15 STATISTICS

## IN THE PATH OF THE STORM

Xenia, Ohio   **April 3, 1974**

On the afternoon of April 3, 1974, dark clouds hung low and ominous above the quiet town of Xenia, Ohio. A new cloud was slowly forming beneath the others—a black mass that kept growing larger and larger until the bottom appeared to drop out of it and spiral toward the ground. In front of Xenia High School, an eighteen-year-old girl named Ruth Venuti stood rooted to the ground, watching in disbelief. The massive cloud was moving in her direction, dragging its tail along the ground at a speed of forty miles per hour. Finally she found her voice—and her feet. She dashed into the school and ran toward the auditorium,
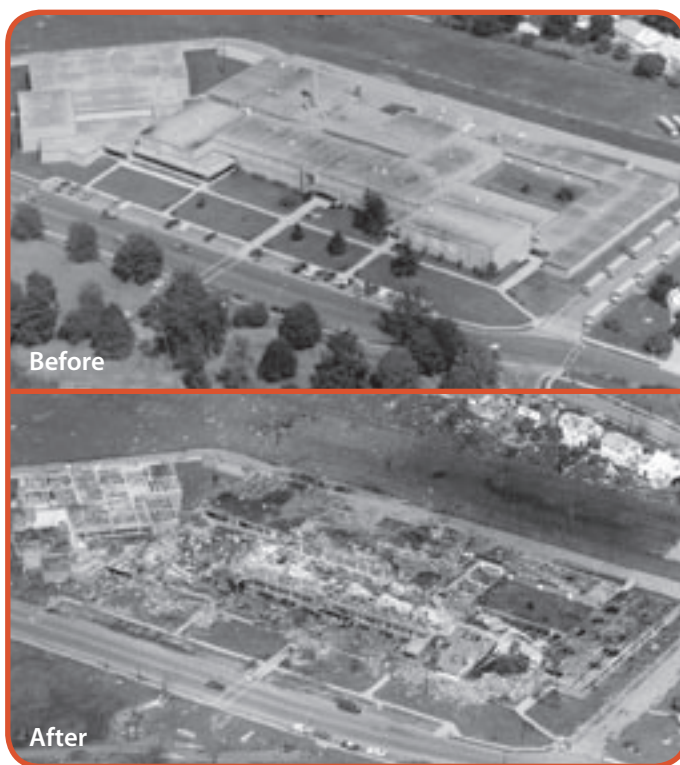
Before

After

Xenia High School before and after the April 1974 tornado

where the drama club was rehearsing. Bursting through the back door, she screamed, "Tornado! There's a twister heading this way!"

The director, David Heath, thought at first that Ruth was joking and started to turn back to the rehearsing students. Then he looked again at her face and realized this was not a laughing matter. He jumped down from the stage and instructed all the students to follow him to the hallway. Through the windows the students could see the black funnel speeding toward them, only two hundred yards away. Mr. Heath directed them to kneel on the floor with their heads in front of their knees. Without asking any questions, the students obeyed. Huddled against the walls, they waited for the tornado to strike.

It did not disappoint them. The F-5 tornado not only swept through Xenia High School but also roared through the town, creating a 32-mile path of rubble in minutes. The funnel picked up cars, people, animals, and furniture, whirling them around and dropping them again. Mr. Heath and his students waited until the eerie shriek of the winds quieted and debris stopped falling on their backs. Slowly, one by one, they raised their heads. Mr. Heath stood and made his way through heaps of dirt, rocks, and fallen beams toward the auditorium. He stopped in shock when he saw that the tornado had picked up a school bus and dropped it through the auditorium roof. It lay upside down on the stage where he and his students had been practicing only minutes before. Ruth's timely warning had saved their lives.

Tornado winds rotate counterclockwise in the Northern Hemisphere and clockwise in the Southern Hemisphere.

Although most tornadoes are not wider than a quarter of a mile, some can grow as wide as one mile and as long as fifty miles.

Most tornadoes travel an average of six miles at approximately 10–20 mph. Some tornadoes can last as long as one hour with winds of up to 250 mph.

Approximately 1,000 tornadoes hit the United States every year, causing an average of eighty deaths and more than 1,500 injuries yearly.

Since 1890, over 100 tornadoes have hit Oklahoma City, which is twenty miles from the home of the Storm Prediction Center for the National Weather Service.

"Tornado Alley" includes eastern Colorado, South Dakota, Kansas, Nebraska, Oklahoma, and northern Texas.

Statistics

Lesson	Topic	Lesson Objectives	Chapter Materials
138	**Statistics**	• Complete a frequency table using given data • Determine the range, median, and mode for a set of data • Calculate the mean for a set of data	**Teaching Visuals (Teacher's Toolkit CD):** • Chart 17: *Histogram* • Chart 18: *Box-and-Whisker Plot*
139	**Double Bar & Double Line Graphs**	• Read and interpret a double bar graph and a double line graph • Determine the range, median, and mode for a set of data • Calculate the mean for a set of data	**Instructional Aids (Teacher's Toolkit CD):** • Cumulative Review Answer Sheet (page IA9) for each student • Frequency Tables (page IA80) • Frequency Tables (page IA80) for each student
140	**Stem-and-Leaf Plots**	• Read and interpret a stem-and-leaf plot • Complete a stem-and-leaf plot • Determine the range, median, and mode for a set of data • Calculate the mean for a set of data	• Double Bar Graph (page IA81) • Double Bar Graph (page IA81) for each student • Double Line Graph (page IA82) • Double Line Graph (page IA82) for each student • Stem-and-Leaf Plot (page IA83)
141	**Line Plots**	• Read and interpret a line plot • Record data on a line plot • Demonstrate an understanding of a cluster, a gap, and an outlier • Determine the effects of an outlier	• Stem-and-Leaf Plot (page IA83) for each student • Line Plot (page IA84) • Line Plot (page IA84) for each student • Histogram (page IA85)
142	**Histograms**	• Read and interpret a histogram • Complete a frequency table using given data • Construct a histogram using given data	• Histogram (page IA85) for each student • Box-and-Whisker Plot (page IA86) • Box-and-Whisker Plot (page IA86) for each student
143	**Box-and-Whisker Plot**	• Develop an understanding of box-and-whisker plots • Determine the lower, middle, and upper quartiles of a set of data • Construct a box-and-whisker plot using given data	• Graph: Double Bar Graph, page IA87 (CD) • Graph: Double Line Graph, page IA88 (CD) • Stem-and-Leaf Plot & Line Plot, page IA89 (CD)
144	**Graph Review**	• Read and interpret graphs: double bar graph, double line graph, stem-and-leaf plot, line plot, histogram, box-and-whisker plot	• Graph: Histogram, page IA90 (CD) • Graph: Box-and-Whisker Plot, page IA91 (CD) • Data (page IA92)
145	**Compare Graphs**	• Calculate the mean for a set of data • Determine the range, median, and mode for a set of data • Record data in a frequency table • Choose a graph to display a set of data	• Data (page IA92) for each student **Christian Worldview Shaping (Teacher's Toolkit CD):** • Page 35
146	**Chapter 15 Review**	• Review	**Other Teaching Aids:** • A calculator for each student • A ruler for each student and the teacher
147	**Chapter 15 Test Cumulative Review**	• Add, subtract, multiply, and divide whole numbers, decimals, and fractions • Find the value of a variable in an equation • Add customary measurements • Convert customary measurements • Express a percent as a fraction in lowest terms • Find the decimal equivalent of a fraction • Identify the value of a digit in a decimal • Round to estimate the difference • Express a fraction as a percent • Measure a line to the nearest sixteenth inch • Identify a chord and a diameter in a circle • Find the unknown measure of an angle in a pair of supplementary angles and in a triangle • Calculate the volume of a cylinder	**Math 6 Tests and Answer Key** **Optional (Teacher's Toolkit CD):** • Fact Review pages • Application pages • Calculator Activities

A Little Extra Help

Use the following to provide "a little extra help" for the student that is experiencing difficulty with the concepts taught in Chapter 15.

Find the mean for a set of data—Remind the student that the mean is the average of a set of data; it is the sum of the data divided by the number of addends. Provide the student with 24 self-adhesive notes. Explain that each self-adhesive note represents $1. Instruct him to illustrate that John has $4 by placing one self-adhesive note above the other, making a column similar to a bar on a vertical bar graph. Direct the student to make other columns to illustrate that Paul has $5, Steven has $8, and Kevin has $7. Explain that the mean can be found by moving one or more dollars from one column and putting it in another column until all columns have an equal number of dollars. Direct the student to move only the dollars that are necessary to move to make the columns equal. After he has completed the task, point out that he redistributed some of the dollars from the taller columns to the shorter columns to make all of the columns level or equal. Ask him what the mean of the $4, $5, $8, and $7 is. *$6* Continue the activity as necessary using other sets of data.

Mental Math

Throughout this chapter, select problems from the list of mental math problems provided on pages IA108–IA110 in the Instructional Aids section of the Teacher's Toolkit CD.

Objectives
- Complete a frequency table using given data
- Determine the range, median, and mode for a set of data
- Calculate the mean for a set of data

Teacher Materials
- Frequency Tables, page IA80 (CD)

Student Materials
- Frequency Tables, page IA80 (CD)
- A calculator

Notes

Preview the Fact Review pages, the Application pages, and the Calculator Activities located on the Teacher's Toolkit CD.

Throughout this chapter, allow the students to use a calculator when calculating the mean during the lesson and for problems on the Student Text pages. You may choose to also allow the students to use a calculator to find the range and the median.

Introduce the Lesson

Guide the students in reading aloud the story and facts on pages 332–33 of the Student Text (pages 330–31 of this Teacher's Edition).

Teach for Understanding

Complete a frequency table

1. Display and distribute the Frequency Tables page. Explain that *statistics* is the branch of mathematics that deals with collecting, organizing, analyzing, and interpreting data. *Data* is a set of collected information or facts.
   ➤ **What data or collected information is listed at the top of the Frequency Tables page?** *Spelling test scores*
   ➤ **What is the lowest recorded score?** *82* **the highest recorded score?** *100*

2. Explain that to analyze a set of data you need to organize it to make it more manageable. A frequency table is one way to organize data.
   ➤ **What do you think would be a good way to organize the Spelling test scores?** *Answers may vary, but elicit that the test scores can be ordered from least to greatest.*
   Choose a student to write the data in least to greatest order for display. Give guidance as needed. *82, 86, 89, 89, 90, 93, 95, 95, 95, 98, 100*

3. Use the following procedure to guide the students in completing the first frequency table on the page. Direct them to write each entry in the frequency table as you write it on the displayed page.
   ➤ **What is the lowest test score?** *82* Write 82 as the first test score in the Score column.
   ➤ **How many test scores of 82 were recorded?** *1* Draw 1 tally in the Tally column in the same row as the score 82.

4. Explain that the tallies in a frequency table represent the number of times that an event occurred. The number of occurrences (tallies) in a category is called the *frequency*.
   ➤ **What is the number of times that 82 was scored on the spelling test?** *1* Write 1 in the Frequency column.

5. Repeat the procedure to record the remaining data on the frequency table: 86 *1*, 89 *2*, 90 *1*, 93 *1*, 95 *3*, 98 *1*, 100 *1*. Elicit from the students that a diagonal is drawn through 4 tallies to indicate 5 tallies.
   ➤ **Why are the scores 83, 84, 87, 88, and 91 not recorded on the frequency table?** *Those scores are not listed in the data.*

Determine the mean, median, mode, and range for a set of data

1. Direct attention to the word *range* below the Spelling Test Scores frequency table. Explain that the *range* is the difference between the greatest value and the least value. It is a measure of the variability of the data (the span of the data or how spread out it is).
   ➤ **Which Spelling test score has the greatest value?** *100* **the least value?** *82*
   ➤ **What is the difference between the greatest value and least value in this set of data? How do you know?** *18; 100 − 82 = 18*
   ➤ **What is the range of the data?** *18* Direct the students to write the range (18) as you write it on the displayed page.

2. Call attention to the word *mean*. Explain that the word *mean* is a statistical term for *average*.
   ➤ **How can you find the average test score?** *Add all of the scores and divide the sum by the number of scores.*

3. Instruct the students to use their calculators to find the average test score. *1,012; 1,012 ÷ 11 = 92*
   ➤ **What is the average test score?** *92* Direct the students to write 92 as the mean as you write it for display.
   ➤ **How could you use the data in the frequency table to write one equation to find the mean?** *Elicit that you could write multiplication expressions inside parentheses to show the test scores that occurred more than one time and write brackets around the expression with all of the test scores to show that the scores must be added before you divide by the number of scores.*

4. Write the equation for display and guide the students in following the Order of Operations to solve it: [82 + 86 + (2 × 89) + 90 + 93 + (3 × 95) + 98 + 100] ÷ 11 = 192. Point out that although this method requires more steps to solve the equation and may appear to require more time, solving one equation is more efficient when you need to find the mean (average) of a large amount of data.

5. Direct attention to the word *median*. Explain that the *median* is the middle value in an ordered set of data.
   ➤ **How do you think you could determine the median in this ordered set of data?** *Accept any correct answer, but elicit that you could repeatedly cross out the least value and the greatest value in the ordered list of test scores until only the middle value remains.*

6. Demonstrate as you guide the students in crossing out pairs of values on their ordered lists of test scores. Point out that this method of finding the median can be used whether values are written in ascending order or descending order.

   82, 86, 89, 89, 90, 93, 95, 95, 95, 98, 100

   ➤ **How many numbers are on each side of the median?** *5*
   ➤ **What is the median?** *93* Direct the students to write 93 as the median as you write it for display.

Statistics is the branch of mathematics that deals with the collection, organization, analysis, and interpretation of data. The data is more easily interpreted when displayed in a table, a chart, or a graph.

| statistics |
| frequency table |
| data |
| range |
| mean |
| median |
| mode |

Brooke organized her math test scores from *least* to *greatest* in a **frequency table**. From this table she can find the range, the mean, the median, and the mode of test scores.

Test Scores: 90, 84, 78, 82, 90, 87, 82, 93, 90

Math Test Scores

Score	Tally	Frequency
78	I	1
82	II	2
84	I	1
87	I	1
90	III	3
93	I	1

Data: collected information or facts

Range: the difference between the greatest value (number) and the least value

Mean (average): the sum of the data divided by the number of addends

Median: the middle value (or an average of the two middle values) of a set of data when ordered from least to greatest

Mode: the value that occurs most often or has the greatest frequency. Some sets may have more than one mode, and some sets may not have a mode.

