CONCEPT Summary Measures of Central Tendency and Range

Measure	Description
mean	sum of the data divided by the number of items in the set
median	middle number of the data ordered from least to greatest, or the mean of the middle two numbers
mode	number or numbers that occur most often
range	difference between the greatest number (maximum) and least number (minimum) in a set of data

EXAMPLE 1 Find Measures of Central Tendency and Range

The ages, in years, of the people seated at a table are 22, 18, 24, 32, 24, 18. Find the mean, median, mode, and range of the set of data.

Mean $\frac{22 + 18 + 24 + 32 + 24 + 18}{6} = \frac{138}{6}$ or 23 years old

Median 18, 18, 22, 24, 24, 32 — Arrange in order from least to greatest.

$\frac{22 + 24}{2}$ = 23 years old

Real-World Link
Although no one actually resides on Antarctica, about 1,000 scientists live at scientific stations during the summer. Some even stay through the winter, when the temperature can drop as low as −94°F.
Source: *World Book*

Mode The data set has two modes, 18 and 24 years old.

Range 32 − 18 or 14 years

CHECK Your Progress

a. The prices of parking at several lots are listed below. Find the mean, median, mode, and range. Round to the nearest cent.
$3, $2.50, $6, $5.50, $3, $4.25

Sometimes one or two measures of central tendency or the range are more representative of the data than the other measure(s).

Real-World EXAMPLE

2 **GEOGRAPHY** **Select the appropriate measure of central tendency or range to describe the data in the table. Justify your reasoning.**

Population of Continents	
Continent	**Population (millions)**
North America	509
South America	369
Europe	729
Asia	3,862
Africa	875
Australia and Oceania	32
Antarctica	0

Source: *The World Almanac for Kids*

Find the mean, median, mode, and range of the data.

Mean

$$\frac{509 + 369 + 729 + 3{,}862 + 875 + 32 + 0}{7}$$

$$= \frac{6{,}376}{7} \approx 910.9$$

The mean is about 910.9 million.

Median Arrange the numbers from least to greatest.
0, 32, 369, 509, 729, 875, 3,862
The median is the middle number or 509 million.

Mode Since each number only occurs once, there is no mode.

Range 3,862 − 0 or 3,862 million

Since the only continent with a population greater than the mean is Asia, the mean is *not* the appropriate measure of central tendency.

Since there is no mode, the median is the appropriate measure of central tendency. The range tells us that the spread of the data is 3,862 million.

CHECK Your Progress

b. **COMPUTERS** Select the appropriate measure of central tendency or range to describe the data in the table. Justify your reasoning.

Computer Model	Hard Drive (gigabytes)
L100	40
L150	80
NX250	40
NX300	120
PC150	40
PC250	40

MathOnline Extra Examples at ca.gr7math.com

Different circumstances determine which measure of central tendency or range is most appropriate to describe a set of data.

STUDY TIP

Range The *range* of a data set gives the spread, or how far the values are spread out. Use the range when you want to describe the spread.

CONCEPT Summary Using Mean, Median, and Mode

Measure	Most Useful When...
mean	the data have no extreme values
median	the data have extreme values there are no big gaps in the middle of the data
mode	the data have many identical numbers

STANDARDS EXAMPLE

3 Spencer has an average of 90 on 12 quizzes. If his teacher drops Spencer's lowest score, a 75, which equation can be used to find a, Spencer's new average score?

A $a = \frac{90 - 75}{11}$

B $a = \frac{90(12) - 75}{11}$

C $a = \frac{90(12) - 75}{12}$

D $a = \frac{90(75 - 12)}{14}$

Read the Item

You need to find the average quiz score after one grade is removed.

Solve the Item

STUDY TIP

Total Score Each test score is not known. But the sum of the 12 scores must equal 90×12.

Spencer's average before dropping lowest score:

$$\text{average score} \rightarrow 90 = \frac{90 \times 12}{12} \begin{array}{l} \leftarrow \text{sum of 12 quiz scores} \\ \leftarrow \text{number of quizzes} \end{array}$$

Spencer's average after dropping lowest score:

$$\text{new average score} \rightarrow a = \frac{(90 \times 12) - 75}{11} \begin{array}{l} \leftarrow \text{sum of 12 quiz scores less 75} \\ \leftarrow \text{number of quizzes less 1} \end{array}$$

The correct answer choice is B because the sum of the scores is reduced by 75 and the number of scores is reduced by one.

CHECK Your Progress

c. Darci has been putting money in her savings account for 30 weeks. Her weekly savings together with gift money she deposited totals \$507. If Darci received a total of \$75 in gifts, which equation can be used to find s, the average weekly amount that Darci saves?

F $s = \frac{(507 + 75)}{30}$

G $s = 507 + \frac{75}{30}$

H $s = 507 - \frac{75}{30}$

J $s = \frac{(507 - 75)}{30}$

Personal Tutor

Personal Tutor at ca.gr7math.com

CHECK Your Understanding

Find the mean, median, mode, and range of each set of data. Round to the nearest tenth if necessary.

Example 1 (p. 585–586)

1. the number of minutes spent on cell phone calls in one day
   19, 21, 18, 17, 18, 22, 46

2. the number of miles several employees commute to work
   10, 3, 17, 1, 8, 6, 12, 15

Example 2 (p. 586)

3. **FOOTBALL** Select the appropriate measure of central tendency or range to describe the data in the table. Justify your reasoning.

Touchdown Passes Completed in the 2005 NFL Season	
Donovan McNabb	16
Carson Palmer	32
Eli Manning	24
Brett Favre	20
Marc Bulger	14
Drew Bledsoe	23

Source: National Football League

Example 3 (p. 587)

4. **STANDARDS PRACTICE** Brianna studied a total of 9 hours over the past 6 days. How many hours should she study on the 7th day so that she can average 1.5 hours per day?

   A 1 hour **C** 2 hours

   B 1.5 hours **D** 2.5 hours

Exercises

HOMEWORK HELP

For Exercises	See Examples
5–8	1
9, 10	2
11	3

Find the mean, median, mode, and range of each set of data. Round to the nearest tenth if necessary.

5. the number of points scored each by five basketball players
   9, 8, 15, 8, 20

6. the ages, in years, of the Henderson family children
   23, 16, 5, 6, 14

7. the prices, in dollars, of several pairs of running shoes
   78, 80, 75, 73, 84, 81, 84, 79

8. the number of channels for various cable television plans
   36, 38, 33, 34, 32, 30, 34, 35

For Exercises 9 and 10, select the appropriate measure of central tendency or range to describe the data in each table. Justify your reasoning.

9.

Fastest Roller Coasters	
Coaster	Speed (mph)
Dodonpa	107
Kingda Ka	128
Millennium Force	93
Phantom's Revenge	82
Steel Dragon 2000	95
Superman: The Escape	100
Top Thrill Dragster	120
Tower of Terror	100

Source: infoplease.com

10.

Known Moons of Planets	
Planet	Number of Moons
Mercury	0
Venus	0
Earth	1
Mars	2
Jupiter	63
Saturn	34
Uranus	27
Neptune	13

Source: NASA

Real-World Link . . . . .
The incubation period for a bird is the time from when the egg is laid until it is hatched. In the case of Major Mitchell's Cockatoo, the male incubates the young during the day and the female during the night.

Source: The Honolulu Zoo

11. **FIELD TRIP** If Gregory earns an 85% average on five tests in Spanish, he can attend the class trip to the Hispanic Cultural Museum. His current test scores are 94%, 82%, 78%, and 80%. Find the minimum test score Gregory needs to earn on the fifth test in order to attend the class trip.

BIRDS **For Exercises 12–14, use the table at the right.**

12. Find the mean, median, mode, and range of the incubation periods of all the birds.

13. Select the appropriate measure of central tendency or range to describe the data. Justify your reasoning.

14. Using the measures of central tendency and the range of the parrots and of the cockatoos, determine which species, parrot or cockatoo, seems to have the greater incubation period. Justify your reasoning.

Number of Days of Incubation Periods for Pet Birds	
Australian King Parrot	20
Glossy Cockatoo	30
Major Mitchell's Cockatoo	26
Princess Parrot	21
Red-Tailed Cockatoo	30
Red-Winged Parrot	21
Regent Parrot	21
Superb Parrot	20
White-Tailed Cockatoo	29
Yellow-Tailed Cockatoo	29

Source: birds2grow.com

15. **BASEBALL** The table gives the seating capacity of several baseball parks. Describe how the mean, median, mode, and range are each affected if the data for Yankee Stadium is not included.

Seating Capacity of Baseball Parks	
Comerica Park	40,120
Tropicana Field	41,315
Jacobs Field	43,405
Yankee Stadium	57,546
Kauffman Stadium	40,793
US Cellular Field	40,615

Source: ballparksofbaseball.com

16. **RUNNING** Natalie runs 4 miles on Mondays, 3.5 miles on Wednesdays, and 4.5 miles on Fridays. Describe how the mean, median, mode, and range would each be affected if Natalie chooses to add a 3.5-mile jog on Sundays.

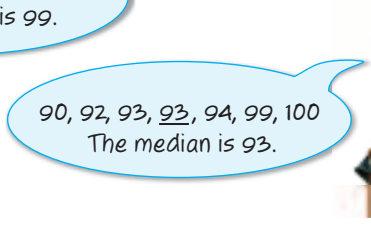
EXTRA PRACTICE
See pages 705, 718.
Math Online
Self-Check Quiz at ca.gr7math.com

H.O.T. Problems

17. **OPEN ENDED** Construct a set of data that has a mode of 4 and a median of 3.

18. **FIND THE ERROR** Toby and Erica are finding the median of 93, 90, 94, 99, 92, 93, and 100. Who is correct? Explain.

Toby



Erica

19. **REASONING** Determine whether the following statement is *sometimes*, *always*, or *never* true. Explain your reasoning.

All measures of central tendency must be members of the set of data.

20. **CHALLENGE** Give a counterexample to show that the following statement is false.

The median is always representative of the data.

21. **WRITING IN MATH** Write a problem that asks for the measures of central tendency. Use data from a newspaper or magazine. Tell which measure is most representative of the data.

STANDARDS PRACTICE

22. The speeds, in miles per hour, of several cars on a busy street were clocked as 42, 38, 44, 35, 50, and 38. Which measure of data would make the speeds appear the fastest?

A mode

B median

C mean

D range

23. Just before Isaac mowed the last lawn in his neighborhood, he had earned $145. He earned $25 mowing the last lawn, making his average earnings per lawn $21.25. To find the total number of lawns he mowed, first find the sum of $145 and $25, and then—

F add the sum to $21.25.

G subtract $21.25 from $145.

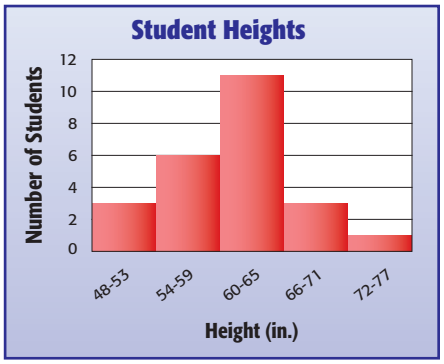
H multiply the sum by $21.25.

J divide the sum by $21.25.

Spiral Review

24. **TENNIS** Of Americans who play tennis, 63% play at public parks, 26% play at private clubs, 6% play at apartment or condo complexes, and 5% play elsewhere. Make a circle graph of the data. (Lesson 11-3)

HEIGHTS For Exercises 25 and 26, use the histogram at the right. (Lesson 11-2)



25. How many students are at least 60 inches tall?

26. How many students are between 54 and 71 inches tall?

27. **SPEED** If a car travels an average of 58 miles per hour, how far will it travel in 3.5 hours? (Lesson 4-3)

GET READY for the Next Lesson

PREREQUISITE SKILL Order each set of rational numbers from least to greatest. (Lesson 2-2)

28. 3.1, 3.25, 3.2, 2.9, 2.89

29. 91.3, 93.1, 94.7, 93.11, 93

30. 17.4, 16.8, 16.79, 15.01, 15.1

Extend 11-4

Spreadsheet Lab
Mean, Median, and Mode

Main IDEA

Use a spreadsheet to find mean, median, and mode.

Standard 7SDAP1.3 **Understand the meaning of, and be able to compute,** the minimum, the lower quartile, **the median,** the upper quartile, and the maximum of a data set.
Standard 7MR2.5 **Use a variety of methods, such as** words, numbers, symbols, **charts**, graphs, **tables**, diagrams, and models, **to explain mathematical reasoning.**

You can use a spreadsheet to find the mean, median, and mode of data.

ACTIVITY

FOOTBALL **The following is a list of the top ten salaries of quarterbacks in the NFL in a recent year. Make a spreadsheet for the data.**

Top Ten Salaries of Quarterbacks in the NFL				
$8,851,198	$6,942,399	$6,020,000	$5,552,250	$4,414,285
$8,485,333	$6,931,191	$5,859,691	$5,483,986	$4,260,000

Source: NFL Players Association

Use = AVERAGE (A2:A11) to find the mean.

Use = MEDIAN (A2:A11) to find the median.

Use = MODE (A2:A11) to find the mode.

Mean, Median, and Mode.xls

	A	B	C	D
1	DATA	MEAN	MEDIAN	MODE
2	8951198	6280033	5939846	#N/A
3	8485333			
4	6942399			
5	6931191			
6	6020000			
7	5859891			
8	5552250			
9	5483986			
10	4414285			
11	4260000			
12				

Sheet 1 Sheet 2 Sheet 3

STUDY TIP

Spreadsheet Notation If the spreadsheet returns #N/A for the mode, this means that the data set has no mode.

Exercises

For Exercises 1–3, use the following tables.

Top Ten Salaries of Running Backs in the NFL	
$8,455,125	$4,400,000
$5,000,000	$4,300,000
$4,962,703	$4,066,666
$4,800,000	$3,334,718
$4,783,600	$2,928,571

Top Ten Salaries of Defensive Ends in the NFL	
$8,750,000	$4,535,500
$5,249,411	$4,445,833
$5,050,000	$4,259,166
$4,843,666	$4,163,674
$4,600,000	$3,850,000

1. Use spreadsheets to find the mean, median, and mode of the top ten salaries for each position.
2. Compare the highest salary for the three positions.
3. Compare the mean and median of the three positions.

CHAPTER 11

Mid-Chapter Quiz

Lessons 11-1 through 11-4

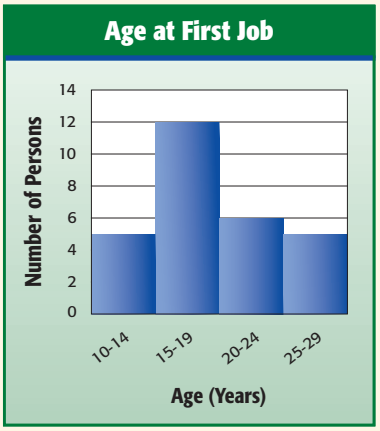
1. **TEMPERATURE** Organize the data below in a frequency table using intervals 60–69, 70–79, 80–89, and 90–99. What is the most common interval of monthly high temperatures? (Lesson 11-1)

Average Monthly High Temperatures (°F) for Tucson, Arizona					
66	82	99	70	90	99
97	66	94	85	74	74

2. **FOOD** Choose intervals and make a frequency table of the data below. Then construct a histogram to represent the data. (Lesson 11-2)

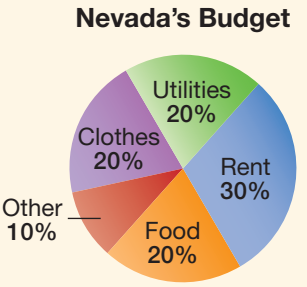
Grams of Sugar per Serving in Selected Adult Cereals								
3	0	5	0	6	9	2	6	3
5	3	7	5	4	3	5	2	11
6	2	0	6	0	5	0	3	10

JOBS For Exercises 3–5, use the histogram below which shows the age, in years, at which several people surveyed started their first job. (Lesson 11-2)



3. How many people surveyed started their first job after their 20th birthday but before their 30th birthday?
4. Based on this histogram, at what age is a person most likely to start their first job?
5. Construct a circle graph for this set of data. (Lesson 11-3)

6. **STANDARDS PRACTICE** Which statement *cannot* be determined from the graph? (Lesson 11-3)



A Nevada budgets half her money for rent and food.

B Nevada budgets the same amount of money for clothes as for food.

C Nevada budgets more money for food and clothes than rent.

D Nevada does not spend any money on going to the movies.

Find the mean, median, mode, and range of each set of data. Round to the nearest tenth if necessary. (Lesson 11-4)

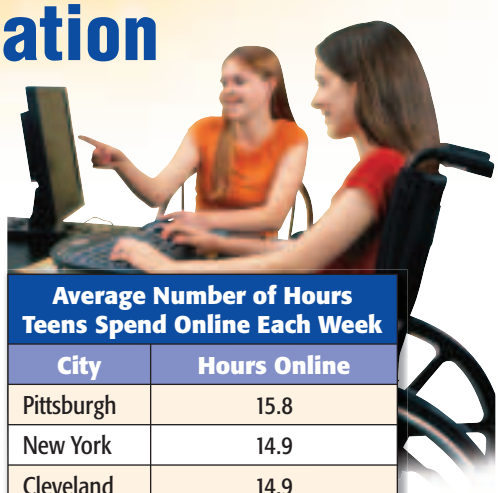
7. sales tax, as a percent, for several states
4.5, 6, 5.75, 5, 6.25, 5.5
8. length, in seconds, of several commercials
35, 41, 17, 22, 25, 33, 17

9. **STANDARDS PRACTICE** The list gives the scores on a recent history test. Which measure of data would make the scores appear highest? (Lesson 11-4)

History Test Scores									
77	82	65	92	77	87	100	83	77	78
45	73	67	87	82	59	75	77	68	85
82	75	87	52	87	79	85	82	87	

F mode
G mean
H median
J range

11-5 Measures of Variation



Main IDEA

Find the measures of variation of a set of data.

Standard 7SDAP1.3 **Understand the meaning of, and be able to compute, the minimum, the lower quartile, the median, the upper quartile, and the maximum of a data set.**

NEW Vocabulary

measures of variation
quartiles
lower quartile
upper quartile
interquartile range
outlier

Vocabulary Link

Quart

Everyday Use one fourth of a gallon

Quartile

Math Use a value dividing a set of data into four equal parts

GET READY for the Lesson

ONLINE TIME The average number of hours that teens in various cities spend online is given in the table.

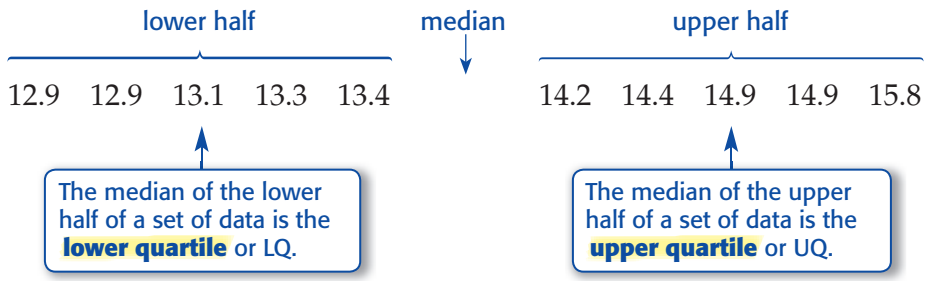
1. Find the median of the data.
2. Organize the data into five groups of equal size. How many data values are in each group?
3. What fraction of the entire data is in each group? what percent?
4. What fraction of the data is below the median? above the median?
5. Find the range of the data.
6. What does the range tell you about the data of the average number of hours teens spend online each week?

Average Number of Hours Teens Spend Online Each Week

City	Hours Online
Pittsburgh	15.8
New York	14.9
Cleveland	14.9
San Diego	14.4
Miami	14.2
Hartford	13.4
Los Angeles	13.3
Detroit	13.1
Philadelphia	12.9
Milwaukee	12.9

Source: Digital Marketing Services

Measures of variation are used to describe the distribution of the data. In Lesson 11-4, you used the range to describe how "spread out" the data are. The range is one measure of variation. **Quartiles** are values that divide a set of data into four equal parts. Recall that the median separates a set of data in two equal parts.



So, one half of the data lie between the lower quartile and the upper quartile. Another measure of variation is the **interquartile range**.

KEY CONCEPT — Interquartile Range

The interquartile range is the range of the middle half of the data. It is the difference between the upper quartile and the lower quartile.

Matt Meadows

EXAMPLE 1 Find Measures of Variation

FOOD **Find the measures of variation for the data in the table.**

Calories in a Serving of Juice	
Juice	**Calories**
Apple	120
Carrot	80
Grape	170
Grapefruit	100
Orange	120
Pineapple	110
Prune	180
Tomato	35

Source: Center for Science in the Public Interest

Range 180 − 35 or 145 Calories

Median, Upper Quartile, and Lower Quartile

Order the numbers from least to greatest.

lower quartile: 80, 100 → $\frac{80 + 100}{2} = 90$

median: 110, 120 → $\frac{110 + 120}{2} = 115$

upper quartile: 120, 170 → $\frac{120 + 170}{2} = 145$

35 80 100 110 120 120 170 180

The median is 115, the lower quartile is 90, and the upper quartile is 145.

Interquartile Range upper quartile − lower quartile
= 145 − 90 or 55

STUDY TIP

Interpreting Interquartile Range
A small interquartile range means that the data in the middle of the set are close in value. A large interquartile range means that the data in the middle are spread out.

CHECK Your Progress

a. **ENTERTAINMENT** Determine the measures of variation for the data in the table.

DVD Prices in Dollars at Various Stores			
14.95	19.99	24.99	17.99
14.99	14.95	23.49	15.89
15.99	21.95	17.99	15.99

Data that are more than 1.5 times the value of the interquartile range beyond either quartile are called **outliers**. An outlier is a data value that is either much *larger* or much *smaller* than the median.

EXAMPLE 2 Find Outliers

FOOD **Find any outliers for the data in the table.**

Find the interquartile range.
6.5 − 2.1 = 4.4

Multiply the interquartile range by 1.5.
4.4 × 1.5 = 6.6

Now subtract 6.6 from the lower quartile and add 6.6 to the upper quartile.
2.1 − 6.6 = −4.5
6.5 + 6.6 = 13.1

Annual Chocolate Sales	
Country	**Sales (billion dollars)**
United States	16.6
United Kingdom ← upper quartile	6.5
Germany	5.1
Russia ← median	4.9
Japan	3.2
France ← lower quartile	2.1
Brazil	2.0

Source: Euromonitor

The only outlier is 16.6 because it is greater than 13.1.

CHECK Your Progress

b. **BUILDINGS** Find any outliers for the data in the table.

Tallest Buildings (ft), Houston, Texas					
1,002	972	901	780	748	762
725	714	691	685	741	732

SBI/NASA/Getty Images

Real-World Link . . . . .
The brain of a dolphin appears to sleep one hemisphere at a time.
Source: Neuroscience for Kids

EXAMPLE 3 Use Measures of Variation to Describe Data

SLEEP **Use the measures of variation to describe the data in the table at the right.**

Number of Hours of Sleep for Selected Animals	
Brown Bat	19.9
Giant Armadillo	18.1
Infant Human	16.0
Cat	12.1
Bottle-nosed Dolphin	10.4
Gray Seal	6.2
Horse	2.9
Giraffe	1.9

Source: Neuroscience for Kids

Find the measures of variation.

The range is 19.9 − 1.9, or 18.

The median is 11.25.

The upper quartile is 17.05.

The lower quartile is 4.55.