Range: 93 − 78 = **15**

Mean: 78 + 82 + 82 + 84 + 87 + 90 + 90 + 90 + 93 = 776; 776 ÷ 9 = **86.2**

Median: 78 82 82 84 (87) 90 90 90 93 **87**

Mode: **90**

■ **Exercises**

Use the data from the frequency table to find the answer.

	Campers	
Age	**Tally**	**Frequency**
10	II	2
11	IIII	4
12	III	3
13	II	2
14	II	2

1. How many campers are represented on the frequency table? **13 campers**
2. What is the range in ages of the campers? **14 − 10 = 4**
3. How many of the campers are 11? **4 campers**
4. What age groups have the same frequency? **10, 13, and 14**
5. What age has the greatest frequency (mode)? **11**
6. Find the mean and the median for this data. Round the mean to the nearest tenth. **mean: 11.8; median: 12**

Make a frequency table showing the high temperatures during spring vacation. Use the data to find the answer.

7. What is the range in temperature? **88° − 80° = 8°**

High Temperatures During Spring Vacation
83° 81° 86° 88° 80° 82° 85°

8. What is the mean? Round to the nearest tenth. **83.6°**
9. What is the median? Use the *less than* sign to write a mathematical sentence comparing the median to the mean. **median: 83°; 83° < 83.6°**
10. Why does this data not have a mode? **because each number appears only once**

Find the range and the mode(s) for the set of data.

11. | 3 8 2 6 5 2 4 2 | **range: 8 − 2 = 6; mode: 2**
12. | 33 35 31 30 33 33 35 | **range: 35 − 30 = 5; mode: 33**
13. | 18 17 14 16 17 15 13 18 | **range: 18 − 13 = 5; mode: 17 and 18**

Find the mean and the median for the set of data. *Process to find median may vary.*

14. | 82 85 79 81 85 87 | **mean: 83.2; median: 83.5**
15. | 48 52 41 51 40 | **mean: 46.4; median: 48**
16. | 17 12 15 10 12 18 19 12 | **mean: 14.4; median: 13.5**

■ **Practice & Application**

The Franseens have started a new church. The frequency table shows the attendance for the first Sunday. Use the data to find the answers for questions 17 through 21.

Age Group	Tally	Frequency
0–5	HII II	7
6–12	HII HII IIII	14
13–17	HII HII I	11
18–25	HII HII	10
26 and over	HII HII HII HII IIII	24

17. What is the least number of chairs that could have been set up for ages 6 and up? **59 chairs**
18. The church uses a ratio of 1 teacher to 4 students in the 0–5 age group. How many workers were needed? **2 workers**
19. How many of the people that attended the new church were 26 or older? **24 people**
20. What ratio can be written comparing people 18 and older to those under 18? **34 : 32**
21. Write the frequency for the table from *least* to *greatest*. **7, 10, 11, 14, 24**

So then faith cometh by hearing, and hearing by the word of God.
—Romans 10:17

Use the rectangular prism to find the answer.

22. How many faces does a rectangular prism have? **6**
23. How many faces have an area of 9 ft²? **2**
24. How many faces have an area of 6 feet × 3 feet? **4**
25. What is the total surface area of the rectangular prism? **90 ft²**
26. What is the volume of the rectangular prism? **54 ft³**

3 ft   3 ft   6 ft

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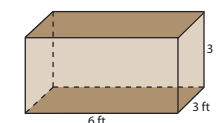
7. Call attention to the word *mode*. Explain that the *mode* is the number that occurs most frequently in a set of data. A set of data may have more than one mode, or if none of the numbers appear more frequently than the other numbers, a set of data has no mode.
   ➤ **Which test score occurs most frequently in the data listed in this frequency table? How do you know?** *95; elicit that 95 occurs more frequently than any of the other scores; it occurs 3 times.* Direct the students to write 95 as the mode as you write it.
   Point out that the range, mean, median, and mode for a set of data are also referred to as *statistics*.

8. Direct attention to the data at the bottom of the page.
   ➤ **What data or collected information is listed here?** *daily low temperatures*

9. Follow a procedure similar to the one used at the beginning of this lesson to guide the students in organizing the data in ascending order *69°, 69°, 71°, 72°, 73°, 74°, 74°, 78°* and then in completing the frequency table: 69 *2*, 71 *1*, 72 *1*, 73 *1*, 74 *2*, 78 *1*.

10. Choose a student to demonstrate finding the range of the data *78° − 69° = 9°* and another student to demonstrate finding the mean. *580° ÷ 8 = 72.5°*

11. Instruct each student to repeatedly cross out the lowest temperature and the highest temperature in his ordered list until only the middle temperature remains.
    ➤ **What do you notice about finding the median with this set of data? Why?** *Elicit that there is no middle number because there is an even number of temperatures.*

12. Explain that when there is an even number of data, the mean or average of the two middle values is the median.
    ➤ **What are the two middle values in this set of data?** *72° and 73°* Draw a circle around the two middle temperatures: 72° and 73°.

13. Choose a student to demonstrate finding the mean (average) of the middle temperatures using one equation. *(72° + 73°) ÷ 2 = 72.5°*
    ➤ **What is the mode in this set of data? Why?** *There is no mode; elicit that no one temperature occurred more frequently that any of the other temperatures.*

Student Text pp. 334–35

Student Text pp. 336–37
Daily Review p. 457b

Objectives
- Read and interpret a double bar graph and a double line graph
- Determine the range, median, and mode for a set of data
- Calculate the mean for a set of data

Teacher Materials
- Double Bar Graph, page IA81 (CD)
- Double Line Graph, page IA82 (CD)

Student Materials
- A calculator

Teach for Understanding

Read and interpret a double bar graph

1. Display the Double Bar Graph page. Explain that a *bar graph* summarizes data in pictorial form and can be drawn horizontally or vertically. All bar graphs have two axes. Each axis is labeled with categories to show the data that is being graphed. The labeling of the axes determines the direction of the bars on the graph.

2. Point out that the categories listed on the horizontal axis of this double bar graph are first grade through sixth grade. The categories listed on the vertical axis represent the frequency (number of occurrences), the number of students per grade.

➤ According to the title, what information is recorded or pictured on this double bar graph? *Grace Christian School Attendance*

➤ For what grades does the graph show attendance? *first, second, third, fourth, fifth, and sixth*

3. Point out that the scale on the left side of the graph has a range of 16 (ranges from 0 to 16). Explain that the *interval* of a scale is the amount between the numbers of the scale. The interval is often determined using the range of the data and the space that is available for making the graph.

➤ What is the interval of the scale for this graph? *2*

4. Remind the students that bar graphs are used to compare data. Explain that a double bar graph compares two sets of related or similar data on the same graph.

➤ What data do the bars on this graph compare? *the number of students in each grade of Grace Christian School*

➤ What two sets of related data do the bars show? How do you know? *The darker bars show the number of boys in each grade, and the lighter bars show the number of girls in each grade; the key shows what the darker and lighter bars represent.*

➤ Which grade has the same number of boys and girls? *fifth grade*

➤ Which grade has the most boys? *fourth grade* the most girls? *third grade*

➤ Which grades have more girls than boys? *second, third, and sixth grades*

➤ Which grade has the greatest difference in the number of boys and girls? How do you know? *Fourth grade; possible answer: the difference in the height of the bars is the greatest (more than 2 intervals) at the fourth grade level.*

➤ Are there more boys or girls in the fourth grade class? *boys* How many more boys are there? How do you know? *5 more boys; 14 boys − 9 girls = 5 more boys*

➤ Which grade has a total of 20 students? How do you know? *first grade; 12 boys + 8 girls = 20 students*

➤ How many more students are in the fifth grade than the first grade? How do you know? *4 students; possible answer: when comparing the darker bars, you can see that the number of boys in the first and the fifth grades is the same; however, the lighter bars show that there are 4 less girls in the first grade.*

➤ What equation can you write to find the number of students in grades 1 through 6? *(12 + 8) + (9 + 13) + (11 + 15) + (14 + 9) + (12 + 12) + (12 + 13) = __*

5. Write the equation for display and direct the students to find the number of students in grades 1 through 6. *20 + 22 + 26 + 23 + 24 + 25 = 140 students*

➤ Which grade has the most students? *third grade* How many students are in the third grade? *26*

➤ Which grade has the least students? *first grade* How many students are in the first grade? *20*

➤ What equation can you write to find the average number of students in grades 1 through 6? *140 students ÷ 6 = __*

6. Direct the students to find the average number of students. Elicit that they need to round the quotient to the nearest whole number. *23 students per grade; 140 ÷ 6 ≈ 23.3*

7. Guide the students in ordering the number of girls in each grade from least to greatest. *8, 9, 12, 13, 13, 15*

➤ What is the range for the number of girls? How do you know? *7; elicit that the range is determined by finding the difference between the greatest value and least value; 15 − 8 = 7.*

➤ What is the *median* of a set of data? *Elicit that the median is the middle value in an ordered list that has an odd number of values or the average of the two middle values in an ordered list that has an even number of values.*

➤ What is the median for the number of girls in grades 1 through 6 at Grace Christian School? How do you know? *12.5; the average of the two middle values, 12 and 13, is 12.5.*

➤ What is the *mode* of a set of data? *the value or number in a list of data that occurs most often or has the greatest frequency*

➤ What is the mode for the number of girls? *13*

➤ Which two grades each have 13 girls? *second grade and sixth grade*

➤ How can you find the mean (average) of the set of girls in grades 1 through 6? *Add the number of girls in all six grades and divide the sum by 6.*

8. Direct the students to find the mean for the set of girls. *(8 + 9 + 12 + 13 + 13 + 15) ÷ 6 ≈ 11.6; 12 girls*

9. Follow a similar procedure for guiding the students in ordering the number of boys in each grade and then in finding the following statistics for the set of data. Elicit that since the two middle values are the same (12), it is not necessary to calculate the average to find the median.

ordered data: *9, 11, 12, 12, 12, 14*
range: *14 − 9 = 5*
median: *12*
mode: *12*
mean: *(12 + 9 + 11 + 14 + 12 + 12) ÷ 6 ≈ 11.6; 12 boys*

Read and interpret a double line graph

1. Display the Double Line Graph page. Explain that a double line graph compares changes that occur over a period of time for two sets of related data.

➤ What information is recorded on this double line graph? *the high and low temperatures of Peaceful Valley for one week*

Double Bar & Double Line Graphs

Graphs are pictorial forms used to summarize data. Bar graphs and line graphs are used to compare or to observe changes in data. The horizontal and vertical axes are reference lines that are labeled with units that use equal **intervals**.

graphs
intervals
double bar graph
double line graph
key

A **double bar graph** compares two sets of related data. The bars can be drawn either horizontally or vertically.

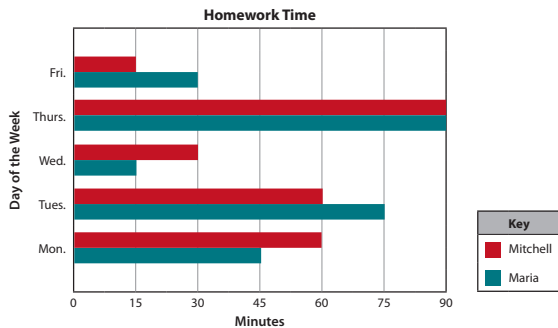A **double line graph** shows changes over time for two sets of related data.

A **key** shows the data that each bar or line represents. The range, the mean, the median, and the mode are found using the graph data.

■ **Exercises**

Use the data from the bar graph to find the answer.

Homework Time

Key
■ Mitchell
■ Maria

1. What is being compared in this graph? *the amount of time that Mitchell and Maria each spend doing homework*
2. Explain the categories listed on the vertical and horizontal axes of the graph. *vertical: days of the week homework is done; horizontal: minutes spent on homework*
3. On which day did Maria and Mitchell spend the most amount of time doing homework? *Thursday*
4. Find the range of homework time for Maria. *90 − 15 = 75*
5. Compare the range of homework time for Maria and Mitchell. *range for Mitchell: 90−15 = 75; the range is the same.*

6. What interval is used for tracking homework time? *15 minutes*
7. What is the average (mean) amount of time spent on homework for Maria? For Mitchell? *51 minutes for both*
8. Does the data show a mode for either Mitchell or Maria? If so, what is it? *yes; Mitchell: 60*
9. Find the median for Mitchell and for Maria. *Mitchell: 60; Maria: 45*
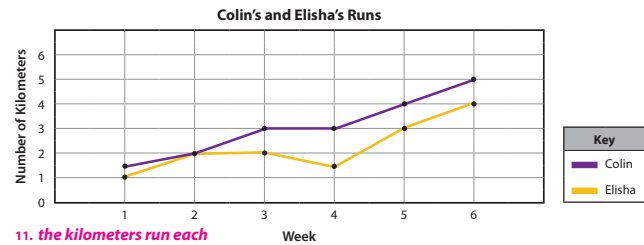10. What days of the week are not shown on the graph? *Saturday and Sunday*

Use the data from the line graph to find the answer.   *Process to find median may vary.*

Colin and Elisha began preparing for a 5K run. They recorded their progress and placed the number of kilometers they ran each week on a line graph. The double line graph shows the change in the number of kilometers they ran in a 6-week period.

Colin's and Elisha's Runs

Key
— Colin
— Elisha

11. *the kilometers run each week by Colin and Elisha*
11. What information is recorded on this graph?
12. Over how much time was the data collected? *6 weeks*
13. During which week did the two boys run the same number of kilometers? *Week 2*
14. Where is the decrease shown in the number of kilometers run by Elisha? *from Week 3 to Week 4*

15. Which week shows the greatest difference in kilometers run? What is the difference? *Week 4; 1.5 km*
16. How many weeks show only a 1-kilometer difference between the two runners? *3 weeks*
17. Find the range, the mean, the median, and the mode for the kilometers run by Colin. Round the mean to the nearest tenth.
18. Find the range, the mean, the median, and the mode for the kilometers run by Elisha. Round the mean to the nearest tenth.

■ **Practice & Application**

Church Attendance		
Date	**Morning**	**Evening**
March 1	212	184
March 8	203	180
March 15	225	190
March 22	240	196
March 29	240	183

17. *range: 3.5 km; mean: 3.1 km; median: 3 km; mode: 3 km*
18. *range: 3 km; mean: 2.3 km; median: 2 km; mode: 2 km*

J *The bars compare the morning service to the evening service.*

19. Make a double line graph showing church attendance for the month of March. Begin the numerical data with 175 and use intervals of 10. Use the data from the line graph to find the answers for questions 20 through 28.
20. What is the range for the evening attendance? *196 − 180 = 16*
21. What is the mean for the morning attendance? *224*
22. Write the data for the morning attendance from *least* to *greatest*. What is the median? *203, 212, 225, 240, 240; median: 225*
23. What is the mode for the morning attendance? *240*

J Make a double bar graph using the same data. Explain the comparison being made between each set of bars.