The interquartile range is 17.05 − 4.55, or 12.5.

The spread of the data is 18 hours. The median is 11.25 hours. One-fourth of the animals got at or below 4.55 hours of sleep and one-fourth of the animals got at or above 17.05 hours of sleep. The number of hours of sleep for half of the animals was in the interval 4.55–17.05.

CHECK Your Progress

c. **CYCLING** Use the measures of variation to describe the data in the table at the right.

Number of Tour de France Wins	
France	36
Belgium	18
Italy	9
Spain	8
United States	8

Source: *World Almanac for Kids 2005*

Personal Tutor

Online **Personal Tutor at** ca.gr7math.com

CHECK Your Understanding

LANGUAGE **For Exercises 1–5, use the data in the table on the right.**

U.S. Non-English Language Spoken at Home	
Language	**Speakers (millions)**
Spanish	28.1
Chinese	2.0
French	1.6
German	1.4
Tagalog	1.2
Vietnamese	1.0
Italian	1.0
Korean	0.9

Source: U.S. Census Bureau

Example 1 (p. 594)

1. Determine the range of the data.
2. Find the median and the upper and lower quartiles.
3. What is the interquartile range of the data?

Example 2 (p. 594)

4. Identify any outliers.

Example 3 (p. 595)

5. Use the measures of variation to describe the data in the table.

Exercises

HOMEWORK HELP

For Exercises	See Examples
6, 7, 10, 11, 14, 15, 18, 19	1
8, 12, 16, 20	2
9, 13, 17, 21	3

SYRUP **For Exercises 6–9, use the data in the table at the right.**

6. What is the range of the data?
7. Find the median, the upper and lower quartiles, and the interquartile range of the data.
8. Identify any outliers.
9. Use the measures of variation to describe the data in the table.

Annual Production of Maple Syrup (gallons)	
Vermont	430,000
Maine	265,000
New York	210,000
Wisconsin	76,000
Michigan	59,000

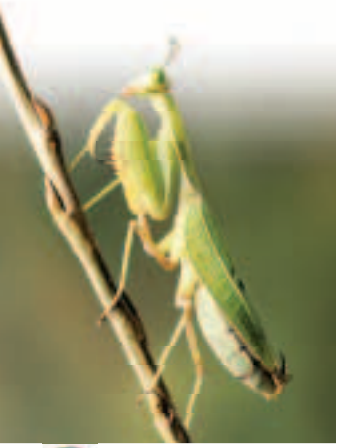
Source: *World Almanac for Kids 2005*

EXERCISE **For Exercises 10–13, use the data in the table at the right.**

10. What is the range of the data?
11. Find the median, upper and lower quartiles, and the interquartile range of the data.
12. Identify any outliers.
13. Use the measures of variation to describe the data in the table.

Calories Burned per Minute of Exercise	
Jogging (6 mph)	8
Jumping Rope	7
Basketball	7
Soccer	6
Bicycling (9.4 mph)	5
Downhill Skiing	5
Walking (4 mph)	4

Source: *World Almanac for Kids 2005*



Real-World Link
Crustaceans, insects, and spiders are all arthropods. There are about 750,000 species of insects alone.
Source: *World Almanac for Kids 2005*

SPACE **For Exercises 14–17, use the data in the table at the right.**

14. What is the range of the data?
15. Find the median, upper and lower quartiles, and the interquartile range for the data.
16. Identify any outliers.
17. Use the measures of variation to describe the data in the table.

Number of U.S. Shuttle Launches 1981–2005	
1981–1985	23
1986–1990	15
1991–1995	28
1996–2000	28
2001–2005	13

Source: NASA

ANIMALS **For Exercises 18–21, use the data in the table at the right.**

18. What is the range of the data?
19. Find the median, upper and lower quartiles, and the interquartile range for the data.
20. Identify any outliers.
21. Use the measures of variation to describe the data in the table.

Number of Species in the Animal Kingdom	
Arthropods	1,100,000
Fish	24,500
Birds	9,000
Mammals	9,000
Reptiles	8,000
Amphibians	5,000

Source: *World Almanac for Kids 2005*

22. **GOLF** Brandon's golf scores relative to par at the end of the County Golf Tournament were −1, −2, 4, −6, 3, −1, and −3. Find the measures of variation of his scores. Then describe what the measures of variation tell you about the data.

Real-World Link
The Verrazano Narrows Bridge in New York City is the longest bridge in the United States. Each of its two towers weighs 27,000 tons.
Source: Metropolitan Transit Authority

WEATHER **For Exercises 23–27, use the table at the right.**

23. Which city has a greater range of temperatures?
24. Find the measures of variation for each city.
25. Compare the medians and the interquartile ranges of the average temperatures.
26. Select the appropriate measure of central tendency or range to describe the average temperatures for each city. Justify your response.
27. Describe the average temperatures of San Francisco and Philadelphia, using both the measures of central tendency and variation.

Average Temperatures (°F)		
Month	San Francisco	Philadelphia
January	49	30
February	52	33
March	53	42
April	56	52
May	58	63
June	62	72
July	63	77
August	64	76
September	65	68
October	61	56
November	55	46
December	49	36

Source: *The World Almanac*

EARTHQUAKES **For Exercises 28–30, use the stem-and-leaf plot.**

28. Find the range, median, upper and lower quartiles, and the interquartile range for the data.
29. Identify any outliers.
30. Use the measures of variation to describe the data in the table.

Magnitude of Earthquakes in the Central U.S. for September 2005

Stem	Leaf
1	5 5 5 5 5 5 5 7 8 8
2	2 2 3 5 6 9
3	6

1 | 5 means 1.5

Source: U.S. Geological Survey

BRIDGES **For Exercises 31–33, use the table at the right.**

31. Find the length of the Golden Gate Bridge if the median is 4,000 feet.
32. Find the length of the Akashi Kaikyo Bridge if the range is 2,566 feet.
33. The 11th longest suspension bridge in the world is the Tagus River Bridge in Portugal, with a length of 3,323 feet. Describe how the measures of variation are affected if this data value is included.

10 Longest Suspension Bridges in the World		
Bridge	Country	Length (ft)
Akashi Kaikyo	Japan	y
Great Belt Link	Denmark	5,328
Humber River	England	4,626
Verrazano Narrows	United States	4,260
Golden Gate	United States	x
Mackinac Straits	United States	3,800
Minami Bian-Seto	Japan	3,668
Second Bosphorous	Turkey	3,576
First Bosphorous	Turkey	3,524
George Washington	United States	3,500

Source: *Structural Steel Designer's Handbook*

EXTRA PRACTICE
See pages 705, 718.
Math Online
Self-Check Quiz at ca.gr7math.com

34. **FIND THE DATA** Refer to the California Data File on pages 16–19. Choose some data and write a real-world problem in which you would determine measures of central tendency and measures of variation.

H.O.T. Problems

35. **OPEN ENDED** Create a list of data with at least eight numbers that has an interquartile range of 20 and one outlier.

36. **CHALLENGE** Create two different sets of data that have the same range but different interquartile ranges. Then create two different sets of data that have the same median and same quartiles, but different ranges.

37. **WRITING IN MATH** Explain why the interquartile range is not affected by very high or low values in the data.

STANDARDS PRACTICE

38. Which of the following statements is never true concerning the measures of variation of a set of data?

A Half the data lie within the interquartile range.

B Three-fourths of the data lie above the lower quartile.

C The median, the lower quartile, and the upper quartile separate the data into three equal parts.

D 50% of the data lie below the median.

39. High temperatures (°F) of twelve cities on March 20 were 40, 72, 74, 35, 58, 64, 40, 67, 40, 75, 68, and 51. Which of the following statements is *not* supported by these data?

F Half of the temperatures were below 61°F and half were above 61°F.

G The spread of the data is 40°F.

H The temperature 35°F is an outlier.

J About one-fourth of the temperatures were at or above 70°F.

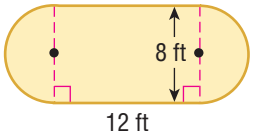
Spiral Review

40. **HEIGHTS** The heights, in inches, of the Allen family are 72, 68, 48, 71, and 67. Find the mean, median, mode, and range. Round to the nearest tenth if necessary. (Lesson 11-4)

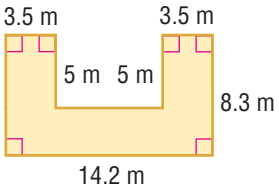
41. **NATIONAL PARKS** Wyoming has 3,159 square miles of Yellowstone National Park while Montana has 264 square miles and Idaho has 49 square miles. Construct a circle graph to show what part of Yellowstone National Park is in each state. (Lesson 11-3)

MEASUREMENT **Find the area of each figure. Round to the nearest tenth.** (Lesson 7-2)

42.



43.



GET READY for the Next Lesson

PREREQUISITE SKILL **Graph each set of points on a number line.** (Lesson 1-3)

44. {3, 5, 8, 9, 10} 45. {13, 15, 20, 27, 31} 46. {9, 13, 16, 17, 21} 47. {3, 9, 10, 15, 19}

11-6 Box-and-Whisker Plots

Main IDEA

Display and interpret data in a box-and-whisker plot.

Standard 7SDAP1.1 **Know various forms of display for data sets, including** stem-and-leaf plot or **box-and-whisker plot; use the forms to display a single set of data or to compare two sets of data.**

NEW Vocabulary

box-and-whisker plot

GET READY for the Lesson

WILDFIRES The table gives the number of acres burned in wildfires for various years.

1. What is the least value in the data?
2. What is the lower quartile of the data?
3. What is the median of the data?
4. What is the upper quartile of the data?
5. What is the greatest value in the data?
6. Name any outliers.

Significant Wildfires in the United States

Year	Number of Acres Burned
1871	3,780,000
1825	3,000,000
1910	3,000,000
1988	1,585,000
1881	1,000,000
1987	640,000
1903	637,000
2002	462,000

Source: National Interagency Fire Center

A **box-and-whisker plot** uses a number line to show the distribution of a set of data. The *box* is drawn around the quartile values, and the *whiskers* extend from each quartile to the extreme data points that are not outliers.

In Motion

Concepts in Motion
Animation ca.gr7math.com

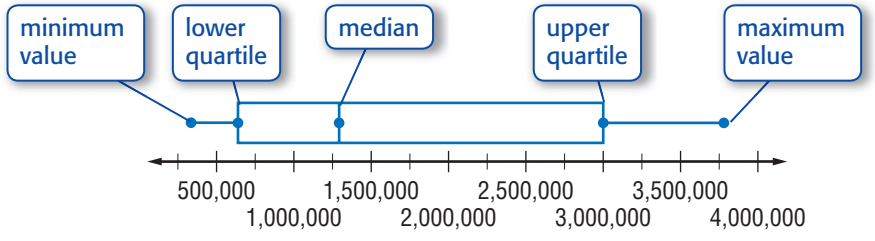
EXAMPLE 1 Construct a Box-and-Whisker Plot

WILDFIRES **Use the data in the table above to construct a box-and-whisker plot.**

Step 1 Draw a number line that includes the least and greatest number in the data.

Step 2 Mark the extremes, the median, and the upper and lower quartile above the number line.

Step 3 Draw the box and the whiskers.



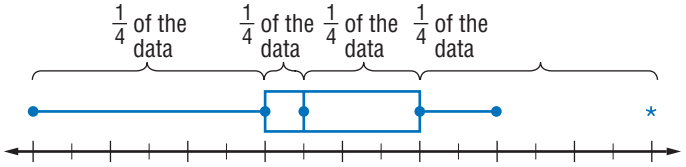
CHECK Your Progress

Construct a box-and-whisker plot for each set of data.

a. Prices, in dollars, of admission to a hockey game:
42, 38, 42, 45, 43, 65, 55, 50, 34, 36, 40, 35

b. Low temperatures for various cities:
52, 58, 67, 63, 47, 44, 52, 28, 49, 65, 52, 59

Box-and-whisker plots separate data into four parts. Although the parts usually differ in length, each part contains one-fourth of the data.



A long whisker or box indicates that the data in that quartile or quartiles have a greater range. A short whisker or box indicates the data in that quartile or quartiles have a lesser range. An asterisk (*) indicates an outlier and is not connected to a whisker.

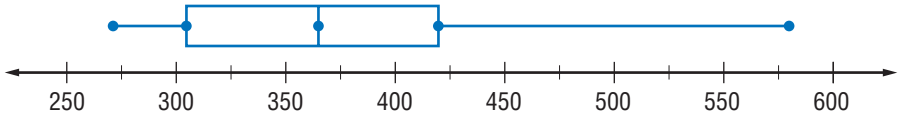
Real-World Career . . . .
How Does a Dietitian Use Math?
Dietitians keep track of Calories, fat, salt, and nutrients in food. They use this information to help people maintain an appropriate diet.

MathOnline
For more information, go to ca.gr7math.com.

EXAMPLE 2 Interpret Data

DIET **What does the length of the box-and-whisker plot tell you about the data?**

Calories in Fast-Food Sandwiches

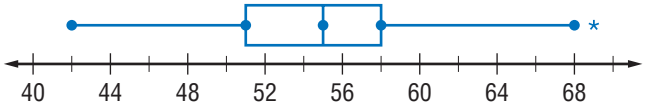


The median line seems to divide the box into two approximately equal parts, so data in the second and third quartiles are similarly spread out. The whisker at the right is longer than the other parts of the plot, so the data in the fourth quartile are more spread out.

CHECK Your Progress

c. **WORK** Compare the lower quartile and the upper quartile of the data.

Average Daily Commute Time (minutes) to Work for Selected U.S. States



Source: U.S. Census Bureau

Personal Tutor

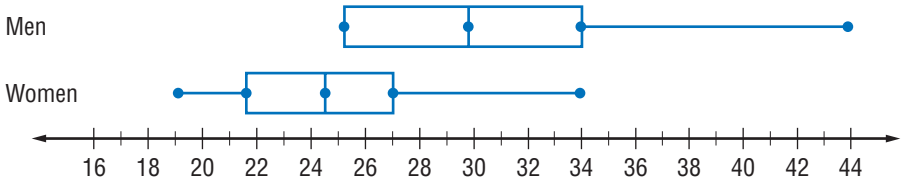
Online Personal Tutor at ca.gr7math.com

Geoff Butler

EXAMPLE 3 Compare Data

OLYMPICS Refer to the double box-and-whisker plot below. Were about half the men and women in the same age group? Justify your reasoning.

Ages of the U.S.A. 2006 Olympic Hockey Players



Source: *USA Today*

The youngest age of the men was 24 years, and the median was 31 years. So, half of the men were 24 to 31 years old.

The median age of the women was 24.5 years, and the oldest age was 30. So, half the women were 24.5 to 30 years old.

So, about half the men and women were in the same age group.

CHECK Your Progress

d. OLYMPICS Describe the ages of the women compared to the ages of the men in the double box-and-whisker plot above.

CHECK Your Understanding

Example 1 (p. 599)

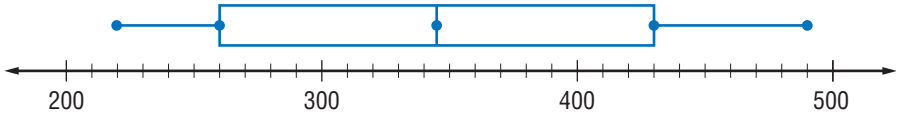
Draw a box-and-whisker plot for each set of data.

1. Hours per month volunteering at the community center: 38, 43, 36, 37, 32, 37, 29, 51
2. Points earned on a test: 100, 70, 70, 90, 50, 90, 50, 90, 100, 50, 90, 100, 90, 50, 25, 80

Example 2 (p. 600)

FOOD For Exercises 3 and 4, use the following box-and-whisker plot.

Calories in Muffins

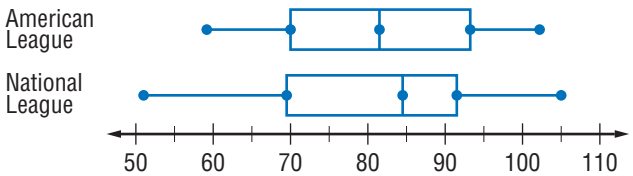


3. What is the interquartile range of the data?
4. Three-fourths of the muffins have at least how many Calories?

Example 3 (p. 601)

5. **BASEBALL** Refer to the box-and-whisker plot. In which league did more than half of the teams win more games than the other league? Justify your reasoning.

Major League Baseball Team Wins, 2005



Source: mlb.com

Exercises

HOMEWORK HELP

For Exercises	See Examples
6–9	1
10–13, 15	2
14, 16–18	3

Construct a box-and-whisker plot for each set of data.

6. Ages of persons in line for a jazz concert:
49, 45, 55, 32, 28, 53, 26, 38, 35, 35, 51

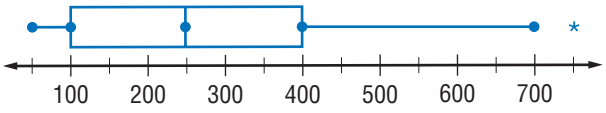
7. Number of miles between rest stops on a highway:
77, 85, 72, 76, 95, 90, 73, 82, 82, 80, 73

8. Speed, in miles per hour, of commercial airliners:
540, 460, 520, 350, 500, 480, 475, 525, 450, 515

9. Prices, in dollars, of plane tickets from Detroit to Atlanta:
225, 245, 220, 270, 350, 280, 230, 240, 225, 270

HISTORY **For Exercises 10 and 11, use the box-and-whisker plot at the right.**

Population of Thirteen Original States, 1790 (thousands)



Source: U.S. Census Bureau

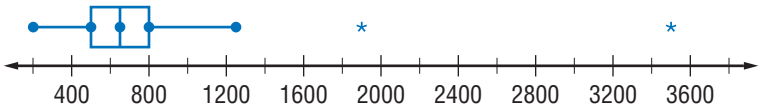
10. Approximately what percent of the states had populations greater than 100,000?

11. How does the length of the whisker after the upper quartile represent the data?

Real-World Link
The first official count of the U.S. population was conducted in 1790 by federal marshals on horseback. It took 18 months to question and record the answers of the 3.9 million U.S. inhabitants in notebooks or on bits of paper.
Source: Population Resource Center

ZOOS **For Exercises 12 and 13, use the following box-and-whisker plot.**

Areas (acres) of the Ten Largest Zoos in the United States



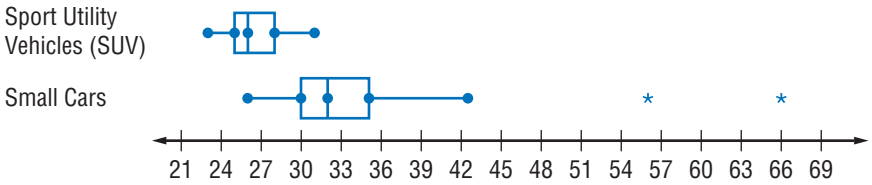
Source: *The Sacramento Bee*

12. How many outliers are in the data?

13. Describe the distribution of the data. What can you say about the areas of the major zoos in the U.S.?

GAS MILEAGE **For Exercises 14–18, use the box-and-whisker plot below.**

Highway Gas Mileage (miles per gallon) for 2006 Models



Source: fueleconomy.gov

14. Which set of data has a greater range?

15. How many outliers are in the data?

16. What percent of the SUVs get at least 28 miles per gallon?

17. What percent of the small cars get at least 30 miles per gallon?

18. In general, do SUVs get more or less gas mileage than small cars? Justify your reasoning.

Real-World Link . . . . .
Florida, the "Sunshine State," actually ranks sixth in the average number of sunny days per year. In fact, Florida has more partly cloudy days than anywhere else in the United States.
Source: washingtontimes.com

PARKS **For Exercises 19 and 20, use the table at the right.**

19. Construct a box-and-whisker plot for the set of data. Then determine in which interval the data are the most spread out.

20. Describe how the box-and-whisker plot would change if the data for California and Florida were not included.

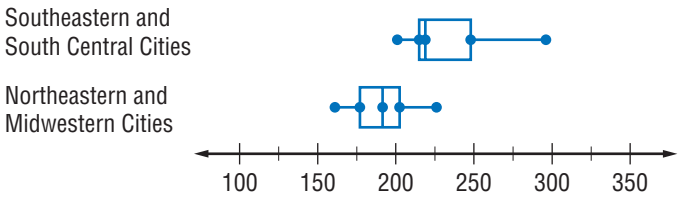
State and National Parkland of Selected States

State	Total Acres per 10 Square Miles of Land
California	616.6
Florida	611.2
Arizona	412.8
Michigan	176.6
North Carolina	172.8
Minnesota	79.5
Texas	72.7
Ohio	58.3
Georgia	25.1

Source: Indiana Chamber

WEATHER **For Exercises 21–23, use the box-and-whisker plot below.**

Average Number of Sunny Days Per Year for Selected U.S. Cities



Source: U.S. Census Bureau

21. What percent of the data for the Southeastern and South Central cities is above the lower quartile for the Northeastern and Midwestern cities?

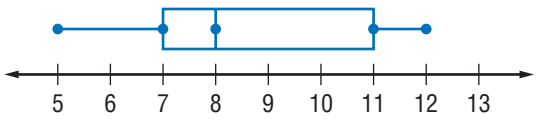
22. Boston, Massachusetts, has an average number of 98 sunny days a year. If this city is added to the data for the Northeastern and Midwestern cities, describe how the box-and-whisker plots would change.

23. Write one or two sentences comparing the average number of sunny days of Southeastern and South Central U.S. cities versus Northeastern and Midwestern U.S. cities.

EXTRA PRACTICE
See pages 705, 718.
Math Online
Self-Check Quiz at ca.gr7math.com

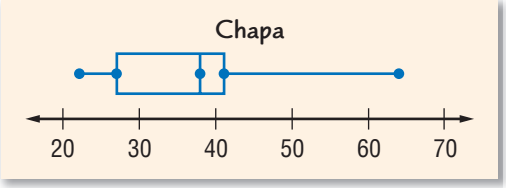
H.O.T. Problems

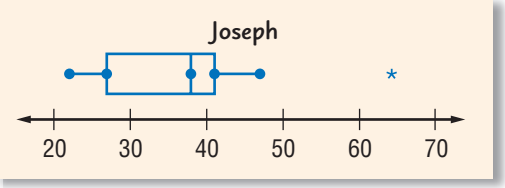
24. **OPEN ENDED** Write a set of data that could be represented by the box-and-whisker plot at the right.



25. **FIND THE ERROR** Chapa and Joseph are making a box-and-whisker plot for the following set of data. Who is correct? Explain.

22, 23, 27, 30, 34, 38, 39, 40, 41, 47, 64





26. **REASONING** The lower quartile, median, and upper quartile of a data set are x, y, and 70, respectively. If a box-and-whisker plot were to be made from this data, give possible values for x and y according to each of the following conditions.

   a. The median separates the box into two equal parts.

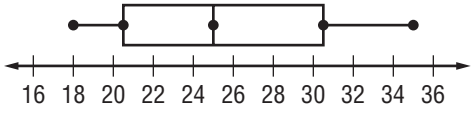
   b. The box between the median and the upper quartile is twice as long as the box between the median and the lower quartile.

27. **WRITING IN MATH** Explain the advantage of using a box-and-whisker plot to display data.