Complete *DAILY REVIEW* **b** on page 457.

➤ **What information is listed along the horizontal axis?** *the days of the week, Sunday through Saturday* **along the vertical axis?** *the Fahrenheit temperatures*
➤ **What is the interval of the scale of this graph?** *Elicit that the interval is 2; there are 2 degrees between the temperatures of the scale.*
2. Explain that since there is no data for 0° to 59°, the broken scale on the vertical axis between 0° and 60° indicates a larger interval than the rest of the scale.
➤ **What does the key tell you?** *The points of the high temperatures are connected by a solid line, and the points of the low temperatures are connected by a broken or dashed line.*
➤ **What does the line graph show you about the changes in the high temperatures during the week?** *Possible answers: only once during the week, the daily high temperature was lower than the previous day's high temperature; the range of the high temperatures was 5° (74°−69° = 5°).*
➤ **What does the line graph show you about the changes in the low temperatures during the week?** *Possible answers: once during the week the daily low temperature was significantly lower than the previous day's low temperature; the range of the low temperatures was 10° (70°−60° = 10°).*
➤ **On which day was the warmest temperature recorded?** *Saturday* **the coolest temperature?** *Friday*
➤ **What was the range of temperatures for Peaceful Valley during the week? How do you know?** *14°; elicit that the difference between the warmest high temperature and the coolest low temperature was 14°, 74° − 60° = 14°.*

3. Lead a discussion about the steadiness of the high and low temperatures. Guide the students to the conclusion that the high temperatures were quite steady, having only a range of 5°; however, there was a greater fluctuation, a range of 10°, among the low temperatures.
➤ **What was the range of the temperatures on Sunday?** *8°* **Monday?** *4°* **Tuesday?** *3°* **Wednesday?** *6°* **Thursday?** *2°* **Friday?** *12°* **Saturday?** *5°*
4. Guide the students as they find the median, mode, and mean for the high temperatures and the low temperatures. Allow them to use their calculators to find each mean, instructing them to round the mean to the nearest hundredth. Choose students to explain how they found the answers.

high temperatures:
median *72*; mode *72*; mean *71.29; 499 ÷ 7 ≈ 71.285*

low temperatures:
median *66*; mode *no mode*; mean *65.57; 459 ÷ 7 ≈ 65.571*

Student Text p. 336–37

You may choose to guide the students in making the line graph for problem 19 on Student Text page 337 or allow them to work in groups.

Student Text pp. 338–39
Daily Review p. 457c

Objectives
- Read and interpret a stem-and-leaf plot
- Complete a stem-and-leaf plot
- Determine the range, median, and mode for a set of data
- Calculate the mean for a set of data

Teacher Materials
- Stem-and-Leaf Plot, page IA83 (CD)

Student Materials
- Stem-and-Leaf Plot, page IA83 (CD)
- A calculator

Teach for Understanding

Read and interpret a stem-and-leaf plot
1. Display and distribute the Stem-and-Leaf Plot page.

> The Christian school Carter attends has classes for K-4 through 6th grade. Carter conducted a survey to find the number of students enrolled in each of the eight grades. He collected the following data: 20, 17, 21, 19, 22, 18, 20, and 9. He later recorded his data on a stem and leaf plot.

➤ **What is the title of this survey?** *Enrollment at Carter's Christian School*
➤ **What data did Carter collect?** *the number of students in each of the eight grades*

2. Write the data for display to the left of the graph: 20, 17, 21, 19, 22, 18, 20, 9.

3. Explain that a *stem-and-leaf plot* is a way to display the frequency of data, using the actual digits from the data to record the results. Each piece of data is displayed using the tens digit as the stem and the ones digit as a leaf.
➤ **What tens digits from each piece of the data are used as the stem values in the graph? Why?** *0, 1, 2; elicit that the digit in the stem column indicates the number of tens in each number in the data; 0 is the digit written in the stem column to show that the Tens place has no value for the number 9.*
➤ **Why are there no numbers greater than 2 in the Stem column?** *Elicit that the data that Carter collected had no values containing more than 2 tens.*

4. Choose a student to count the number of leaves or pieces of data recorded in the Leaf column. *8*
➤ **Why do you think there are 8 digits in the Leaf column?** *Elicit that there is one leaf or digit for each piece of data (each number) that Carter recorded on the graph.*

5. Choose a student to explain the key. *Possible explanation: 1|7 = 17 students shows that 1|7 indicates 1 ten and 7 ones or 10 + 7 or 17 students.*
➤ **What is the least number and the greatest number of students in a grade at Carter's Christian school?** *9 and 22*
➤ **What is the term given for the difference between the greatest value and the least value in a set of data?** *range*
➤ **What is the range of the number of students in a grade? How do you know?** *13; 22 − 9 = 13*

6. Remind the students that the range (13) measures the variability or the span of the data (how spread out it is). Direct them to write 13 as the range on their page as you write it for display. Instruct them to write the mode, median, and mean as you write them for display during the following discussion.
➤ **Which number of students in each grade occurred most often? How do you know?** *20; elicit that there were 20 students in two different grades.*
➤ **What term is used to refer to the value that occurs most often or has the greatest frequency in a set of data?** *mode* Write 20 as the mode.
➤ **What is the middle value in a set of data?** *the median*
➤ **How do you think you can find the median for the digits in a stem-and-leaf plot?** *Elicit that if the data has an odd number of leaves, you can count from the top leaf down and from the bottom leaf up to find the middle leaf. If the number of leaves is even, you can count from the top leaf down and from the bottom leaf up to find the middle two leaves and then average the numbers represented by the two middle leaves (digits).*
➤ **How many leaves are in the stem-and-leaf plot?** *8*
➤ **Since there is an even number of leaves (digits), what two numbers must you average? How do you know?** *19 and 20; elicit that 9 and 0 (the fourth and fifth leaves) are part of the numbers 19 and 20; there are 3 leaves (digits) representing values that are less than the two middle leaves and 3 leaves (digits) representing values that are greater than the two middle leaves.*

7. Elicit that since 19 and 20 are consecutive numbers, you can determine that the median for the set of data is 19.5 without calculating the average of 19 and 20. Write 19.5 as the median.
➤ **What is another word for the average of a set of data?** *mean*
➤ **How do you find the mean?** *Elicit that you add all of the data (the numbers of students in all of the grades) and divide the sum by 8 (the number of grades or addends).*

8. Direct the students to find the mean. *(9 + 17 + 18 + 19 + 20 + 20 + 21 + 22) ÷ 8 = 146 ÷ 8 = 18.25*
➤ **What is the mean for this set of data?** *18.25*
➤ **What does a mean or average of 18.25 students per class mean?** *$18\frac{1}{4}$ students are enrolled per class; elicit that although there is not $\frac{1}{4}$ of a student in each class, the total enrollment (146) was not equally distributed among the 8 classes; 146 is not divisible by 8.*

9. Remind the students that the range, mean, median, and mode can be referred to as *statistics* for the set of data.

Complete a stem-and-leaf plot

> Lennae asked each of her friends to write the ages of their siblings on paper. Then she compiled the following data: 3, 8, 14, 2, 5, 10, 14, 16, 4, 10, 8, 7, 4, 15, 24, 20, 10, 9.

1. Write the given data to the left of the blank graph at the bottom of the page.
➤ **What could you title this stem-and-leaf plot?** *Answers may vary, but elicit Ages of Friends' Siblings.* Direct the students to write the title above the stem-and-leaf plot as you write it for display.

2. Instruct the students to organize the data from least to greatest. Choose a student to write his organized list for display. *2, 3, 4, 4, 5, 7, 8, 8, 9, 10, 10, 10, 14, 14, 15, 16, 20, 24*

Stem-and-Leaf Plots

Another way to display data is on a **stem-and-leaf plot**. Each piece of data is displayed using the tens digits of the data as its stems and the ones digits of the data as its leaves. The leaves indicate the number of items in the data. A title and a key are provided to give guidance for reading and understanding the graph.

> **steam-and-leaf plot**
> stem: tens
> leaf: ones

Juan recorded his math test scores to evaluate his progress: 89, 92, 87, 95, 79, 98, 94, 92, 89, and 92. He ordered the scores from *least to greatest* and put them in the stem-and-leaf plot. Then he found the range, the mean, the median, and the mode.
79, 87, 89, 89, 92, 92, 92, 94, 95, 98

Math Test Scores

Stem	Leaf
7	9
8	7 9 9
9	2 2 2 4 5 8

There are 10 leaves or 10 pieces of data.

Key 8|7 = 87

Range	Mean	Median	Mode
98 − 79 = **19**	907 ÷ 10 = **90.7**	**92**	**92**

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■ **Exercises**   *Process to find median may vary.*

Make a stem-and-leaf plot showing the number of books sold. Use the data from the plot to find the answer.

1. Write the title and the key for the stem-and-leaf plot. ***Answers may vary.***
2. How many days are represented? ***12***
3. Write the number of books sold from *least* to *greatest*. ***9, 10, 12, 14, 15, 18, 19, 20, 21, 21, 23, 30***
4. What is the range of the data? ***30 − 9 = 21***
5. Find the mean of the data. Round to the nearest tenth. ***The sum of the data is 212; 212 ÷ 12 ≈ 17.7***
6. What is the median? ***18.5***
7. What is the mode? ***21***

> The store manager recorded the number of books sold in his Christian bookstore for a time period of two weeks. The store is closed on Sundays.
>
> **Books Sold:** 12, 21, 30, 14, 10, 9, 15, 18, 23, 20, 21, 19

Make a stem-and-leaf plot showing the ages of missionaries. Use the data from the plot to find the answer.

8. Write the title and the key for the stem-and-leaf plot. ***Answers may vary.***
9. Write the ages of the missionaries from *least* to *greatest*.
10. What is the range of the data? ***61 − 28 = 33***
11. Find the mean. Round to the nearest tenth. ***40.9***
12. What is the median? ***39***
13. What is the mode? ***30***
14. Which stem has the most leaves? ***3***
15. What ages are represented by stem 4? ***40, 41, 43, and 44***

> The Community Bible Chapel compiled a list of the ages of the missionaries it supports. The data represents the oldest person in each missionary family.
>
> **Ages of Missionaries:** 44, 53, 41, 37, 39, 44, 30, 40, 60, 32, 43, 28, 30, 61, 35, 57, 35, 30, 38

9. ***28, 30, 30, 30, 32, 35, 35, 37, 38, 39, 40, 41, 43, 44, 44, 53, 57, 60, 61***

11. ***mean: The sum of the data is 777; 777 ÷ 19 ≈ 40.9***

Use the data from the stem-and-leaf plot to find the answer.   *Process to find median may vary.*

> Many missionaries go on deputation, which is a time of visiting churches to raise prayer and financial support. This stem-and-leaf plot shows the number of months some missionaries have been on deputation.

Months of Deputation

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

Key 1|3 = 13

16. What is the greatest amount of time spent on deputation? ***63 months***
17. What is the least amount of time spent on deputation? ***13 months***
18. What is the range of the data? ***63 − 13 = 50***
19. A total of 584 months are represented on the stem-and-leaf plot. Round to the nearest tenth to find the mean for this data. ***584 ÷ 19 ≈ 30.7***
20. What is the median? ***27***
21. What is the mode? ***25***

■ **Practice & Application**

Emergency Service Calls

Year	Fox Hills Squad	Cool Springs Squad
2006	515	589
2007	522	513
2008	533	506
2009	516	533
2010	559	509

22. Make a double line graph showing the service calls for each emergency squad. Begin the numerical data with 500 and use intervals of 10. Use the data from the line graph to find the answers for questions 23 and 24.
23. What is the range, the mean, and the median for the Fox Hills Squad? ***range: 559 − 515 = 44; mean: 529; median: 522***
24. What is the range, the mean, and the median for the Cool Springs Squad? ***range: 589 − 506 = 83; mean: 530; median: 513***
25. 14.86 × 27 ***401.22***
26. 3.79 × 5.2 ***19.708***
27. Round to the nearest hundredth to find the quotient of 495 ÷ 0.34. ***1,455.88***
28. Round to the nearest thousandth to find the quotient of 733 ÷ 6.4. ***114.531***

Answers are shown using cancellation.

29. $1\frac{3}{4} \times \frac{5}{8}$ $\frac{7}{4} \times \frac{5}{8} = \frac{35}{32} = 1\frac{3}{32}$
30. $\frac{2}{3} \times 3\frac{1}{2}$ $\frac{2}{3} \times \frac{7}{2} = \frac{7}{3} = 2\frac{1}{3}$
31. $\frac{5}{8} \div \frac{1}{2}$ $\frac{5}{8} \times \frac{2}{1} = \frac{5}{4} = 1\frac{1}{4}$
32. $5\frac{1}{6} \div \frac{5}{12}$ $\frac{31}{6} \times \frac{12}{5} = \frac{62}{5} = 12\frac{2}{5}$

Ⓙ Write the definitions for the terms *mean*, *median*, and *mode*. List your math test grades for this quarter. Find the mean, the median, and the mode of your test grades. ***Answers will vary.***

Tornadoes begin in severe thunderstorms called *supercells*. As the wind sweeps into the storm, it forms a funnel.

Complete **DAILY REVIEW** Ⓒ on page 457.

➤ **What digits should you write in the Stem column to represent the Tens values in the data? Why?** *0, 1, and 2; elicit that there is data that have no tens, 1 ten, and 2 tens.*

3. Direct the students to write 0, 1, and 2 in the Stem column as you write the stem values for display.
   (*Note:* The digits representing the stem values may be written in ascending or descending order.)

➤ **How many leaves will be on this stem-and-leaf plot? Why?** *18; there will be one leaf or digit for each piece of data (each number) in the list of data.*

4. Guide the students in writing the leaves on the graph in order from least to greatest for each stem.
5. Direct the students to make a key similar to the one at the top of the page. Remind them that the key is an example of how to read the stems and leaves. ***Answers will vary.***
   Choose several students to write their key for display and explain it. Write one of the keys for display below the graph.

Ages of Friends' Siblings

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

Key 1|0 = 10 years old

➤ **What is the age of the youngest sibling?** *2* **the oldest?** *24*
Point out that these numbers measure the variability of the data.

➤ **What is the difference between the greatest value and the least value in a set of data called?** *the range*
➤ **What is the range of the siblings' ages? How do you know?** *22; 24 − 2 = 22* Direct the students to write 22 as the range as you write it for display.

6. Guide the students in using the stem-and-leaf plot to find the mode, median, and mean (rounded to the nearest hundredth), recording the answers below the graph.
   mode *10*, median *9.5*, mean *10.17; 183 ÷ 18 ≈ 10.17*

Student Text pp. 338–39

Objectives
- Read and interpret a line plot
- Record data on a line plot
- Demonstrate an understanding of a cluster, a gap, and an outlier
- Determine the effects of an outlier

Teacher Materials
- Line Plot, page IA84 (CD)

Student Materials
- Line Plot, page IA84 (CD)
- A calculator

Teach for Understanding

Read and interpret a line plot

1. Display and distribute the Line Plot page. Explain that a *line plot* is another type of graph that is used to record data. An *X* is placed above a number on a number line each time that number, which indicates a piece of data, appears in the data. A line plot for a set of data helps you to quickly identify the frequency of the data.

> The Sunday school teacher recorded the number of verses that each of her students memorized for the memory verse contest.

➤ **How many students are in the Sunday school class? How do you know?** *21; each X on the line plot represents 1 student.*

➤ **What is the least number of verses that any student memorized?** *1* **the greatest number memorized by any student?** *15*

➤ **How can you find the range of the number of verses that were memorized?** *Find the difference between the greatest number and the least number of verses that were memorized; 15 − 1.*

➤ **What is the range?** *14* Guide the students in writing the range in the blank just below the line plot. Remind them that the range shows the span or the variability of the data. (*Note:* Throughout this lesson, direct each student to write the answers on his page as you write them for display.)

2. Point out the scale of the line plot (1–15). Explain that the scale for a line plot must include the range of the data being recorded.

➤ **What is the mode for this set of data? How do you know?** *7; elicit that since the mode is the number that occurs most frequently in a set of data, the number above which the most Xs are recorded (7) indicates the greatest frequency (i.e., the greatest number of students memorized 7 verses); 4 students memorized 7 verses.* Write 7 as the mode.

3. Elicit that the median is the middle value of a set of data that has been ordered from least to greatest.

➤ **What number is the median? How do you know?** *7; elicit that Xs represent the number of verses memorized by each of 21 students; there are 10 Xs above the numbers that are less than 7 (1–6) and 10 Xs above the numbers that are equal to or greater than 7; the middle X is above 7.* Write 7 as the median.

4. Elicit that the mean is the average for a set of data.

➤ **How can you find the mean?** *Elicit that you add all of the data (the numbers of verses that were memorized) and divide the sum by 21 (the number of students or addends).*

Direct the students to find mean for the set of data. Instruct them to round the answer to the nearest hundredth. *140 ÷ 21 ≈ 6.666; 6.67* Write 6.67 as the mean on the displayed page.

➤ **What does the mean of 6.67 indicate for this set of data?** *Elicit that if the verses memorized were equally distributed among the 21 students, each student would have memorized $6\frac{67}{100}$ verses.*

5. Point out that in this set of data the mode (7), median (7), and mean (6.67) are all close in value.

➤ **Where do you notice a grouping of the majority of the data?** *Elicit that the majority of the Xs are grouped above the numbers 4 to 9 on the line plot.*

6. Explain that a tight grouping of the data on a line plot is called a *cluster*.

➤ **What does the cluster on this line plot indicate?** *Elicit that the grouping of 2 or more Xs indicates that 2 or more students memorized 4 to 9 verses.*

➤ **Where do you notice an empty space on the line plot?** *12–14* **What do you think this empty space indicates?** *Elicit that no data (Xs) was recorded for 12–14; no students memorized 12–14 verses.*

7. Explain that a space in which no data has been recorded on a line plot is called a *gap*.

8. Point out the *X* above 15. Explain that this piece of data is an *outlier*, a value that is greater than or less than the values of the other data and separated from the other data by a gap.

Determine the effects of an outlier
Record data on a line plot

➤ **Do you think that an outlier in a set of data will affect the range, median, mode, and mean of the data? Why?** *Answers will vary.*

1. Direct the students to find the mean, median, mode, and range for the number of verses memorized without the outlier. Allow them to use a calculator if needed.

➤ **What is the range without the outlier? How do you know?** *10; 11 − 1 = 10* Write 10 as the range without the outlier.

➤ **Did omitting the outlier affect the mode? How do you know?** *No; elicit that the mode is still 7; the outlier does not affect the number with the greatest frequency.* Write 7 as the mode.

➤ **What is the median without the outlier?** *6.5* **the mean?** *6.25; 125 ÷ 20 = 6.25* Write 6.5 as the median and 6.25 as the mean.

➤ **What do you notice about the statistics when they were calculated without the outlier?** *Elicit that the mode the remained the same, but the range, median, and mean decreased.*

2. Point out that in this set of data the outlier has a greater value than the other data; therefore, the range decreased because omitting the outlier reduced the span of the data, and the median and the mean decreased when they were determined without the outlier. The mode was not affected by the outlier because the outlier does not occur most frequently. Explain that omitting outliers allows the statistics to better represent the data.

Line Plots

A **line plot** uses the range of data as its **scale**. Each piece of data is indicated by an X above the number it represents.
Katie jogged 1 mile on two days.

A **cluster** is a tight grouping of data on the line plot.
There is a cluster from 1 to 5.

A **gap** is an empty space with no data on the line plot.
There is a gap from 6 to 7.

An **outlier** is a piece of data that is much greater or much less than the other data.
The outlier is 8 miles jogged.

line plot
scale
cluster
gap
outlier

Katie kept a record of the miles she jogged for 10 days.

1, 3, 2, 2, 5, 4, 1, 2, 4, 8

cluster | gap | outlier

Miles Jogged

■ **Exercises**

Process to find median may vary.

Use the data from the line plot to find the answer.

Each track team member kept a record of how many cups of water he drank daily. Jeremy collected the data and made this line plot.

Cups of Daily Water Intake
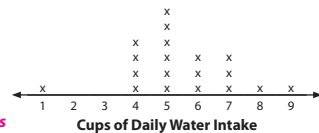
1. How many members are on the team? **19 members**

2. How many members drank 6 cups of water per day? **3 members**

3. Name and explain the outlier. **1; 1 is much less than the other data.**

4. How do you determine the range of the data? **find the difference between the greatest value (number) and the least value**

5. What is the range of the data? **9 − 1 = 8**

6. What is the mode? **5**

7. What is the median? **5**

8. Find the mean. Round to the nearest tenth. **The sum of the data is 103; 103 ÷ 19 ≈ 5.4**

Find the statistics without the outlier. Round the mean and the median to the nearest tenth.

9. range **9 − 4 = 5**   10. mode **5**   11. median **5**   12. mean **The sum of the data is 102; 102 ÷ 18 ≈ 5.7**

13. Analyze how the range, the mode, the median, and the mean were affected without the outlier. **Without the outlier, the median and the mode remained the same, the range was less, and the mean was greater.**

Make a line plot showing the number of museum visitors. Use the data from the line plot to find the answer.

Museum Visitors

16, 17, 19, 21, 20, 25, 20, 21, 20, 18, 20, 21, 21, 19, 18, 21, 16, 18, 19

Process to find median may vary.

14. How many days had 21 visitors? **5**

15. Where is the cluster on the line plot? **16 to 21**

16. Which number is the outlier? **25**

17. Where is the gap on the line plot? **22 to 24**

18. What is the range of the data? **25 − 16 = 9**

19. What is the mode? **21**

20. Find the mean of the data. Round to the nearest tenth. **19.5**

21. What is the median? **20**

22. Find the range, the mean, the median, and the mode without the outlier. Round the mean and the median to the nearest tenth. **range: 21 − 16 = 5; mean: the sum of the data is 345; 345 ÷ 18 ≈ 19.2; median: 19.5; mode: 21**

■ **Practice & Application**

Complete the table. Use the data from the table to find the answer.

Sports activities, such as baseball, soccer, swimming, and tennis, all use math in some way. Information such as scores, time, or distance is recorded. These statistics can be analyzed to evaluate individual or team performance.

Soccer Team Records			
Season	Games Won	Games Lost	Percent Won
2005	10	5	**67%**
2007	8	6	**57%**
2008	12	5	**71%**
2009	11	6	**65%**
2010	10	8	**56%**

23. In which season did the soccer team have its best record? **2008**

24. In which season did it have its worst record? **2010**

Solve.

25. Write a ratio that shows that Jasper made 9 of 15 attempted field goals. What percentage of field goals did Jasper make? **$\frac{9}{15}$ = 9 ÷ 15 = 0.6; 0.6 × 100 = 60%**

26. C. J. made 12 of his 19 field goal attempts. Who has a better success percentage, Jasper or C.J.? **$\frac{12}{19}$ = 63%; 63% > 60%; C. J.**

27. Sherman High scored 9 points in the first half of the football game. Use the chart to list all the possible ways the team could score 9 points. An extra point can be scored only immediately after a touchdown.

Football Points			
touchdown	6	field goal	3
extra point	1	safety	2

27. **Answers may vary; touchdown + field goal; touchdown + extra point + safety; field goal + field goal + field goal.**

The line graph shows change over time.

Ⓙ Make a line plot and a line graph to show the consecutive science test scores for Rico. Explain which graph allows you to better visualize how his grade changes with each test.

Test scores: 100, 98, 96, 92, 95, 89, 90, 95, 80, 93, 91

Complete *DAILY REVIEW* Ⓓ on page 458.

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3. Guide the students in listing the Science test scores in the following situation.

The teacher recorded the following scores for a Science test: 90, 93, 95, 90, 81, 90, 95, 91, 90, 92, 93, and 94.

➤ **What is the range of the test scores? How do you know?** *14; the difference between the highest score (95) and the lowest score (81) is 14; 95 − 81 = 14.* Write 14 as the range.

4. Direct attention to the blank line plot at the bottom of the Line Plot page. Remind the students that the scale for a line plot should include the range of the data.

➤ **What do you think the scale for this line plot should be? Why?** *Accept any correct scale; the scale must include the range of the data (the Science test scores).*

5. Guide the students in writing the scale 80–95 for the line plot. Point out that other scales that include the range of the test scores could also be used. (e.g., 75–100 or 75–95)

6. Direct the students to record each test score as you record it on the displayed page. Point out that the Xs need to be uniform in size to easily compare the data.

➤ **How many students took the Science test? How do you know?** *12; each X represents 1 student.*

➤ **Where do you see a cluster in the line plot?** *90–95*

➤ **Is there a gap in the line plot? Where?** *yes; from 82 to 89*

➤ **What is the outlier?** *81*

➤ **What is the mode? How do you know?** *90; elicit that 90 is the score above which the most Xs were recorded; four students earned a score of 90 on their test.* Write 90 as the mode.

7. Instruct the students to find the median and the mean for the set of data, rounding the mean to the nearest hundredth.

➤ **What is the median? How do you know?** *91.5; elicit that the two middle scores are 91 and 92; five scores (Xs) are less than 91 and five scores are greater than 92. The average of 91 and 92 is 91.5; therefore, the median is 91.5.* Write 91.5 as the median.

➤ **What is the mean? How do you know?** *91.17; elicit that the sum of all the test scores is 1,094; 1,094 divided by 12 (the number of scores) is 91.17.* Write 91.17 as the mean.

➤ **Since the outlier is a lesser value than the other data, how do you predict omitting it will affect the statistics for this set of data?** *Elicit that the mode will remain the same because its frequency is not affected by the lesser outlier; however, the range, median, and mean will increase when they are determined without the lesser outlier.*

8. Guide the students as they find and record the range, mode, median, and mean without the outlier (81).

➤ **What is the range?** *5* **mode?** *90* **median?** *92* **mean?** *92.09*

➤ **Were your predictions about calculating the statistics without the outlier correct?** *Yes; elicit that, as predicted, the mode remained the same, and the range, median, and mean all increased.*

➤ **Which statistic showed the greatest change?** *the range* **What change in the range was shown?** *Elicit that the range changed from 14 with the outlier to 5 without the outlier.*

Student Text p. 340–41

(**Note**: *Assessment* available on Teacher's Toolkit CD.)

Student Text pp. 342–43
Daily Review p. 458e

Objectives
- Read and interpret a histogram
- Complete a frequency table using given data
- Construct a histogram using given data

Teacher Materials
- Chart 17: *Histogram*
- Histogram, page IA85 (CD)
- A ruler

Student Materials
- Histogram, page IA85 (CD)
- A ruler

Teach for Understanding

Read and interpret a histogram

1. Display the *Histogram* chart. Explain that although it is similar to a bar graph, a *histogram* rather than a typical bar graph is used to graph large amounts of data. The data is separated into equal *intervals* so there is no space between the bars. Each bar represents an interval.
   ➤ **What is the title of this histogram?** *Piano Students' Weekly Practice*
   ➤ **What are the intervals on this histogram?** *0–1, 2–3, 4–5, 6–7, 8–9, and 10–11*
   ➤ **What do you notice about the intervals?** *Elicit that the intervals are of equal size, they are continuous, and they do not overlap.*

2. Explain that unlike bar graphs that can have horizontal or vertical bars, a histogram always has vertical bars. The horizontal axis shows the data separated into equal intervals, and the vertical axis shows the frequency of the data.
   ➤ **What do the intervals along the horizontal axis of this histogram represent?** *the number of practice hours*
   ➤ **What do the numbers along the vertical axis represent?** *the number of students practicing the piano*

3. Call attention to the bars on the histogram.
   ➤ **What does the first bar illustrate?** *Elicit that 2 students practiced 1 hour or less during the week.*
   ➤ **How many students practiced 2–3 hours during the week?** *5* **4–5 hours?** *8* **6–7 hours?** *4* **8–9 hours?** *2* **10–11 hours?** *1*
   ➤ **How many piano students does the teacher have? How do you know?** *22; elicit that adding the number of students that were recorded for each interval of practice time gives you the total number of students; 2 + 5 + 8 + 4 + 2 + 1 = 22 students.*
   ➤ **How do you think you can find the mode for this set of data?** *Elicit that the tallest bar in the histogram indicates the interval of time that the most students practiced (the interval with the greatest frequency).*
   ➤ **What interval is the mode for this set of data?** *4–5 hours*
   ➤ **How many hours did the least number of students practice? How do you know?** *10–11 hours; elicit that the 10–11 interval has the shortest bar, showing that 1 student practiced 10–11 hours.*
   ➤ **What is the range of the practice hours in this set of data? How do you know?** *11; the intervals begin at 0 and end with 11; 11 − 0 = 11.*

Complete a frequency table and construct a histogram

1. Display and distribute the Histogram page.
   ➤ **What data is given on the page?** *the ages of campers that attended the first week of camp*

2. Remind the students that making a frequency table can be used to organize data so that the data is more manageable. A histogram can be constructed using the organized data in a frequency table.