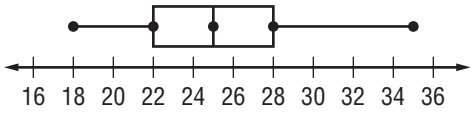
STANDARDS PRACTICE

28. Which box-and-whisker plot represents the data set 18, 22, 31, 25, 30, 19, 26, 24, and 35?

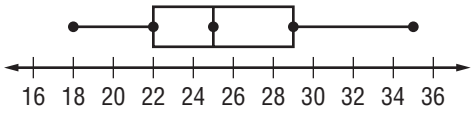
A



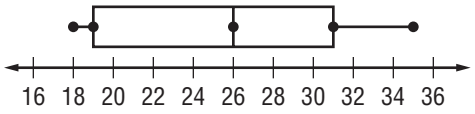
B



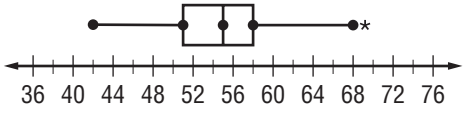
C



D



29. Which of the following statements is *not* true concerning the box-and-whisker plot below?



F The value 69 is an outlier.

G Half of the data is above 55.

H $\frac{1}{4}$ of the data is in the interval 58–69.

J There are more data values in the interval 42–51 than there are in the interval 55–58.

Spiral Review

Find the range, median, upper and lower quartiles, interquartile range, and any outliers for each set of data. (Lesson 11-5)

30. 73, 52, 31, 54, 46, 28, 47, 49, 58

31. 87, 63, 84, 94, 89, 74, 50, 85, 91, 78, 99, 81, 77, 86, 65, 81, 74

32. **LIFE SCIENCE** Find the mean, median, mode, and range of the plant heights 22, 4, 1, 12, 5, 22, 5, 25, 25, 19, 23, 24, 11, 16, 3, and 22 inches. Round to the nearest tenth if necessary. (Lesson 11-4)

GET READY for the Next Lesson

PREREQUISITE SKILL **Make a line plot for each set of data.** (Page 662)

33. 2, 5, 9, 8, 2, 6, 2, 5, 8, 10

34. 14, 12, 9, 7, 12, 10, 14, 7, 8, 12

Extend 11-6

Graphing Calculator Lab
Box-and-Whisker Plots

Main IDEA

Use a graphing calculator to make box-and-whisker plots.

Standard 7SDAP1.1 **Know various forms of display for data sets, including** stem-and-leaf plot or **box-and-whisker plot; use the forms to display a single set of data** or to compare two sets of data. **Standard 7MR2.5** **Use a variety of methods, such as** words, numbers, symbols, charts, graphs, **tables, diagrams,** and models, **to explain mathematical reasoning.**

You can create a box-and-whisker plot using a graphing calculator.

ACTIVITY

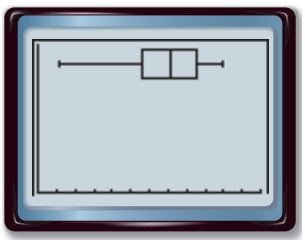
Made a box-and-whisker plot of the data at the right. It shows the grades on Miss Romero's last math test.

Miss Romero's Math Test Scores							
78	94	85	92	72	56	89	92
90	84	98	82	75	100	94	87
92	85	94	70	78	95	70	80

STEP 1 Clear list L1 by pressing STAT ENTER ▲ CLEAR ENTER. Then enter the data into L1. Input each number and press ENTER.

STEP 2 Press 2nd [STAT PLOT] ENTER to choose the first plot. Highlight On, the modified box-and-whisker plot for the type, L1 for the Xlist, and 1 as the frequency.

STEP 3 Press WINDOW and choose an appropriate range for the *x* values. The window 50 to 110 with a scale of 4 includes all of this data.



STEP 4 Press GRAPH. Press TRACE and the arrow keys to determine the five key data points of you graph.

Analyze the Results

1. What are the values of the five key data points of the graph? What do they represent?
2. What percent of the test scores are below 78?
3. What percent of the test scores are above the median? What percent of the test scores are below the median?
4. What percent of the scores are between 56 and 86?
5. Suppose you earned a grade of 80. Describe what percent of students scored higher and what percent scored lower than you.

11-7 Stem-and Leaf Plots

Main IDEA

Display data in stem-and-leaf plots. Interpret data in stem-and-leaf plots.

Standard 7SDAP1.1 **Know various forms of display for data sets, including stem-and-leaf plot** or box-and-whisker plot; **use the forms to display a single set of data or to compare two sets of data.**

GET READY for the Lesson

An elector is a voter that represents his or her state in a presidential election. The number of electors for each state, including the District of Columbia, is shown in the table below.

Number of Electors								
AL: 9	CT: 7	ID: 4	LA: 9	MS: 6	NJ: 15	OK: 7	TN: 11	WV: 5
AK: 3	DE: 3	IL: 21	ME: 4	MO: 11	NM: 5	OR: 7	TX: 34	WI: 10
AZ: 10	DC: 3	IN: 11	MD: 10	MT: 3	NY: 31	PA: 21	UT: 5	WY: 3
AR: 6	FL: 27	IA: 7	MA: 12	NE: 5	NC: 15	RI: 4	VT: 3	
CA: 55	GA: 15	KS: 6	MI: 17	NV: 5	ND: 3	SC: 8	VA: 13	
CO: 9	HI: 4	KY: 8	MN: 10	NH: 4	OH: 20	SD: 3	WA: 11	

Source: *The World Almanac*

Write each number on a self-stick note. Then group the numbers: 0-9, 10-19, 20-29, 30-39, 40-49, 50-59.

1. Is there an equal number of electors in each group? Explain.
2. Name an advantage of displaying the data in groups.

NEW Vocabulary

stem-and-leaf plot
stems
leaves
back-to-back stem-and-leaf plot

In a **stem-and-leaf plot**, numerical data are listed in ascending or descending order. The digits in the greatest place value of the data is used for the **stems**. The digits in the next greatest place value forms the **leaves**.

Real-World EXAMPLE 1 Draw a Stem-and-Leaf Plot

OLYMPICS **The table shows the total points scored in the first beach volleyball match played by each team in the 2004 Olympics. Display the data for the men's teams in a stem-and-leaf plot.**

Beach Volleyball Scores		
Country	Men	Women
Greece	52	47
United States	61	42
Brazil	42	42
Canada	44	42
South Africa	60	17
Cuba	50	54
Germany	55	52
Australia	42	42
Switzerland	49	29
Norway	46	37

Source: athens2004.com

Step 1 Find the least and the greatest number. Then identify the greatest place value digit in each number.

- The least number, 42, has 4 in the tens place.
- The greatest number, 61, has 6 in the tens place.

Step 2 Draw a vertical line and write the stems from 4 to 6 to the left of the line.

Stem	Leaf
4	
5	
6	

Step 3 Write the leaves to the right of the the corresponding stem on the *other* side of the line. For example, for 42, write 2 to the right of 4.

Stem	Leaf
4	2 4 **2** 9 6
5	2 0 5
6	1 0

Step 4 Rearrange the leaves so they are ordered from least to greatest. Repeat a leaf as often as it occurs. Then include a key to explain how to interpret the data.

Beach Volleyball Scores

Stem	Leaf
4	2 2 4 6 9
5	0 2 5
6	0 1

5|2 = 52 points

CHECK Your Progress

a. Display the data for the women's teams in a stem-and-leaf plot.

Real-World Link
The first President was George Washington. He was 57 years old at the time of his inauguration. He served as President from 1789 to 1797 and earned $25,000 per year.
Source: infoplease.com

Real-World EXAMPLE Interpret Data

2 PRESIDENTS **The stem-and-leaf plot lists the ages of the U.S. Presidents at the time of their first inauguration.**

Age at Inauguration

Stem	Leaf
4	2 3 6 6 7 8 9 9
5	0 0 1 1 1 1 2 2 4 4 4 4 4 5 5 5 5 6 6 6 7 7 7 7 8
6	0 1 1 1 2 4 4 6 8 9

5|0 = 50 years

Source: *The World Almanac*

Based on the data, what inferences can be made about the ages of the U.S. Presidents at their first inauguration?

- Most of the data occur in the 50–59 interval.
- The youngest age is 42. The oldest age is 69. The range is 27.
- The median age is 55.

CHECK Your Progress

Refer to the stem-and-leaf plot in Example 1.

b. In which interval(s) do most of the scores occur?

c. What is the range of the data?

d. What is the median score?

Two sets of data can be compared using a **back-to-back stem-and-leaf plot**. The back-to-back stem-and-leaf plot below shows the scores of two basketball teams for the games in one season.

The leaves for one set of data are on one side of the stem.

Points Scored

Falcons	Stem	Cardinals
7 6 5 5 4 2 2 2	6	4 2
8 8 8 5 4	7	0 2 2 5 7 9
1 0 0	8	1 3 4 6 8 9 9

1|8 = 81 points *8|6 = 86 points*

The leaves for the other set of data are on the other side of the stem.

Real-World EXAMPLE Compare Data

3 **WEATHER** **The average monthly temperatures for Helena, Montana, and Seattle, Washington, are shown. Which city has more varied temperatures? Explain.**

The data for Helena are spread out, while the data for Seattle are clustered. So, Helena has the more varied temperatures.

Average Monthly Temperatures

Seattle, WA	Stem	Helena, MT
	2	0 1 6
	3	2 4
7 6 4 2 1	4	3 5
6 4 0	5	3 5
6 5 1 1	6	2 7 9

1|6 = 61° *4|5 = 45°*

CHECK Your Progress

Use the test score data below.

e. Which class had higher test scores? Explain.

f. Which class had more varied test scores? Explain.

3rd Period	Stem	7th Period
8 8 3 2 2	7	3
7 6 3 1 0 0	8	1 2 5 6 6 8 9 9
3 2 1 1 0	9	0 2 2 3 3 3 3 5 6

8|7 = 78% *7|3 = 73%*

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CHECK Your Understanding

Example 1 (pp. 606–607)

Display each set of data in a stem-and-leaf plot.

1.

Average Life Span					
Animal	**Years**	**Animal**	**Years**	**Animal**	**Years**
Asian Elephant	40	African Elephant	35	Lion	15
Horse	20	Red Fox	7	Chipmunk	6
Moose	12	Cow	15	Hippopotamus	41

Source: *The World Almanac*

2.

Summer Paralympic Games Participating Countries												
Year	'60	'64	'68	'72	'76	'80	'84	'88	'92	'96	'00	'04
Countries	23	22	29	44	42	42	42	61	82	103	128	136

Source: *paralympic.org*

Example 2 (p. 607)

SCHOOL **For Exercises 3–5, use the test score data shown at the right.**

3. Find the lowest and highest scores.
4. What is the median score?
5. Write a statement that describes the data.

Test Scores

Stem	Leaf
5	0 9
6	4 5 7 8
7	0 4 4 5 5 6 7 8 8
8	2 3 3 5 7 8
9	0 1 5 5 9

5|9 = 59%

Example 3 (p. 608)

FOOD **For Exercises 6 and 7, use the food data shown in the back-to-back stem-and-leaf plot.**

6. What is the greatest number of fat grams in each sandwich?
7. In general, which type of sandwich has a lower amount of fat? Explain.

Fat (g) of Various Burgers and Chicken Sandwiches

Chicken		Burgers
8	0	
9 8 5 5 3 3	1	0 5 9
0	2	0 6
	3	0 3 6

8|0 = 8 g *2|6 = 26 g*

Exercises

HOMEWORK HELP

For Exercises	See Examples
8–10	1
11–15	2
16–19	3

Display each set of data in a stem-and-leaf plot.

8.

State Representatives Largest States	
State	**Number**
California	53
Florida	25
Illinois	19
Michigan	15
New York	29
Ohio	18
Pennsylvania	19
Texas	32

Source: www.house.gov

9.

2005–2006 Big 12 Women's Softball	
University	**Wins**
Baylor	38
Iowa State	23
Kansas	36
Missouri	26
Nebraska	44
Oklahoma	40
Oklahoma State	21
Texas	55
Texas A&M	34
Texas Tech	19

Source: big12sports.com

Real-World Link

The Louisiana Tech women's basketball team has the best-winning percentage in Division I. Over a 31-year period, the team has 873 wins and 149 losses.

Source: ncaa.org

ANALYZE TABLES **For Exercises 10–15, use the table shown.**

National League Single Season Home Run Leaders, 1994–2005		
Year	**Player**	**Home Runs**
1994	Matt Williams	43
1995	Dante Bichette	40
1996	Andres Galarraga	47
1997	Larry Walker	49
1998	Mark McGwire	70
1999	Mark McGwire	65
2000	Sammy Sosa	50
2001	Barry Bonds	73
2002	Sammy Sosa	49
2003	Jim Thome	47
2004	Adrian Beltre	48
2005	Andruw Jones	51

Source: mlb.com

10. What is the mean number of home runs hit by a single season home run leader?
11. Display the number of home runs in a stem-and-leaf plot
12. What is the most home runs hit between 1994 and 2005?
13. How many of the season leaders hit fewer than 50 home runs?
14. What is the median number of home runs hit by a single season home run leader?
15. Write a sentence that describes the data.

ANALYZE TABLES **For Exercises 16–19, use the information shown in the back to back stem-and-leaf plot.**

NCAA Women's Basketball Statistics
Overall Games Won, 2005–2006

Big Ten Conference	Stem	Big East Conference
6 6	0	6 8 9
9 9 8 6 3 1	1	0 5 7 8 9 9
9 6 3	2	1 2 2 2 7 7
	3	2
0|1 = 10		*2|5 = 25*

Source: espn.com

16. What is the greatest number of games won by a Big Ten Conference team?
17. What is the least number of games won by a Big East Conference team?
18. How many teams are in the Big East Conference?
19. Compare the median number of games won by each conference.

EXTRA PRACTICE

See pages 706, 718.

Math Online

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H.O.T. Problems

20. **COLLECT THE DATA** Display the foot lengths, in inches, of the students in your class in a stem-and-leaf plot. Then write a few sentences that analyze the data.

21. **CHALLENGE** Create a stem-and-leaf plot of at least 10 pieces of data in which the maximum value is 70, the range is 50, and the median is 25.

22. **WRITING IN MATH** The data about the ages of U.S. Presidents on their inauguration are displayed in a histogram on page 571 and in a stem-and-leaf plot on page 607. Discuss the advantages and disadvantages of using each display.

STANDARDS PRACTICE

23. The back-to-back stem-and-leaf plot shows the amount of protein in certain foods.

Amount of Protein (g)

Dairy Products	Stem	Legumes, Nuts, Seeds
9 8 8 7 7 6 2 2	0	5 6 9
0	1	4 5 8
6	2	
	3	9

6|2 = 26 grams *3|9 = 39 grams*

Which of the following is a true statement?

A The median amount of protein in dairy products is 9 grams.

B The difference between the greatest and least amount of protein in dairy products is 28 grams.

C The average amount of protein in legumes, nuts, and seeds is more than the average amount in dairy products.

D The greatest amount of protein in legumes, nuts, and seeds is 93 grams.

Spiral Review

Draw a box-and-whisker plot for each set of data. (Lesson 11-6)

24. 22, 25, 36, 42, 33, 76, 45, 53, 44, 36, 37, 29

25. 61, 67, 76, 72, 56, 53, 61, 24, 58, 74, 61, 68

RIVERS **For Exercises 26–28, use the table at the right.** (Lesson 11-5)

26. Determine the measures of variation for the data.

27. Find any outliers of the data.

28. Use the measures of variation to describe the data.

Major U.S. Rivers

River	Length (mi)
Arkansas	1,459
Colorado	1,450
Columbia	1,243
Mississippi	2,348
Ohio	981
Rio Grande	1,900

Source: *infoplease.com*

GET READY for the Next Lesson

PREREQUISITE SKILL **Find the mean and median for each set of data.** (Lesson 11-4)

29. 75, 66, 67, 85, 86, 74, 74, 62, 72

30. 20, 28, 21, 16, 16, 15, 20, 21, 56, 17, 16, 18

11-8 Select an Appropriate Display

Main IDEA

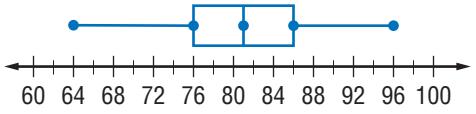
Select an appropriate display for a set of data.

Standard 7SDAP1.1 Know various forms of display for data sets, including stem-and-leaf plot or box-and-whisker plot; use the forms to display a single set of data or to compare two sets of data.

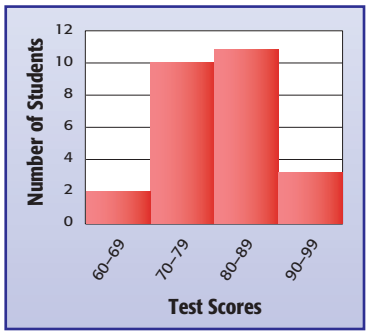
GET READY for the Lesson

SCHOOL The following are five different ways a teacher can display the scores on a test.

Box-and-Whisker



Histogram

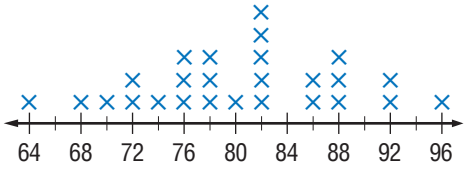


Stem-and-Leaf Plot

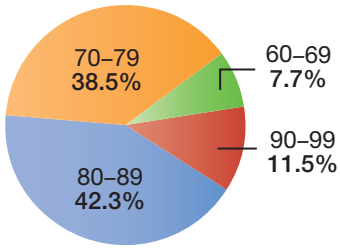
Stem	Leaf
6	4 8
7	0 2 2 4 6 6 6 8 8 8
8	0 2 2 2 2 2 6 6 8 8 8
9	2 2 6

6|4 = 64%

Line Plot



Circle Graph



1. Which display(s) shows the interval of scores for half the class?
2. Which display(s) allow you to find the score for a specific student?

As you decide what type of display to use, ask the following questions.

- What type of information is this?
- What do I want my graph or display to show?

EXAMPLE 1 Select an Appropriate Display

SCHEDULES **Select an appropriate display to show the parts of a day taken up by many activities. Justify your reasoning.**

Since the display will show the parts of a whole, a circle graph would be an appropriate display to represent this data.

CHECK Your Progress **Select an appropriate display.**

a. the population of the United States arranged by age intervals

b. the spread of the average top speeds of 100 selected cars

EXAMPLE 2 Construct an Appropriate Display

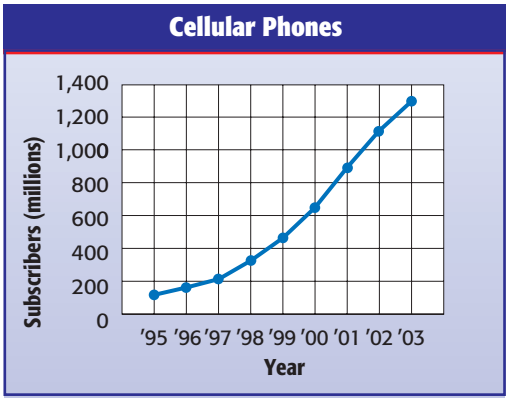
CELLULAR PHONES Select an appropriate type of display for the data below to predict the number of subscribers in 2010. Justify your reasoning. Then construct the display.

Cellular Phone Subscribers					
Year	Subscribers (millions)	Year	Subscribers (millions)	Year	Subscribers (millions)
1995	91	1998	319	2001	900
1996	145	1999	471	2002	1,155
1997	214	2000	650	2003	1,329

Source: International Telecommunication Union

Real-World Link
Cell phones are sophisticated radios. A cell phone carrier usually gets 832 radio frequencies to use across a city.
Source: howstuffworks.com

These data deal with changes over a period of time. A line graph would be an appropriate display to show the change over time.



CHECK Your Progress

c. **OCEANS** The table lists the areas in square miles of five oceans. Select an appropriate type of display to compare the areas of the oceans. Then construct the display.

Ocean Areas	
Ocean	Area (sq. mi)
Arctic	5,427,000
Atlantic	29,637,900
Indian	26,469,900
Pacific	60,060,700
Southern	7,848,300

Source: www.infoplease.com

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STUDY TIP
Look Back
You can review **bar graphs** on p. 662, **line graphs** on p. 662 and Venn diagrams in Lesson 3-3.

CONCEPT Summary — Statistical Displays

Type of Display	Best used to
Bar Graph	show the number of items in specific categories.
Box-and-Whisker Plot	show measures of variation for a set of data.
Circle Graph	compare parts of the data to the whole.
Histogram	show frequency of data divided into equal intervals.
Line Graph	show change over a period of time.
Line Plot	show how many times each number occurs in the data.
Stem-and-Leaf Plot	list all individual numerical data in condensed form.
Venn Diagram	show how elements among sets of data are related.

CHECK Your Understanding

Example 1 (p. 611)

Select an appropriate display for each situation. Justify your reasoning.

1. the parts of a landfill used for various types of trash
2. plant height measurements made every 2 days in a science fair report

Example 2 (p. 612)

3. **FOOD** Select an appropriate type of display for the data. Justify your reasoning. Then construct the display.

Grams of Carbohydrates in a Serving of Various Vegetables											
3	8	10	4	7	6	1	5	19	6	1	2
3	12	23	34	17	3	10	28	7	28	11	

Exercises

HOMEWORK HELP

For Exercises	See Examples
4–9	1
10–13	2

Select an appropriate display for each situation. Justify your reasoning.

4. points scored by individual members of a basketball team compared to the team total
5. numbers of Americans who speak Spanish, French, and/or German
6. the profits of a company every year for the last ten years
7. the populations of the states arranged by intervals
8. the number of students who wish to order each size of T-shirt
9. the price of an average computer for the last twenty years

Select an appropriate display for each situation. Justify your reasoning. Then construct the display.

10.

Americans Studying in Selected Countries	
Country	Number
United Kingdom	31,706
Italy	18,936
Spain	18,865
France	13,080
Australia	10,691

Source: www.IIENetwork.org

11.

Average Height of Females	
Age (years)	Height (inches)
10	56.4
11	59.6
12	61.4
13	62.6
14	63.7
15	63.8

Source: *National Health and Nutrition Examination Survey*

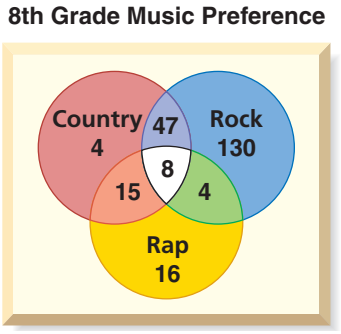
12. **ANIMALS** Refer to the table at the right. Construct an appropriate display of the data.

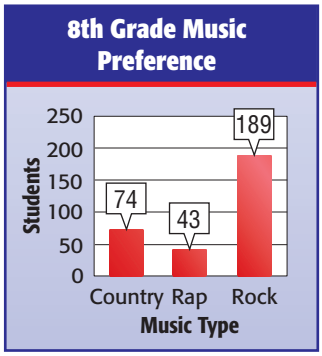
Federally Endangered Animals, U.S.	
Type	Number of Species
Mammals	68
Fish	74
Reptiles and Amphibians	26
Birds	77
Invertebrates	153

Source: U.S. Fish and Wildlife Service

13. **MUSIC** A survey asked teens what they liked most about a song. Of those who responded, 59 said the music only, 41 said the lyrics only, 18 said they liked both equally, and 5 said they did not like either. Construct an appropriate display of this data.