3. Direct attention to the frequency table on the page. Explain that since the data represents a continuous range of numbers, you can list the ages in intervals. Knowing the range of a set of data is useful in determining the scale of a histogram and the scale's intervals for graphing the data.
   ➤ **What is the range of the ages of the campers that attended the first week of camp? How do you know?** *7 years; the difference in the ages of the youngest camper (8) and the oldest camper (15) is 7; 15 − 8 = 7.*
   ➤ **What do you think the scale of the histogram should be? Why?** *Elicit that the scale should be 8–15; the scale must include the least number to the greatest number in the data.*

4. Explain that intervals of a histogram do not need to begin with 0 or 1. The range (7) indicates the greatest number of intervals possible (one for each year), but 4 intervals of 2 years each can also be used.
   ➤ **What intervals of 2 years each will include the range of 7 years from 8 to 15?** *8–9, 10–11, 12–13, and 14–15*

5. Direct the students to write the age intervals in the Age column of the frequency table. Then instruct them to draw a tally beside the appropriate age interval as you cross out each piece of data (each age) listed on the page.
   (**Note:** You may choose to guide the students in ordering the data from least to greatest before guiding them in drawing the tallies on the frequency table.)

6. Instruct the students to count the tallies for each interval and write the total in the Frequency column: ages 8–9 *7*, ages 10–11 *6*, ages 12–13 *9*, ages 14–15 *3*.

7. Use the following procedure to guide the students in constructing a histogram using the data recorded in the frequency table. Demonstrate each step.
   ➤ **What part of the histogram is used to illustrate the intervals?** *the horizontal axis*
   ➤ **How many bars are needed in the histogram? Why?** *4; one bar is drawn for each of the 4 age intervals.*

8. Guide the students in using a ruler to mark four 1-inch-wide intervals on the horizontal axis (the bottom line of the histogram). Instruct them to write the age intervals below the horizontal axis.
   ➤ **What label could you write below the histogram to show what the intervals represent?** *Answers will vary, but elicit Campers' Ages.*

9. Direct the students to write the label *Campers' Ages* below the intervals for the histogram.
   ➤ **What part of the histogram illustrates the frequency?** *the vertical axis*
   ➤ **What label could you write for the vertical axis?** *Elicit the label Number of Campers.*
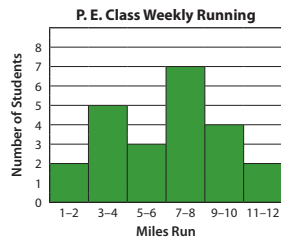
Histograms

When there is a greater amount of data to graph, **histograms** are used instead of the typical bar graph. The data is separated into equal **intervals** on the horizontal axis. The vertical axis is used to show the frequency. A histogram always uses vertical bars with no spaces between them. A frequency table helps to organize the data before the histogram is constructed.

> histograms
> interval

> Since 1983, May has been declared as Fitness Month. To encourage physical fitness, Mr. Hawkins assigned the students in his physical education class to keep track of the number of miles they ran during the first week of May. He posted each student's results at the end of the week.
>
> **Miles Run:** 8, 7, 12, 7, 1, 5, 10, 2, 3, 10, 12, 9, 4, 6, 9, 4, 3, 7, 8, 5, 7, 4, 8

Interval	Tally	Frequency
1–2	II	2
3–4	IIIII	5
5–6	III	3
7–8	IIIII II	7
9–10	IIII	4
11–12	II	2

P. E. Class Weekly Running

Exercises

Use the data from the frequency table and the histogram to find the answer.

1. What data is represented on the frequency table and the histogram? *weekly running totals*

2. How many students are in the physical education class? *23 students*

3. What is the range of miles run? *12 − 1 = 11*

4. How many students ran 3–4 miles in the first week of May? *5 students*

5. How many more students ran in the 7–8 mile interval than in the 1–2 mile interval? *5 more students*

6. How many students ran 1 to 6 miles? *10 students*

7. The largest group of runners is represented in which interval? *7–8*

8. How many students ran 9 miles or more? *6 students*

9. What interval is the mode for this set of data? *7–8*

10. Brodie ran $9\frac{1}{4}$ miles. Which interval is he in? *9–10*

Use the set of data to complete the frequency table.
Use the table to make a histogram.
Use the data from the frequency table and the histogram to find the answer.

> **History Test Scores**
>
> 79, 82, 86, 91, 97, 80, 87, 93, 91, 90, 89, 81, 83, 95, 92, 88, 85, 73, 68, 81, 76, 70, 85, 73, 83, 79

History Test Scores

Interval	Tally	Frequency
60–69	I	1
70–79	IIIII I	6
80–89	IIIII IIIII II	12
90–99	IIIII II	7

11. How many students took the history exam? *26 students*

12. What is the range of test scores? *97 − 68 = 29*

13. How many test intervals are on the histogram? *4*

14. How many students scored 80 or above? *19 students*

15. How many students scored 79 or less? *7 students*

16. Ashton made a 90.3 on the test. In which interval is his test grade? *90–99*

17. Which interval has the highest frequency? *80–89*

18. What interval is the mode? *80–89*

19. Mrs. Clater allowed any student who made lower than a 70 to retake the test. How many students took the test again? *1 student*

■ Practice & Application

Use the data from the frequency table to find the percent for the set of data.

> Tanner surveyed his class to find which after-school activity his classmates preferred most.

Activity	Tally	Frequency
bike riding	IIIII I	6
skateboarding	IIIII III	8
playing sports	IIIII IIIII I	11

20. percentage of students that ride bikes $\frac{6}{25} = \frac{n}{100}$; *n = 24; 24%*

21. percentage of students that skateboard $\frac{8}{25} = \frac{n}{100}$; *n = 32; 32%*

22. percentage of students that play sports $\frac{11}{25} = \frac{n}{100}$; *n = 44; 44%*

Use the data from the chart to find the answer.

23. Which country has the largest urban population? *Iceland*

24. Which country has the largest rural population? *South Africa*

25. Write the percentages of rural population from *least* to *greatest*. What is the median? *7, 14, 21, 25, 48; median: 21 Process to find median may vary.*

26. Find the mean of the rural population. *The sum of the data is 115; 115 ÷ 5 = 23*

27. Is there a mode for this data? *no*

28. Create a double bar graph for the table. Use intervals of 10.

% of Population Distribution		
Country	Urban	Rural
United States	79	21
Iceland	93	7
South Africa	52	48
Colombia	75	25
Japan	86	14

Ⓙ Explain how a frequency table can help you construct a histogram. *The frequency table helps determine the intervals and organize the data.*

Complete *DAILY REVIEW* Ⓔ on page 458.

Student Text pp. 342–43

10. Direct the students to write the label *Number of Campers* to the left of the histogram.
    ➤ **What could you title this histogram?** *Answers will vary; possible answers: Age of Campers: Week 1; First Week of Camp Attendance.*

11. Guide the students in selecting a title from the answers that were given and direct the students to write the title above the histogram.

12. Guide the students in drawing bars on the histogram to illustrate the data recorded in the frequency table. Remind them that there are no spaces between the bars of a histogram. Direct the students to shade the bars to complete the histogram.
    ➤ **What is the total number of campers that attended the first week of camp? How do you know?** *25; elicit that when the number of campers that were recorded for each age interval are added, the total number of campers is 25; 7 + 6 + 9 + 3 = 25 campers.*
    ➤ **Which age group had the greatest number of campers during the first week of camp?** *the campers that were 12–13 years old*
    ➤ **What age group had the fewest number of campers during that week?** *the campers that were 14–15 years old*

13. Choose a student to tell whether the following statement is a true statement and to explain his answer: More than half of the campers that attended the first week of camp were 8 to 11 years old. *Yes, the statement is true; 13 of the campers were 8–11 years old, and 13 is more than half of the total number of campers (25); $\frac{1}{2}$ of 25 = 12.5.*

Objectives
- Develop an understanding of box-and-whisker plots
- Determine the lower, middle, and upper quartiles of a set of data
- Construct a box-and-whisker plot using given data

Teacher Materials
- Chart 18: *Box-and-Whisker Plot*
- Box-and-Whisker Plot, page IA86 (CD)

Student Materials
- Box-and-Whisker Plot, page IA86 (CD)
- A calculator

Teach for Understanding

Develop an understanding of box-and-whisker plots

1. Choose a student to list the points that Joel scored (2–16) for display as you slowly read aloud the values in the following situation.

> Joel's basketball team played in seven games of a basketball tournament. The basketball coach recorded the number of points that Joel scored in each of the seven games. The points that the coach recorded for Joel were 2, 4, 7, 10, 11, 12, and 16.

➤ **What is the range of the points that Joel scored? How do you know?** *14; 16 − 2 = 14* Write the range for display.

➤ **What is the mode for this set of data? Why?** *There is no mode; none of the values occurs more frequently than the other values.*

➤ **How can you find the mean of the points that were scored by Joel?** *Elicit that since the mean is the average of all the points scored, you divide the sum of the points scored by the number of games that Joel played in (the number of addends).*

2. Direct the students to find the mean. Instruct them to round the answer to the nearest whole number. *62 ÷ 7 ≈ 8.8; 9 points* Write the mean for display.

3. Elicit that when a set of data has been ordered from least to greatest, the median is the middle value or an average of the two middle values.

➤ **What do you notice about the displayed list of the points that Joel scored?** *The points are listed in order from least to greatest.*

➤ **What is the median of the set of data? How do you know?** *10; elicit that 10 is the middle value of the set of data; there are 3 numbers of lesser value and 3 numbers of greater value.* Write the median for display.

4. Display the *Box-and-Whisker Plot* chart. Explain that a *box-and-whisker plot* is used to summarize data on a number line using a list of data that has been organized from least to greatest. A box is drawn around the middle half of the data and whiskers are drawn from the box to the least value of the data and from the box to the greatest value.

➤ **What is the range of the data listed on the chart?** *14* Point out that the range of the data helps you to determine the scale and the interval when drawing a number line for a box-and-whisker plot. Elicit that every mark on the number line does not need to have a number written below it.

5. Explain that besides the least value and the greatest value of the data, three other statistics are needed to construct a box-and-whisker plot: the *lower quartile*, the *middle quartile*, and the *upper quartile*. The middle quartile is determined first. It is the median of the whole set of data and separates the data into two equal sets.

➤ **What is the median of the ordered set of data on the chart?** *10* Point out the middle quartile (10) in the box-and-whisker plot.

6. Explain that the upper and lower quartiles are the medians of the upper and lower halves of the ordered set of data.

➤ **What numbers in the ordered set of data are to the left of the middle quartile?** *2, 4, and 7*

➤ **What is the median of 2, 4, and 7?** *4*

➤ **What is the lower quartile? Why?** *4; 4 is the median of the lower half of the ordered set of data.* Point out the lower quartile (4) in the box-and-whisker plot.

➤ **What numbers in the ordered set of data are to the right of the middle quartile?** *11, 12, and 16*

➤ **What is the median of 11, 12, and 16?** *12*

➤ **What is the upper quartile? Why?** *12; 12 is the median of the upper half of the ordered set of data.* Point out the upper quartile (12) in the box-and-whisker plot.

7. Explain that the points indicating the middle, lower, and upper quartiles have been drawn above the number line. A vertical line has been drawn at the location of each quartile and horizontal lines have been drawn to form a box with the lower quartile to the upper quartile as its sides.

Point out that the whiskers of the plot were formed by drawing a point above the least value of the set of data (2) and another point above the greatest value of the set of data (16). Then a horizontal line was drawn from the lower quartile to the least value and another horizontal line was drawn from the upper quartile to the greatest value. The value of the point at the end of each whisker can be used to determine the range of the data pictured on a box-and-whisker plot.

➤ **What do you notice about the whiskers in this box-and-whisker plot?** *Elicit that upper whisker is longer (12–16) than the lower whisker (2–4).*

Construct a box-and-whisker plot

1. Display and distribute the Box-and-Whisker Plot page and use the following procedure to guide the students in constructing a box-and-whisker plot for the given data.

➤ **What data is given on the page?** *test scores*

2. Direct the students to find the median of the test scores. *87*

➤ **How did you find the median of this set of data?** *Answers may vary, but should include that to find the median, the students needed to find the average of the two middle numbers in the ordered list of data; (85 + 89) ÷ 2 = 87.*

➤ **What is the median of the whole set of data called on a box-and-whisker plot?** *the middle quartile*

3. Instruct the students to write 87 as the middle quartile as you write it on the displayed page.

4. Call attention to the term *lower quartile* on the page.

➤ **How do you find the lower quartile?** *Elicit that you find the median of the lower half of the data.*

➤ **Since 87 is the middle quartile, which test scores are in the lower half of the data?** *76, 80, 82, and 85*

Box-and-Whisker Plot

A **box-and-whisker plot** summarizes data on a number line using a list that is organized from *least* to *greatest*.

Use the least value of the data as the beginning point of the number line and the greatest value of the data as the ending point.

Find the median of the whole set of data and plot that point on the number line. This is the **middle quartile**. The median separates the data into two sets.

Plot the **lower quartile** by finding the median for the lower half of the data.
Plot the **upper quartile** by finding the median for the upper half of the data.

Draw a box from the lower quartile to the upper quartile. The whiskers are the lines that extend from the box to the least value and the greatest value of the data.
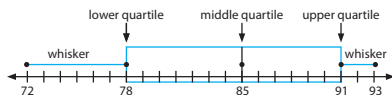
> box-and-whisker plot
> middle quartile
> lower quartile
> upper quartile

> Remember to average the two middle numbers to find the median.

Number of points scored by the boys' basketball team: 72, 85, 91, 87, 79, 78, 93

Plot the middle, upper, and lower quartiles.

72, 78, 79, 85, 87, 91, 93
Median of data: 85
Lower quartile: 72 78 79 78
Upper quartile: 87 91 93 91

Exercises

Make a box-and-whisker plot.
Use the data from the plot to find the answer.   *Process to find median may vary.*

Ages of the children who attended Jesse's birthday party
3, 7, 7, 9, 11, 11, 12, 12, 12, 13, 15

1. In what order is the data? *least to greatest*
2. What is the median of the data? *11*
3. What is the lower quartile? *7*
4. What is the upper quartile? *12*

5. Which side has the longer whisker? *lower whisker*
6. Which box shows the smaller amount of data? *upper quartile*
7. What is the range of the data? *15 − 3 = 12*

Math test scores listed by Mrs. Peyton on the board
83, 91, 95, 80, 100, 88, 92, 98, 100, 85, 93, 90, 75, 92, 85

8. Write the data from *least* to *greatest*.
9. What is the median of the data? *91*
10. What is the lower quartile? *85*
11. What is the upper quartile? *95*
12. What is the range of the data? *100 − 75 = 25*

13. Describe the length of the whiskers. *lower: 75–85; upper: 95–100*
14. What part of the diagram shows the smaller amount of data? *upper quartile*
15. Is the median in the center of the box? *no*

8. *75, 80, 83, 85, 85, 88, 90, 91, 92, 92, 93, 95, 98, 100, 100*

Use the data from the box-and-whisker plot to find the answer.