MUSIC **For Exercises 14 and 15, refer to the displays below. Select which display is most appropriate to answer each question. Justify your reasoning. Then answer the question.**



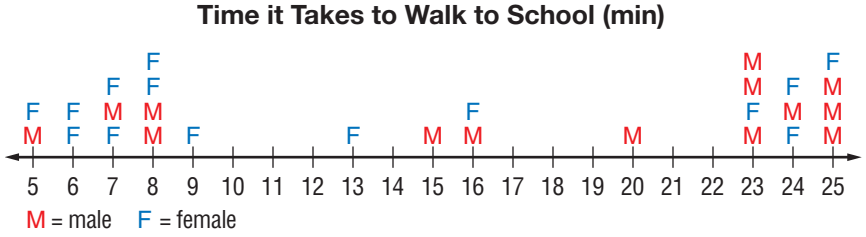


14. How many students like only country music?

15. How many students like rock music?

16. **COLLECT THE DATA** Conduct a survey of your classmates about sports using data that can be presented in a Venn diagram. Then draw the Venn diagram.

SCHOOL **For Exercises 17 and 18, use the plot below. Construct another type of display appropriate to represent this data to answer each of the following questions. Then answer the question.**



17. Compare the median times to walk to school for males and females.

18. What fraction of students are male and spend less than 15 minutes walking to school?

EXTRA PRACTICE
See pages 706, 718.
Math Online
Self-Check Quiz at ca.gr7math.com

19. **FIND THE DATA** Refer to the California Data File on pages 16–19. Choose some data, select an appropriate display for the data, and construct the display.

H.O.T. Problems

20. **OPEN ENDED** Give an example of data that could be represented using a line graph.

CHALLENGE **For Exercises 21–23, state whether the following statements are *always*, *sometimes*, or *never* true. Justify your response.**

21. A circle graph can be used to display data from a histogram.

22. A line graph can be used to display data from a Venn diagram.

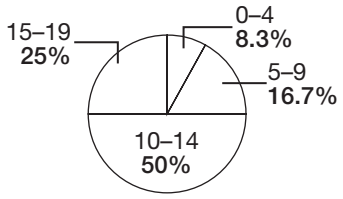
23. A box-and-whisker plot can be used to display data from a line plot.

24. **WRITING IN MATH** Compare and contrast bar graphs and histograms. Explain when it is appropriate to use a histogram rather than a bar graph.

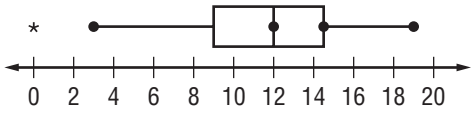
STANDARDS PRACTICE

25. Roger polled 24 classmates to find out the average number of hours each spends online each week. Which of the following displays would be most appropriate to show the individual student responses?

A **Number of Hours Spent Online Each Week**



C **Number of Hours Spent Online Each Week**

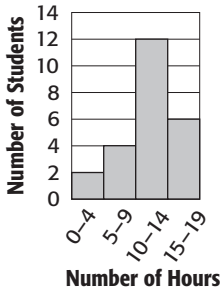


B **Number of Hours Spent Online Each Week**

Stem	Leaf
0	0 3 5 7 8 8
1	0 0 1 2 2 2 3 4 4 4 4 4 5 6 6 8 8 9

1|2 means 12

D **Number of Hours Spent Online Each Week**



Spiral Review

26. Display the data set {$12, $15, $18, $21, $14, $37, $27, $9} in a stem-and-leaf plot. (Lesson 11-7)

Draw a box-and-whisker plot for each set of data. (Lesson 11-6)

27. 42, 38, 42, 45, 43, 80, 55, 50, 34, 36, 40, 35 **28.** 52, 58, 67, 63, 47, 44, 52, 15, 49, 65, 52, 59

POPULATION **For Exercises 29–31, use the table at the right.** (Lesson 11-5)

29. Determine the measures of variation for the data.

30. Find any outliers of the data.

31. Use the measures of variation to describe the data.

Ancestral Origins of America (millions)	
German	42.8
Irish	30.5
African American	24.9
English	24.5
American	20.2
Mexican	18.4
Other	120.7

Source: U.S. Census Bureau

32. **CRAFTS** It takes Carolyn two hours to complete a cross-stitch pattern. Carolyn can spend no more than fourteen hours cross-stitching. Write an inequality that represents this situation and use it to determine whether Carolyn can complete 8 cross-stitch patterns. (Lesson 8-6)

ALGEBRA **Use the Distributive Property to rewrite each expression.** (Lesson 8-1)

33. $8(y + 6)$ **34.** $-5(a - 10)$ **35.** $(9 + k)(-2)$ **36.** $(n - 3)5$

CHAPTER 11

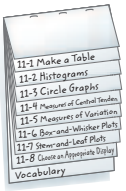
Study Guide and Review

Download Vocabulary Review from ca.gr7math.com

FOLDABLES Study Organizer

GET READY to Study

Be sure the following Key Concepts are noted in your Foldable.



Key Concepts

Displays (Lessons 11-2, 11-3, and 11-6 to 11-8)

- Bar graphs show the number of items in specific categories.
- Box-and-whisker plots use a number line to show the distribution of a set of data.
- Circle graphs compare parts of the data to the whole.
- Histograms show the frequency of data that has been organized into equal intervals.
- Line graphs show change over a period of time.
- Line plots show how many times each number occurs in the data.
- Stem-and-leaf plots list all individual numerical data in a condensed form.

Measures of Central Tendency (Lesson 11-4)

- The mean of a set of data is the sum of the data divided by the number of items in a data set.
- The median of a set of data is the middle number of the ordered data, or the mean of the middle two numbers.
- The mode or modes of a set of data is the number or numbers that occur most often.

Measures of Variation (Lesson 11-5)

- The range of a set of data is the difference between the greatest and the least numbers in the set.
- The interquartile range is the range of the middle half of the data. It is the difference between the upper quartile and the lower quartile.

Key Vocabulary

box-and-whisker plot (p. 599)
circle graph (p. 576)
histogram (p. 570)
interquartile range (p. 593)
lower quartile (p. 593)
mean (p. 585)
measures of central tendency (p. 585)
measures of variation (p. 593)
median (p. 585)
mode (p. 585)
outlier (p. 594)
quartiles (p. 593)
range (p. 585)
stem-and-leaf plot (p. 606)
upper quartile (p. 593)

Vocabulary Check

State whether each sentence is *true* or *false*. If *false*, replace the underlined word or number to make a true sentence.

1. A histogram is a bar graph that shows the frequency of data in intervals.
2. A variation is a piece of data that is more than 1.5 times the value of the interquartile range beyond the quartiles.
3. The range is one of the measures of central tendency.
4. The mean is the sum of the data divided by the number of pieces of data.
5. If you want to show how the parts compare to the whole, use a circle graph.
6. The mode is the middle number of a set of data.
7. The range is the difference between the greatest and the least values in a set of data.
8. The median is a data value that is quite separated from the rest of the data.

MathOnline Vocabulary Review at ca.gr7math.com

Lesson-by-Lesson Review

11-1 PSI: Make a Table (pp. 568–569)

Solve. Use the *make a table* strategy.

9. **SPEEDS** About what percent of the speeds in the table below were from 20–24 miles per hour?

Car Speeds on Maple Avenue		
Speeds (mph)	Tally	Frequency
20–24	𝍸	5
25–29	𝍸 𝍸 ||	12
30–34	𝍸 ||||	9
35–39	||||	4

10. **MAIL** The list shows the cost to mail letters of various weights. Organize the data in a table using the intervals \$0.00–\$0.49, \$0.50–\$0.99, \$1.00–\$1.49, and \$1.50–\$1.99. What is the most common interval of costs?

\$0.87	\$0.30	\$1.25	\$0.68	\$0.45	\$1.24
\$1.40	\$1.10	\$0.49	\$0.37	\$0.37	\$1.00
\$0.35	\$1.76	\$0.39	\$1.30	\$1.99	\$0.99
\$0.43	\$0.29	\$0.66	\$0.40	\$0.98	\$0.39

Example 1 **About what percent of the temperatures below are from 80°F–84°F? Round to the nearest percent. Use the *make a table* strategy.**

Pittsburgh's Daily High Temperatures		
Temperature (°F)	Tally	Frequency
70–74	𝍸 𝍸	10
75–79	𝍸 ||	7
80–84	𝍸	5
85–89	||||	4
90–95	||	2

Find the total number of temperatures listed in the table.

10 + 7 + 5 + 4 + 2 or 28 Add frequencies.

Find the percent of 80°F–84°F.

5 ÷ 28 or 0.179 Divide.

0.179 × 100 or 17.9 Multiply.

So, 18% of the temperatures were in the 80°F–84°F range.

11-2 Histograms (pp. 570–574)

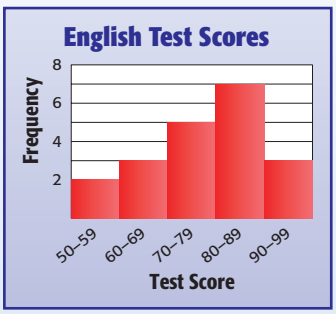
For Exercises 11–14, use the histogram at the right.

11. How large is each interval?
12. How many students scored at least 80?
13. What was the most likely score?
14. What was the lowest score?
15. **ANIMALS** The numbers of years various types of animals are expected to live are listed below. Choose intervals and construct a histogram to represent the data.

1, 3, 5, 5, 6, 7, 8, 8, 10, 10, 10, 12, 12, 12, 12, 15, 15, 15, 15, 16, 18, 20, 20, 25, 35

Example 2 **Choose intervals and construct a histogram to represent the following English test scores.**

56	87	87	74	87	84	94	80	72	58
87	90	68	90	70	73	74	82	64	68



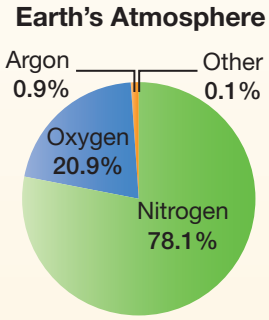
CHAPTER 11

Study Guide and Review

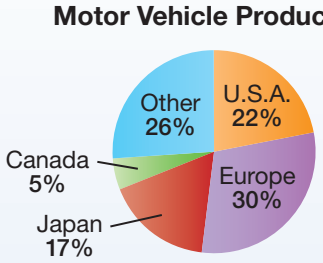
11-3 Circle Graphs (pp. 576–582)

16. **LAKES** Lake Erie is 9,910 square miles, Lake Huron is 23,010 square miles, Lake Michigan is 22,300 square miles, Lake Ontario is 7,540 square miles, and Lake Superior is 31,700 square miles. Make a circle graph showing what percent of the total area of the Great Lakes is represented by each lake.

17. **SCIENCE** Use the graph to describe the makeup of Earth's atmosphere.



Example 3 **Use the circle graph to describe the makeup of vehicle production by region or country.**



Europe produces the greatest amount of vehicles compared to other regions or countries, a little less than one-third. The United States produces about one-fourth of the vehicles. Japan produces a little less than one-fifth of the vehicles.

11-4 Measures of Central Tendency and Range (pp. 585–590)

Find the mean, median, mode, and range for each set of data. Round to the nearest tenth if necessary.

18. the height in feet of various slides
20, 19, 15, 15, 18, 15, 3

19. the number of pounds of recycled newspaper
6.5, 5.6, 6.8, 10.1, 9.6

20. **FOOD DRIVE** Miss Hollern's homeroom collected 18 cans on Monday, 22 cans on Tuesday, 34 cans on Wednesday, 17 cans on Thursday, and 5 cans on Friday. Select the appropriate measure of central tendency or range to describe the data. Justify your answer.

Example 4 **The numbers of grams of fat in various candy bars are listed below. Find the mean, median, mode, and range. Round to the nearest tenth if necessary. Then select the appropriate measure of central tendency or range to describe the data. Justify your answer.**

9, 8, 9, 8, 9, 13, 24

mean: $\frac{8 + 8 + 9 + 9 + 9 + 13 + 24}{7}$ or 11.4 g

median: 8, 8, 9, (9), 9, 13, 24

mode: 9 g occurs most frequently

range: 24 − 8 or 16 g

The appropriate measure of central tendency or range to describe the data is the median or the mode. The mean is affected by the highest value, 24 grams.