The box-and-whisker plot shows the number of miles Taylor biked this month.

16. What is the greatest number of miles traveled? *46 miles*
17. What is the least number of miles traveled? *10 miles*
18. Find the median of the data. *25*

19. What are the upper and lower quartiles? *upper: 40; lower: 18*
20. What is the range of the data? *46 − 10 = 36*
21. What is true about the length of the whiskers? *The lower whisker is longer than the upper whisker.*

Use the data to find the middle, lower, and upper quartiles. Round decimal answers to the nearest tenth. Make a box-and-whisker plot to display the set of data.

22. Data: 5, 8, 19, 21, 23, 27, 30, 31, 33

23. Data: 71, 72, 75, 79, 80, 81, 82

22. *middle quartile: 23*
lower quartile: (8 + 19) ÷ 2 = 13.5
upper quartile: (30 + 31) ÷ 2 = 30.5

23. *middle quartile: 79*
lower quartile: 72
upper quartile: 81

Practice & Application

24. Make a stem-and-leaf plot to show the number of pages read by the students.

52, 45, 60, 65, 30, 48, 41, 37, 62, 43

25. Find the mean of the data. Round to the nearest tenth. *The sum of the data is 483; 483 ÷ 10 = 48.3*
26. Use the stem-and-leaf plot to find the median. *(45 + 48) ÷ 2 = 46.5*
27. What is the range? *65 − 30 = 35*
28. Use intervals of 5 to make a frequency table and a histogram to show the number of miles traveled by families to church. Use the data from the table or the histogram to find the answers for 29 through 31.

17, 5, 3, 10, 24, 2, 14, 7, 15, 7, 30, 8, 16, 20, 10, 20, 33, 11

29. What mile interval shows the mode? *6–10*
30. The Chapin family walks $\frac{1}{4}$ of a mile to church. In which interval are the Chapins? *0–5*
31. How many families drive more than 10 miles? *10*

24.

Pages Read	
Stem	**Leaf**
3	0 7
4	1 3 5 8
5	2
6	0 2 5

Key 3|0 = 30

28.

Miles Traveled to Church		
Miles	**Tally**	**Frequency**
0–5	III	3
6–10	ℍℍ	5
11–15	III	3
16–20	IIII	4
21–25	I	1
26–30	I	1
31–35	I	1

Complete DAILY REVIEW ❶ on page 459.

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5. Direct the students to find the median of the test scores in the lower half of the data. *the average of the two middle numbers in the lower half of the data: (80 + 82) ÷ 2 = 81*
➤ **What is the lower quartile?** *81*

6. Instruct the students to write 81 as the lower quartile as you write it for display.

7. Repeat the procedure to guide the students in finding the upper quartile. *(91 + 95) ÷ 2 = 93*

8. Guide the students in drawing above the number line the points for the middle quartile (the median), the lower quartile, and the upper quartile. Then guide them in drawing a vertical line through each quartile, beginning with the middle quartile, and the horizontal lines to form the box. Guide the students in drawing the points to show the least value and the greatest value and then drawing the whiskers from the box to the value.

➤ **What is the range of the test scores? How do you know?** *22; elicit that the difference of the greatest value and the least value on the box-and-whisker plot is 22; 98 − 76 = 22.*
➤ **What do you notice about the whiskers in this box-and-whisker plot?** *The whiskers are the same length.* **Describe the length of the whiskers.** *lower whisker: 76–81; upper whisker: 93–98*
➤ **Is the median in the center of the box?** *yes*
➤ **Is the median (the middle quartile) included in the ordered list of data?** *no*
➤ **Is the lower quartile included in the ordered list of data?** *no*
➤ **Is the upper quartile included in the ordered list of data?** *no*

9. Cover the list of data at the top of the page.
➤ **If you were examining the box-and-whisker plot and the lists of data were not given, what do you think are the only two pieces of data that you can be certain are included in the list of test scores? Why?** *Elicit that you could only know that the least value (76) and the greatest value (98) would be included in the list of test scores (the data) because they were the only actual test scores for which points were drawn. The middle, lower, and upper quartiles were all determined by averaging two test scores.*

Student Text pp. 344–45

Objectives
- Read and interpret graphs: double bar graph, double line graph, stem-and-leaf plot, line plot, histogram, box-and-whisker plot

Teacher Materials
- Graph: Double Bar Graph, page IA87 (CD)
- Graph: Double Line Graph, page IA88 (CD)
- Stem-and-Leaf Plot & Line Plot, page IA89 (CD)
- Graph: Histogram, page IA90 (CD)
- Graph: Box-and-Whisker Plot, page IA91 (CD)

Student Materials
- A calculator

Teach for Understanding

Read and interpret a double bar graph
Display the Graph: Double Bar Graph page. Remind the students that a bar graph is used to compare data. A double bar graph compares two sets of related or similar information.

➤ **What data is being compared in this double bar graph? How do you know?** *Elicit that the urban and rural populations of countries A, B, C, and D are being compared; possible explanations: the key shows that the darker bars indicate urban populations and the lighter bars indicate rural populations; the categories below the bars indicate four different countries.*

➤ **What type of community does the word "urban" refer to?** *a city*

➤ **What type of community does the word "rural" refer to?** *a town or a village in the country*

➤ **What comparison is shown for country A?** *Elicit that 75% of the population lives in an urban area (a city) and 25% of the population lives in a rural area (the country).*

➤ **What comparison is shown for country B?** *90% of the population lives in a city and 10% of the population lives in the country.*

➤ **Which two countries have the same distribution of urban and rural populations? How do you know?** *Countries A and D; elicit that both countries have a population that is 75% urban and 25% rural.*

➤ **Which country has the greatest percentage of rural population?** *country C* **What percentage of country C's population lives in a rural area?** *40%*

➤ **What is the estimated mean of the rural populations of all four countries? Why?** *approximately 25%; accept any reasonable explanation.*

➤ **What do you notice about the populations in each of the four countries?** *Elicit that there is a greater percentage of urban population than rural population in each country.*

Read and interpret a double line graph
Display the Graph: Double Line Graph page. Remind the students that a line graph is used to show changes in data over a period of time. A double line graph compares the changes in two sets of data over the same period of time.

➤ **What information is recorded on the graph? How do you know?** *The monthly precipitation in inches for city Y and city Z from January through August; possible explanations: the key shows that the solid line is used to illustrate the changes in the amount of monthly precipitation that city Y received and the dashed line is used to illustrate the changes in the amount of monthly precipitation that city Z received; the scale indicates that the amounts of precipitation were recorded in inches.*

➤ **What interval was used for the precipitation scale?** *Elicit that half-inch intervals were used.*

➤ **During which months did city Y receive the least amount of precipitation?** *July and August* **What amount was recorded?** *2 inches*

➤ **What was the greatest amount of precipitation recorded?** *4 inches* **When was it received?** *in March and April* **Where was it received?** *city Y*

➤ **When was the greatest amount of precipitation received in city Z?** *March* **What amount was recorded?** *2 inches*

➤ **During what month did city Z receive the lowest amount of precipitation?** *August* **What amount of precipitation was recorded?** *0.25 inches or a quarter of an inch*

➤ **What is the mean of the amounts of precipitation city Y received?** *3 inches* **the amounts of precipitation city Z received?** *approximately 1.03 inches*

➤ **Considering this double line graph, what prediction could you make about the amount of precipitation that will be received in these cities in September?** *Possible answers: city Y will receive more precipitation than city Z; both city Y and city Z will show an increase in the amount of rain received because the amount of rain that they received during the previous two or three months was below their averages for the past 8 months.*

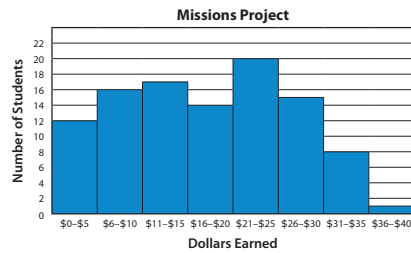### Read and interpret a stem-and-leaf plot and a line plot
1. Direct attention to the stem-and-leaf plot on the Stem-and-Leaf Plot & Line Plot page. Remind the students that a stem-and-leaf plot is a way to display the frequency of data, using the actual digits in each piece of data to record the results.

➤ **What do the digits in the Stem column represent?** *the number of tens in each number of the data* **the digits in the Leaf column?** *the digits in the Ones place of each piece of data*

➤ **What is the range of the employees' ages? How do you know?** *43 years; elicit that the least value on the stem-and-leaf plot is 19 and the greatest value is 62; $62 - 19 = 43$.*

➤ **What age bracket shows the greatest frequency? How do you know?** *The 20s; elicit that the 8 leaves for the 2 stem indicates that there are 8 employees in their 20s.*

➤ **What is the median?** *34*

2. Instruct the students to find the mean age of the employees to the nearest year. Elicit that the mean is the average age. *$773 \div 22 \approx 35.1$; the average age is 35.*

3. Direct attention to the line plot on the page. Remind the students that a line plot is also used to identify the frequency of a set of data.

➤ **What is the range of the number of miles that were hiked? How do you know?** *8 miles; elicit that the line plot shows that the greatest number of miles hiked was 9 and the least number of miles hiked was 1; $9 - 1 = 8$.*

➤ **What is the mode for the number of miles hiked? Why?** *5; elicit that the four Xs above the number 5 show that 5 miles was the distance that was most frequently hiked.*

➤ **What is the median?** *4*

➤ **What is the outlier on this line plot?** *9* **Does the outlier affect the mode?** *No, the mode is still 5.* **the median?** *No, the median is still 4.*

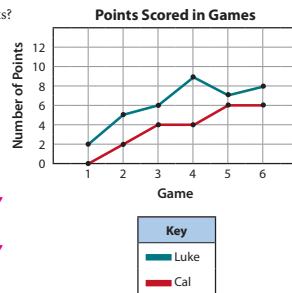### Read and interpret a histogram
Display the Graph: Histogram page. Remind the students that histograms are useful when there is a large amount of data to graph. Elicit that unlike a bar graph, there is no space in between the bars of a histogram. Each bar represents an equal interval of the data. Point out the consecutive intervals.

Graph Review

■ Exercises

Use the data from the histogram to find the answer.

1. How many students helped to earn money for the mission project? ***103 students***
2. How many students earned $26–$30? ***15 students***
3. What is the mode for the amount earned? ***$21–$25***
4. In which interval was the greatest amount of money earned by a student for the mission project? ***$36–$40***
5. Explain the data shown on the graph. ***The data shows the amount of money earned by 103 students for a missions project.***

Missions Project

Use the data from the double line graph to find the answer.

6. In which game did Luke score his highest number of points? ***Game 4***
7. In which game did Cal *not* score? ***Game 1***
8. What is the range of Luke's scores? ***9 − 2 = 7***
9. What is the range of Cal's scores? ***6 − 0 = 6***
10. In which game did Luke score only one more point than Cal? ***Game 5***
11. What was the mean of Cal's scores? Round to the nearest hundredth. ***The sum of the data is 22; 22 ÷ 6 ≈ 3.67***
12. What was the mean of Luke's scores? Round to the nearest hundredth. ***The sum of the data is 37; 37 ÷ 6 ≈ 6.17***
13. What trend do you see in Luke's and Cal's games? ***The number of points scored improved as more games were played.***

Points Scored in Games

Key
- Luke
- Cal

Use the data from the stem-and-leaf plot to find the answer.

14. How many children attended vacation Bible school? ***21 children***
15. What is the range in ages of the children at VBS? ***12 − 6 = 6***
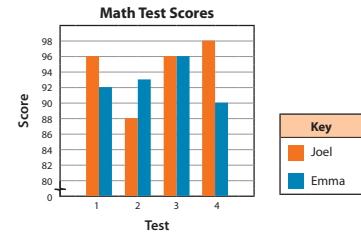16. What is the mode? ***11***
17. What is the median? ***10***

Age of Children at VBS

Stem	Leaf
0	6 6 6 7 7 8 8 8 9 9
1	0 0 0 0 1 1 1 1 1 2 2

Key 1|0 = 10

Chapter 15

Use the data from the double bar graph to find the answer.

18. What is being compared in the graph? ***math test scores***
19. On which test did Joel and Emma receive the same score? ***Test 3***
20. What is the range of the test scores for Joel? For Emma? ***Joel: 98 − 88 = 10; Emma: 96 − 90 = 6***
21. Which student had the highest test score? ***Joel; he had a score of 98.***
22. What is the mean of Emma's test scores? Of Joel's test scores? ***Emma: The sum of the data is 371; 371 ÷ 4 = 92.75; Joel: The sum of the data is 378; 378 ÷ 4 = 94.5***

Math Test Scores

Key
- Joel
- Emma

Use the data from the line plot to find the answer.   ***Process to find median may vary.***

23. What is the range in the miles walked? ***9 − 1 = 8***
24. What is the mode? ***1***
25. How many people walked 3 or fewer miles? ***9 people***
26. What is the median of the data? ***3***

Miles Walked for the Walk-a-thon

Use the data from the box-and-whisker plot to find the answer.   ***Process to find median may vary.***
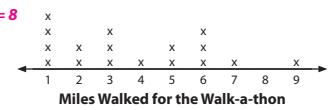
Mrs. Alier used history test data for her box-and-whisker plot.
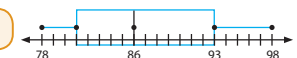
27. What is the lowest test score? ***78***
28. What is the highest test score? ***98***
29. What is the median test score? ***86***
30. What is the lower quartile? ***81***
31. What is the upper quartile? ***93***
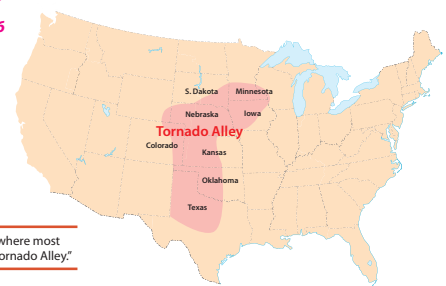
Tornado Alley

The area of the United States where most tornadoes develop is called "Tornado Alley."

Complete *DAILY REVIEW* 9 on page 459.

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➤ **What does this histogram illustrate?** *the number of credits earned by college juniors for the first semester*
➤ **What were the least credits earned?** *1–2* **the most credits earned?** *23–24*
➤ **What interval is the mode for this histogram? How do you know?** *15–16; elicit that the tallest bar indicates the interval of credits that were earned by the most students in the junior class (the interval with greatest frequency).*
➤ **How many students in the junior class earned 9–10 credits?** *16* **17–18 credits?** *15* **19–20 credits?** *12*
➤ **What does an overall view of the histogram show you?** *Answers will vary, but elicit that most of the junior class earned 9–20 credits.*

Read and interpret a box-and-whisker plot

1. Display the Graph: Box-and-Whisker Plot page. Remind the students that a box-and-whisker plot summarizes data on a number line. A box is drawn around the middle half of the data and whiskers are drawn from the box to the least value of the data and from the box to the greatest value. Elicit that each whisker contains an equal amount of the other half of the data.
➤ **What pieces of data are used to construct a box-and-whisker plot?** *Elicit that the pieces of data used to construct a box-and-whisker plot are those having the least and greatest values, the middle quartile (the median of all the ordered data), the lower quartile (the median of the ordered data that are less than the middle quartile), and the upper quartile (the median of the ordered data that are greater than the middle quartile).*
➤ **What is the lowest recorded score for Science Test 6?** *80* **the highest score?** *97*

➤ **What is the median test score?** *90* **the lower quartile?** *81.5* **the upper quartile?** *94*
(***Note:*** You may choose to point out that the box of this box-and-whisker plot shows that half of the test scores are between 81.5 and 94 and that the whiskers show that the lower one-fourth of the scores are between 80 and 81.5 and the upper one-fourth of the scores are between 94 and 97.)
➤ **What are the only two pieces of data on this box-and-whisker plot that you can be certain are included in the list of recorded test scores? Why?** *80 and 97; they are the high and low test scores. Elicit that the other numbers shown on the box-and-whisker plot are medians. They may be the middle value listed in the lower and upper halves of the data or they may be the average of the two middle values listed in the lower and upper halves of the data.*

2. Write for display this list of Science Test 6 scores: 80, 80, 80, 83, 86, 89, 91, 92, 93, 95, 96, 97. Guide the students in finding the middle quartile *90 (the average of 89 and 91)*, the lower quartile *81.5 (the average of 80 and 83)*, and the upper quartile *94 (the average of 93 and 95)*.

   Elicit that none of the quartiles are included in the list of recorded test scores.

3. Guide the students in using the displayed list of Science Test 6 scores to verify the answers given to the previous questions about the box-and-whisker plot.

Student Text pp. 346–47

(***Note***: *Assessment* available on Teacher's Toolkit CD.)

Student Text pp. 348–49
Daily Review p. 460h

Objectives
- Calculate the mean for a set of data
- Determine the range, median, and mode for a set of data
- Record data in a frequency table
- Choose a graph to display a set of data

Teacher Materials
- Data, page IA92 (CD)
- Christian Worldview Shaping, page 35 (CD)

Student Materials
- Data, page IA92 (CD)
- A calculator

Preparation
Write the following types of graphs for display as a word bank.

bar graph	histogram
box-and-whisker plot	line graph
double bar graph	line plot
double line graph	stem-and-leaf plot

Teach for Understanding

Calculate the mean for a set of data
Determine the range, median, and mode
1. Display and distribute the Data page. Point out the chart at the top of the page.

> Mr. Boles hired four students to work at his shop after school and on Saturdays.

➤ **How many weeks did each of the four students work?** *4 weeks*
➤ **Which student worked the most hours during the four weeks?** *Logan* **How many hours did he work?** *58 hours*

2. Direct the students to find the mean of the number of hours that each student worked. Elicit that the mean is the average of a set of data; it can be found by dividing the sum of the data by the number of addends.

➤ **What is the mean of the number of hours that Ethan worked?** *7.5 hours* **that Logan worked?** *14.5 hours* **that Samuel worked?** *7.75 hours* **that Zachary worked?** *11 hours*
Elicit that each mean represents the average number of hours that each student worked *per week* because the hours that each student worked were recorded on a weekly basis.

3. Instruct the students to find the mean of the number of hours that all four of the students worked during each of the four weeks.

➤ **What is the mean of the number of hours that all four students worked during week 1?** *12 hours* **during week 2?** *10.5 hours* **during week 3?** *9.25 hours* **during week 4?** *9 hours*
Elicit that each mean represents the average number of hours worked *per student* for that week because the total number of hours that the students worked that week was divided by the number of students.

4. Direct the students to find the mean of the number of hours that all four of the students worked during all four weeks. Instruct them to round their answer to the nearest hundredth. Choose students to write their solution for display and explain it. *Possible solutions: divide the total number of*

hours worked by 16 (the number of pieces of data); (8 + 6 + 10 + 6 + 16 + 16 + 10 + 16 + 10 + 10 + 5 + 6 + 14 + 10 + 12 + 8) ÷ 16 ≈ 10.19 or [5 + (3 × 6) + (2 × 8) + (5 × 10) + 12 + 14 + (3 × 16)] ÷ 16 ≈ 10.19; or add the average number of hours worked per week for all four students and divide the sum by 4 (the number of weeks); (7.5 + 14.5 + 7.75 + 11) ÷ 4 ≈ 10.19; or add the average number of hours worked per student for all four weeks and divide the sum by 4 (the number of students); (12 + 10.5 + 9.25 + 9) ÷ 4 ≈ 10.19.
Elicit that 10.19 represents the average number of hours worked *per student per week.*

➤ **What is the range for a set of data?** *The range is the difference between the greatest and the least numbers in a set of data.*
➤ **What is the range of the data on the chart? How do you know?** *11 hours; the greatest number of hours worked is 16 and the least number of hours worked is 5; 16 − 5 = 11 hours.*

5. Direct each student to list the data (hours worked) from least to greatest. *5, 6, 6, 6, 8, 8, 10, 10, 10, 10, 10, 12, 14, 16, 16, 16*

➤ **What is the median of this ordered set of data? How do you know?** *10 hours; elicit that the median is the middle value or the average of the two middle values in a set of data. The average of the two middle values (10 and 10) in the ordered set of data is 10.*
➤ **What is the mode of this set of data? How do you know?** *10; elicit that the mode is the value in a set of data that has the greatest frequency (occurs most often); 10 occurred the most often in the set of data; its frequency is 5.*

Record data in a frequency table
Direct the students to list the hours worked from greatest to least in the frequency table on their page. Then instruct them to complete the frequency table. Give guidance and demonstrate on the displayed page as needed.
Frequency: 16 *3;* 14 *1;* 12 *1;* 10 *5;* 8 *2;* 6 *3;* 5 *1*

Choose a graph to display a set of data
1. Explain that different types of graphs are used to display data in various ways so that the data can be quickly and easily interpreted or understood. A particular type of graph is chosen based on how clearly the information can be displayed on the graph. Different types of graphs organize data differently for statistical reports.

2. Direct attention to the types of graphs written for display as a word bank.

➤ **What kind of graph shows changes over a period of time for a set of data?** *a line graph*
➤ **What kind of graph allows you to easily compare a set of related or similar data?** *a bar graph*
➤ **What type of graph is used to arrange data using the actual digits of the data to clearly display the frequency of the data?** *a stem-and-leaf plot*
➤ **What type of graph could you use to clearly display the frequency of data by creating columns of Xs above numbers in the scale as you record each piece of data?** *a line plot*
➤ **What kind of graph shows changes over a period of time for two sets of related data?** *a double line graph*
➤ **What kind of graph compares two sets of related information on the same graph?** *a double bar graph*
➤ **What type of graph allows you to display a large amount of data by separating the data into equal intervals?** *a histogram*
➤ **What type of graph can you use to summarize data by finding the median of a set of data that has been ordered from least to greatest and then finding the median of each half of the set of data?** *a box-and-whisker plot*

Compare Graphs

■ **Exercises** *Answers may vary.*

Use the data from the chart to find the answer.

Chase and Chloe recorded the amount of savings they have on the first day of each month.

	Jan.	Feb.	Mar.	April	May	June
Chase	$100	$140	$115	$125	$135	$145
Chloe	$100	$110	$120	$130	$140	$150

1. Which type of graph is used to compare how Chase's and Chloe's savings totals change over a 6-month span? *double line graph*

2. Which type of graph is used to compare their monthly totals? *double bar graph*

3. Make the graph you choose for problem 1 or 2. *Answers will vary.*

Ages of the first 15 presidents of the United States on the day of their inauguration

57, 61, 57, 57, 58, 57, 61, 54, 68, 51, 49, 64, 50, 48, 65

4. Which type of graph would you use to show the number of ages that repeat? *stem-and-leaf plot*

5. How is the data listed in this type of graph? *by digits (tens, ones) in numerical order*

6. Make the graph you choose for problem 4. *Answers will vary.*

Cameron pitched 7 innings in Saturday's game. He faced the following number of batters.

3, 5, 4, 7, 4, 3, 3

7. Which type of graph would you use to show the number of batters in each inning? *a line plot or a bar graph*

8. Make the graph you choose for problem 7.

9. What is the mode of the data? Does this graph easily depict the mode? *3; yes*

Use the set of data to find the **middle**, **lower**, and **upper** quartiles. Make a box-and-whisker plot to display the data.

10. Data: 4, 6, 6, 7, 8, 12, 13 — *middle quartile: 7; lower quartile: 6; upper quartile: 12*

11. Data: 16, 18, 19, 23, 24, 25 — *middle quartile: $(19 + 23) \div 2 = 21$; lower quartile: $(16 + 18) \div 2 = 17$; upper quartile: $(24 + 25) \div 2 = 24.5$*

Find the range and the mean for the set of data. Round decimal answers to the nearest tenth.

12. 16, 12, 9, 8, 2 — *range: $16 - 2 = 14$; mean: the sum of the data is 47; $47 \div 5 = 9.4$*

13. 24, 20, 16, 18, 23, 25, 21 — *range: $25 - 16 = 9$; mean: the sum of data is 147; $147 \div 7 = 21$*

14. 56, 42, 50, 48, 42, 40 — *range: $56 - 40 = 16$; mean: the sum of the data is 278; $278 \div 6 \approx 46.3$*

15. 8, 3, 9, 5, 7, 1, 8, 4 — *range: $9 - 1 = 8$; mean: the sum of the data is 45; $45 \div 8 \approx 5.6$*

Use the data from the frequency table to make a histogram.

16.

Ages Enrolled in Summer Swimming Lessons

Interval	Tally	Frequency
3–5	|||	3
6–9	⊬⊬ ⊬⊬ ⊬⊬ ||	17
10–12	⊬⊬ ⊬⊬ ||	12
13–15	⊬⊬ |||	8

The frequency table shows the ages of children taking summer swimming lessons.

Use data from the line graph to find the answer.

Canoe Race

Key: Whitewater Team, Big Rapids Team
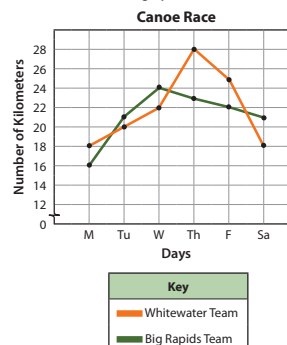
17. On which days did the Big Rapids team paddle the greater distance? *Tuesday, Wednesday, and Saturday*

18. How far did the Whitewater team paddle on Monday? *18 km*

19. On which 2 days did the Whitewater team paddle the same distance? *Monday and Saturday*

20. About how many kilometers did the Big Rapids team paddle for the week? *$16 + 21 + 24 + 23 + 22 + 21 = 127$ km*

21. Which team paddled the greater distance? *The Whitewater Team $18 + 20 + 22 + 28 + 25 + 18 = 131$; $131 > 127$*

Complete **DAILY REVIEW** ⓗ on page 460.

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3. Guide the students in analyzing the data recorded on the Data page to decide which graph could be used to best display the following.
   a) Compare the hours that Ethan and Logan worked each week. *double bar graph*
   b) Compare how the number of hours that Ethan and Zachary worked changed during the 4 weeks. *double line graph*
   c) Show the frequency of the number of hours worked. *stem-and-leaf plot or line plot*
   d) Display the quartiles of the data. *box-and-whisker plot*
4. Lead a discussion about how to best display the data on each of the graphs. Then direct each student to choose one of the graphs and construct it.
5. **Christian Worldview Shaping (CD)**

Student Text pp. 348–49

Student Text pp. 350–51

Chapter Review

Objectives
- Complete a frequency table using given data
- Read and interpret graphs: double bar graph, double line graph, stem-and-leaf plot, line plot, histogram, box-and-whisker plot
- Calculate the mean for a set of data
- Determine the range, mode, and median for a set of data

Teacher Materials
- Chart 17: *Histogram*
- Chart 18: *Box-and-Whisker Plot*
- Double Bar Graph, page IA81 (CD)
- Double Line Graph, page IA82 (CD)

Student Materials
- A calculator

Note
This lesson reviews the concepts presented in Chapter 15 to prepare the students for the Chapter 15 Test. Student Text pages 350–51 provide the students with an excellent study guide.