11-5 Measures of Variation (pp. 593–598)

Find the range, median, upper and lower quartiles, interquartile range, and any outliers for each set of data.

21. the number of miles from school to home: 12, 2, 3, 2, 3, 3, 4, 5, 4, 6, 1
22. the number of hours spent listening to music: 7, 5, 7, 3, 7, 8, 9, 8
23. **MOVIES** The number of times Jean's friends have been to the movie theater over the last six months is 8, 9, 5, 10, 7, 6, 2, and 4. Use the measures of variation to describe this data.

Example 5 **The numbers of hours spent studying for the French exam are listed below. Find the range, median, upper and lower quartiles, interquartile range, and any outliers for the set of data.**

10, 9, 2, 9, 3, 9, 4, 5, 6, 9, 9

range: $10 - 2$ or 8

median: 2, 3, 4, 5, 6, ⑨, 9, 9, 9, 9, 10

lower quartile: 2, 3, ④, 5, 6

upper quartile: 9, 9, ⑨, 9, 10

interquartile range: $9 - 4$ or 5

outliers: $5 \times 1.5 = 7.5$. Since none of the data are less than $6 - 7.5$ or -1.5, or greater than $10 + 7.5$ or 17.5, there are no outliers.

11-6 Box-and-Whisker Plots (pp. 599–604)

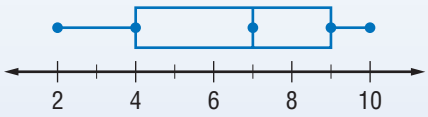
Construct a box-and-whisker plot for each set of data.

24. the number of miles an athlete ran: 0, 5, 7, 11, 13, 13, 13, 14, 15
25. the number of hours spent grading papers: 7, 2, 7, 8, 8, 9, 7, 5
26. **PETS** The numbers of pets various students have are 3, 6, 2, 3, 1, 3, 6, 4, 5, 4, and 2. Construct a box-and-whisker plot for the data. What do the lengths of the parts of the plot tell you?

Example 6 **The hours of various plane flights are listed below. Draw a box-and-whisker plot for the set of data.**

9, 2, 3, 9, 5, 6, 7, 9, 4, 10, 9

Lengths of Plane Flights (hours)



CHAPTER 11

Study Guide and Review

11-7 Stem-and-Leaf Plots (pp. 606–610)

Display each set of data in a stem-and-leaf plot.

27.

Grade	9th	10th	11th	12th
Students	77	65	72	84

28.

Favorite Color	Green	Yellow	Red	Blue
Number	12	17	33	25

WEATHER **For Exercises 29–32, use the temperature data shown below.**

Average Monthly High Temperatures (˚F) for Lake Tahoe, CA

Stem	Leaf
4	1 2 2 6 9
5	3
6	1 2
7	0 2 9 9

7|9 = 79˚

Source: weather.com

29. In which interval(s) do most of the temperatures occur?
30. What is the lowest average monthly temperature? the highest?
31. What is the range of the data?
32. What is the median temperature?

Example 7 **The costs of various cell phone plans are listed below. Draw a stem-and-leaf plot for the set of data.**

$35, $43, $57, $39, $46

Stem	Leaf
3	
4	
5	

Write the stems from 3 to 5 to the left of the vertical line.

Stem	Leaf
3	5 9
4	3 6
5	7

5|7 = $57

Write the leaves to the right of the line, with the corresponding stem. Include a key.

11-8 Select an Appropriate Display (pp. 611–615)

33. **EXPENSES** Select an appropriate display to show the percent of income people spend on various monthly expenses.
34. **POPULATIONS** Is a histogram an appropriate display to represent the populations of counties in Pennsylvania? Justify your answer.

Example 8 **Select an appropriate display for the number of hockey players compared to the total number of athletes.**

An appropriate display would be a circle graph because you are comparing a part to the whole.

CHAPTER 11

Practice Test

1. **NUTRITION** Make a table to determine the number of grams of carbohydrates listed most often.

Carbohydrates (g) in Various Cereals							
15	34	44	38	24	32	22	44
32	15	32	15	24	33	22	32
34	24	32	24	33	44	33	32

EXERCISE **For Exercises 2–5, use the list below.**

Hours Spent Exercising per Week									
3	0	9	1	4	2	0	3	6	14
4	2	5	3	7	3	0	8	3	10

2. Choose intervals and construct a frequency table of this data.
3. Construct a histogram.
4. How many people were surveyed?
5. How many people spend more than 8 hours per week exercising?

PICNICS **For Exercises 6–11, use the list below of the ages of the people at a picnic.**

75, 36, 25, 26, 19, 32, 35, 38, 16, 23, 22, 40, 17

6. Find the mean, median, mode, and range.
7. Select the appropriate measure of central tendency or range to describe the data. Justify your reasoning.
8. Find the upper and lower quartiles and the interquartile range.
9. Identify any outliers.
10. Construct a box-and-whisker plot.
11. When one more person joined the picnic, the mean age was 30. How old was the person that joined the picnic?

12. **STANDARDS PRACTICE** Marsha has an average of 88 for 21 quiz grades. If her teacher drops Marsha's lowest grade, a 70, which equation can be used to find n, Marsha's new quiz average?

A $n = \frac{88 - 70}{20}$ **C** $n = \frac{88 \times 15 - 70}{21}$

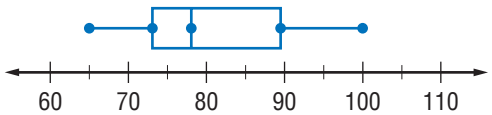
B $n = \frac{88 \times 21 - 70}{20}$ **D** $n = \frac{88 \times 70 - 21}{20}$

13. **STANDARDS PRACTICE** A grocery store had daily sales of \$15,696, \$23,400, \$19,080, \$18,000, \$23,400, \$17,604, and \$15,228 last week. Which data measure would make the sales last week appear the most profitable?

F mean **H** mode
G median **J** range

14. **SCORES** About what percent of the scores in the display below are greater than or equal to 78?

Scores on a Recent Biology Test



15. **DVDs** Select an appropriate type of display to represent the average prices of DVDs over the last 10 years. Justify your answer.

16. **SCHOOL** Display the data for the number of students with a "B" average at Jefferson Elementary School by grade in a stem-and-leaf plot.

Grade	Jackson	Jefferson
1st	27	13
2nd	22	28
3rd	17	36
4th	12	9
5th	33	27
6th	26	30

CHAPTER 11

California Standards Practice

Cumulative, Chapters 1–11

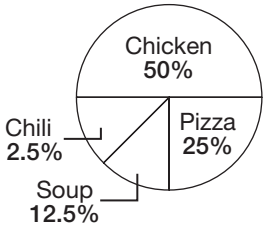
Read each question. Then fill in the correct answer on the answer document provided by your teacher or on a sheet of paper.

1 Clarence surveyed the students in his class about their favorite cafeteria food. The table shows the results of the survey.

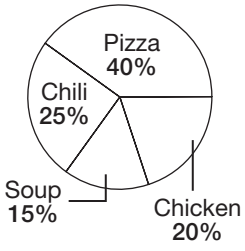
Favorite Cafeteria Food				
Food	Chili	Pizza	Chicken	Soup
Votes	3	12	6	3

Which circle graph best represents the data?

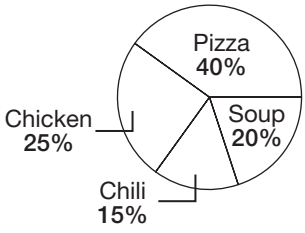
A **Favorite Cafeteria Food**



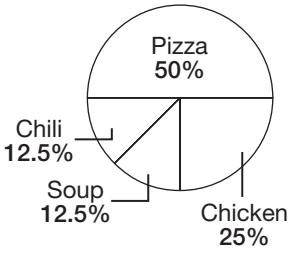
C **Favorite Cafeteria Food**



B **Favorite Cafeteria Food**



D **Favorite Cafeteria Food**



2 Cindy's bowling average is 192 for 12 games. If she drops her lowest score of 174, which equation can be used to find n, Cindy's new bowling average?

F $n = \dfrac{(192 \times 12) - 174}{11}$

G $n = \dfrac{(192 \times 12) - 174}{12}$

H $n = \dfrac{(174 \times 12) - 192}{12}$

J $n = \dfrac{(192 - 174) \times 12}{11}$

3 Janelle wants to buy a new television. She will finance the total cost of $600 by making 12 equal monthly payments to pay back this amount plus interest. What other information is needed to determine the amount of Janelle's monthly payment?

A The interest rate being charged

B The amount of money Janelle has in her savings account

C The brand of the computer

D The amount of Janelle's weekly income

4 The table shows the number of hours students have volunteered at a community center over several months. If the students volunteer 290 hours during the month of September, which measure of data will change the most?

Student Volunteer Hours						
Month	Jan	Feb	Mar	Apr	May	Jun
Hours	145	150	125	165	160	155

F the mean

G the median

H the mode

J They will all change the same amount.

5 Marcia's average math test score was 82. Which of the following students has the same average math test score as Marcia?

A Jenny earned 492 points on 6 tests.

B Frankie earned 352 points on 4 tests.

C Jeremiah earned 468 points on 6 tests.

D Julieanne earned 344 points on 4 tests.

6 Which is an irrational number?

F -2

G $-\frac{7}{8}$

H $\sqrt{3}$

J $\sqrt{4}$

MathOnline **California Standards Practice at** ca.gr7math.com

7 Before the last soccer game of the season, Tony scored a total of 45 goals. He scored 3 goals in the final game, making his season average 2 goals per game. To find the total number of games that Tony played, first find the sum of 45 and 3, and then —

A add the sum to 2.

B subtract 3 from 145.

C multiply the sum by 2.

D divide the sum by 2.

8 Rakim's French test scores were 86, 84, 80, 75, 90, 75, and 88. Which measure of data would give Rakim the highest test score?

F mode

G median

H mean

J range

TEST-TAKING TIP

Question 8 Review any terms that you have learned before you take a test. For example, for a test on data and statistics, be sure that you understand such terms as *mean*, *median*, and *mode*.

9 The cost of a pair of rollerblades is $33. If the rollerblades are on sale for 35% off, what is the sale price of the rollerblades?

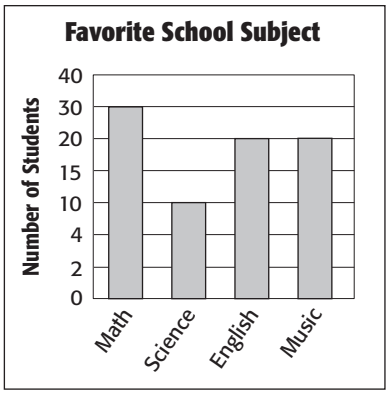
A $11.55

B $15.45

C $21.45

D $23.55

10 The bar graph shows the results of a survey on the favorite school subject among middle school students. Which statement best describes why a person reading the graph might get an incorrect idea about the favorite subject of middle school students?



F The intervals on the vertical scale are not consistent.

G The graph does not include History.

H The vertical scale should show the number of votes for each subject.

J The title of the graph is misleading.

Pre-AP

Record your answers on a sheet of paper. Show your work.

11 A pet store has 8 black dogs, 10 brown dogs, 2 white dogs, 6 spotted dogs, and 5 multicolored dogs.

a. Make a graph that shows the number of each type of coloring the pet store has.

b. Make a graph that shows what part of the total number of dogs is represented by each type of coloring.

c. Describe an advantage of each type of graph you drew.

NEED EXTRA HELP?											
If You Missed Question...	1	2	3	4	5	6	7	8	9	10	11
Go to Lesson...	11-3	11-4	1-1	11-4	11-4	3-4	11-4	11-4	5-7	11-8	11-8
For Help with Standard...	SDAP1.1	SDAP1.3	MR1.1	SDAP1.3	SDAP1.3	NS1.4	SDAP1.3	SDAP1.3	SDAP1.7	SDAP1.1	SDAP1.1