Check for Understanding

Complete a frequency table using given data

1. Write for display *Ages of young people in the youth orchestra: 10, 15, 12, 9, 10, 11, 11, 12, 16, 14, 12, 13, 11, 13, 14, 12, 15.*
   ➤ **What is a good way to organize data to make it more manageable?** *Possible answers: order the data from least to greatest; record the data in a frequency table; display the data on a graph.*

2. Direct the students to order the data from least to greatest on paper. Then instruct them to record the data on a frequency table: 9 *1*; 10 *2*; 11 *3*; 12 *4*; 13 *2*; 14 *2*; 15 *2*; 16 *1*.
   ➤ **What is the range of ages in this set of data? How do you know?** *7; elicit that the range is the difference between the greatest value and the least value in a set of data; 16 − 9 = 7.*
   ➤ **What is the mean of a set of data?** *the average of the data*
   ➤ **How can you find the mean of the ages of the students in the youth orchestra?** *Add all of the ages and divide the sum by the number of students in the data.*

3. Direct the students to find the mean. Instruct them to round their answer to the nearest whole number if needed. *210 ÷ 17 ≈ 12.3; the average age is 12.*
   ➤ **What is the median of the ages? How do you know?** *12; elicit that the median is the middle value or the average of the two middle values in an ordered list of data. Since there is an odd number of ages, the median is the middle number (12).*
   ➤ **What number is the mode in this set of data? How do you know?** *12; elicit that the mode is the number that occurs most frequently in a set of data. Twelve is recorded four times, more frequently than any of the other ages.*

Read and interpret a double bar graph

1. Display the Double Bar Graph page. Remind the students that double bar graphs can be drawn horizontally or vertically. Elicit that bar graphs are used to compare two sets of related or similar information.
   ➤ **What information is recorded on this graph?** *the number of boys and girls in grades 1–6 at Grace Christian School*
   ➤ **What information (categories) is on the horizontal axis?** *the grades in the school*

   ➤ **What is listed on the vertical axis?** *Elicit that the number of students is listed in intervals of 2.*
   ➤ **Which grade has the greatest difference between the number of boys and the number of girls?** *fourth grade*

2. Direct the students to find the mean of the number of girls in grades 1–6 and the mean of the number of boys in grades 1–6. Instruct them to round their answer to the nearest tenth if needed. *70 ÷ 6 ≈ 11.7 girls per grade; 70 ÷ 6 ≈ 11.7 boys per grade*
   ➤ **How does the average number of boys compare with the average number of girls?** *The average number of boys is the same as the average number of girls, 11.7.*
   ➤ **What is the mode for the girls?** *13* **for the boys?** *12*
   ➤ **What is the range for the girls?** *7* **for the boys?** *5*

Read and interpret a double line graph
Display the Double Line Graph page. Elicit that a double line graph shows changes over a period of time for two related sets of data. Choose a student to explain the changes in the temperatures in Peaceful Valley during one week.
   ➤ **On what day did the least change in temperature occur?** *Thursday* **What was the range of temperatures on Thursday?** *2°*
   ➤ **On what day did the greatest change in temperature occur?** *Friday* **What was the range of temperatures on Friday?** *12°*
   ➤ **What was the median high temperature?** *70°* **the median low temperature?** *64°*

Read and interpret a stem-and-leaf plot and a line plot

1. Write for display *Years taught: 5, 6, 8, 9, 10, 11, 11, 12, 12, 12, 20.* Explain that this data was gathered during a survey that was taken to determine the statistics of the faculty's teaching experience.
   ➤ **How is data displayed on a stem-and-leaf plot?** *Elicit that each piece of data is displayed using the tens digits of the data as its stems and the ones digits of the data as its leaves. Since the leaves indicate the number of items in the data, the ones digit of each piece of data must be written in the Leaf column.*

2. Choose a student to make for display a stem-and-leaf plot for the years taught by the faculty while the students construct it on paper.
   ➤ **What number has the greatest frequency?** *12* Elicit that 12 is the mode of the set of data; 12 is the value that occurs most often.
   ➤ **What does a mode of 12 tell you about the faculty's years of teaching experience?** *More teachers have had 12 years of teaching experience than the other number of years listed.*
   ➤ **What other type of graph is used to display the frequency of data?** *a line plot*
   ➤ **How do you display data on a line plot?** *Elicit that an X is drawn above a number on a number line each time that number appears in the data.*
   ➤ **How do you determine the scale of the number line used to make a line plot?** *Elicit that the scale for the line plot must include the range of the data.*
   ➤ **What is the range of this set of data?** *15* Elicit that the range is from 5 to 20.

3. Choose a student to make for display a line plot for the years taught by the faculty while the students construct it on paper.
   ➤ **Where is a cluster located on this line plot? How do you know?** *8–12; there is a tight grouping of data from 8 to 12.*

Process to find median may vary.

Use the set of data to make a frequency table.

1. Basketball Game Scores: 63, 72, 59, 52, 69, 62, 59, 58, 60

2. Find the mean game score. Round to the nearest tenth. ***The sum of the data is 554; 554 ÷ 9 ≈ 61.6***

3. Find the median of the scores. ***60***

4. What is the range of the game scores? ***72 − 52 = 20***

5. What is the mode? ***59***

Use the data from the double bar graph to find the answer.

6. Which week shows the greatest difference in the number of pages read? ***Week 3***

7. What is the mean of pages read by Carl? Round to the nearest tenth. ***The sum of the data is 160; 160 ÷ 3 ≈ 53.3 pages***

8. Who read the most pages? ***John***

9. How many pages did John read? ***215 pages 60 + 80 + 75 = 215***

Reading Contest

	Key
	■ Carl
	■ John
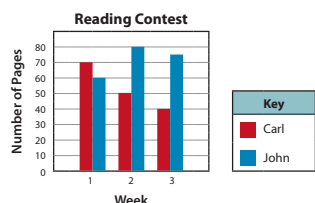
Use the data from the double line graph to find the answer.

10. On which days were the temperature differences between the cities two degrees? ***June 1, 4, 6, and 7***

11. What day shows the greatest temperature difference between the two cities? ***June 8***

12. What is the range in temperatures for Sunnyville? ***88 − 78 = 10***

13. What is the mode for Peaceful Valley? ***82°F***

14. What is the mean temperature for Sunnyville? Round to the nearest tenth. ***The sum of the data is 674; 674 ÷ 8 ≈ 84.3°F***

Daily High Temperatures

Key	
▬	Sunnyville
▬	Peaceful Valley

Process to find median may vary.
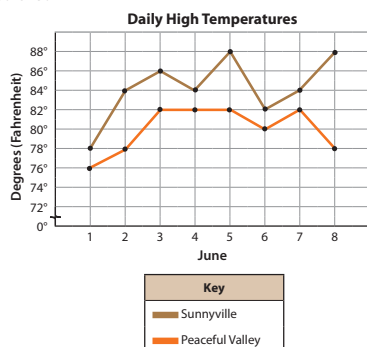
Use the set of data to make a line plot.

15. Pages of Term Paper: 8, 4, 6, 3, 4, 3, 5, 5, 4, 5, 4, 2, 4

16. What is the mode for the number of pages? ***4***

17. What is the range? ***8 − 2 = 6***

18. What is the median? ***4***

```
                  x
                  x
              x   x
              x x x
        x x x x x       x
        2 3 4 5 6 7 8
```

Use the set of data to make a stem-and-leaf plot.

19. Hours Worked: 8, 15, 20, 20, 20, 25, 30, 30, 35, 35, 35, 40, 40, 42

20. What is the range of hours worked? ***42 − 8 = 34***

21. Find the mean. Round to the nearest tenth. ***The sum of the data is 395; 395 ÷ 14 ≈ 28.2***

22. What is the median? ***30***

19.

Hours Worked	
Stem	**Leaf**
0	8
1	5
2	0 0 0 5
3	0 0 5 5 5
4	0 0 2

Key	1|5 = 15

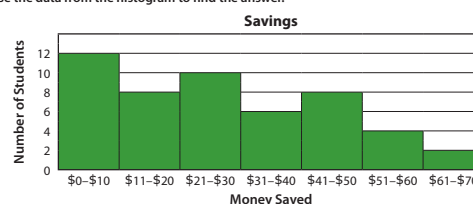**Use the data from the box-and-whisker plot to find the answer.**

Mr. Darsey used the math test scores as data for his box-and-whisker plot.

```
        ┼──┼──┼──┼──┼──┼──┼──┼──┼──┼──┼──┼──┼──┼
        82   85   88        93 95
```
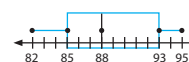
23. What is the highest score? ***95***

24. What is the median score? ***88***

25. What is the lower quartile? ***85***

Use the data from the histogram to find the answer.

Savings

26. What is the range of the data? ***70 − 0 = 70***

27. Is this statement true or false? More than half of the students have $30 or less in their savings. Explain your answer. ***True; of the 50 students represented in the graph, 30 students are in the ranges $0 to $30.***

28. What is the mode? ***$0–$10***

➤ **Where is a gap located on this line plot? How do you know?** *At 7 and from 13 to 19; there is an empty space with no data at those locations on the line plot.*

➤ **What number is an outlier on the line plot? Why?** *20; it has a value that is much greater than the values of the other data.*

4. Remind the students that an outlier can affect the mean, range, and median; but the mode is not affected.

Read and interpret a histogram

Display the *Histogram* chart.

➤ **When would you graph data on a histogram?** *when there is a large amount of data to graph*

➤ **Describe a histogram.** *Elicit that although a histogram is similar to a bar graph, a histogram always used vertical bars and there are no spaces between the bars. The data is separated into equal intervals on the horizontal axis and each bar represents an interval.*

➤ **How many piano students practiced 4–5 hours during the week?** *8* **how many practiced 8–9 hours?** *2*

➤ **What interval is the mode of the set of data that is displayed on this histogram? How do you know?** *4–5; elicit that the bar for that interval indicates the greatest frequency.*

➤ **What does an overall view of the histogram show you?** *Answers will vary, but elicit that most of the piano students practiced 2–7 hours during the week.*

Read and interpret a box-and-whisker plot

1. Display the *Box-and-Whisker Plot* chart. Elicit that a box-and-whisker plot can be used to summarize data on a number line using a list of data that has been ordered (organized) from least to greatest.

➤ **What do the quartiles of a box-and-whisker plot represent?** *The middle quartile is the median of the set of data, the lower quartile is the median of the lower half of the data, and the upper quartile is the median of the upper half of the set of data.*

2. Cover the lists of data at the top of the chart.

➤ **What is the least number of points that Joel scored during a basketball game?** *2* **the greatest number of points?** *16*

➤ **What is the range of the data? How do you know?** *14; 16 − 2 = 14*

➤ **What is the median? How do you know?** *10; it is the middle quartile, the middle value in the ordered set of data.*

➤ **If the lists of data were not given, what are the only two pieces of data that you can be certain would be included in the list of data? Why?** *Elicit that you could only know that the least value (2) and the greatest value (16) would be included in the list of data. By just examining the box-and-whisker plots there is no way to know whether the middle, lower, and upper quartiles are included in the list of data or if they were determined by averaging two pieces of data.*

Student Text pp. 350–51

Student Text pp. 352–55

Chapter 15 Test
Cumulative Review

For a list of the skills reviewed in the Cumulative Review, see the Lesson Objectives for Lesson 147 in the Chapter 15 Overview on page 332 of this Teacher's Edition.

Student Materials
- Cumulative Review Answer Sheet, page IA9 (CD)

Use the Cumulative Review on Student Text pages 352–54 to review previously taught concepts and to determine which students would benefit from your reteaching of the concepts. To prepare the students for the format of achievement tests, instruct them to work on a separate sheet of paper, if necessary, and to mark the answers on the Cumulative Review Answer Sheet.

Read aloud the Career Link on Student Text page 355 (page 353 of this Teacher's Edition) and discuss the value of math as it relates to an architect.

Mark the answer.

11. $5{,}177 = 31 \times n$
A. $n = 166$ C. $n = 169$
B. $n = 167$ D. $n = 170$

12. $n \div 251 = 36$
A. $n = 9{,}036$ C. $n = 8{,}936$
B. $n = 8{,}306$ D. $n = 1{,}036$

13.
$$16\text{ lb }10\text{ oz} + 18\text{ lb }6\text{ oz}$$
A. 35 lb   C. 36 lb 2 oz
B. 35 lb 4 oz   D. 37 lb

14. Twenty quarts can make how many gallons?
A. 4 gal   C. 5 gal
B. 6 gal   D. 7 gal

15. What is 15% as a common fraction in lowest terms?
A. $\frac{1}{4}$ C. $\frac{3}{20}$
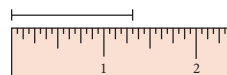B. $\frac{1}{5}$ D. $\frac{5}{17}$

16. What is the value of $\frac{1}{7}$ in decimal form? Round to the nearest thousandth.
A. 0.143   C. 1.144
B. 1.429   D. 7.1

17. What is the value of 4 in 649,782,163.51?
A. 40 thousand   C. 40 million
B. 4 million   D. 4 billion

18. Round to the greatest place value to estimate the answer.
$$7.014 - 4.38$$
A. 3   C. 4
B. 2   D. 1

19. What is $\frac{4}{5}$ as a percent?
A. 70%   C. 80%
B. 90%   D. 100%

20. Measure to the nearest sixteenth inch.
A. $1\frac{5}{16}$ C. $1\frac{9}{16}$
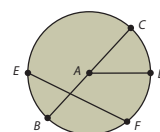B. $1\frac{7}{16}$ D. $1\frac{15}{16}$

CUMULATIVE REVIEW

Test Prep

Mark the answer.

1.
$$58.509 - 49.932$$
A. 7.437   C. 9.437
B. 8.577   D. 18.437

2.
$$4.6897 + 68.3974$$
A. 74.3071   C. 73.0121
B. 73.0871   D. 72.0971

3.
$$\$37.24 \times 342$$
A. $12,736.08   C. $12,068.80
B. $12,638.08   D. $11,763.08

4. $8\overline{)783}$
A. $95\frac{7}{8}$ C. $97\frac{7}{8}$
B. $96\frac{5}{8}$ D. $98\frac{1}{8}$

5. $76.3 \div 100$
A. 0.0763   C. 7.63
B. 0.763   D. none of the above

6. $\frac{5}{8} - \frac{7}{32}$
A. $\frac{2}{32}$ C. $\frac{13}{32}$
B. $\frac{7}{32}$ D. $\frac{15}{32}$

7. $6\frac{1}{10} - 3\frac{3}{5}$
A. $3\frac{4}{5}$ C. $2\frac{7}{10}$
B. $3\frac{2}{5}$ D. $2\frac{1}{2}$

8. $\frac{2}{7} + \frac{1}{4}$
A. $\frac{5}{7}$ C. $\frac{11}{14}$
B. $\frac{3}{28}$ D. $\frac{15}{28}$

9. $\frac{5}{8} \div \frac{2}{3}$
A. $\frac{5}{6}$ C. $\frac{5}{16}$
B. $\frac{5}{8}$ D. $\frac{15}{16}$

10. $\frac{5}{8} \times 6$
A. $3\frac{3}{4}$ C. 3
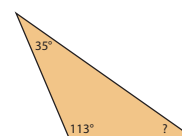B. $3\frac{1}{2}$ D. $2\frac{7}{8}$

Use ⊙A to find the answer.

21. What is the diameter of Circle A?
A. $\overline{AD}$
B. $\overline{CB}$
C. $\overline{EF}$
D. none of the above

22. If ∠CAD is 73°, what is the measure of ∠BAD?
A. 75°
B. 90°
C. 107°
D. none of the above

23. Name a chord that is *not* the diameter.
A. $\overline{EF}$
B. $\overline{AD}$
C. $\overline{AC}$
D. none of the above

Mark the answer.

24. What is the measure of the unknown angle?
A. 42°
B. 32°
C. 22°
D. none of the above

25. What is the volume of the figure?
A. 148.45 cm³
B. 169.56 cm³
C. 16.966 cm³
D. none of the above

Architect

Architecture is both an art and a science. Precise math skills and geometry elements (such as angles, arcs, and shapes) are used to plan and construct buildings. Think back to the Great Pyramid built in Egypt about 2575 BC. Precision and beauty mingled with mathematical calculation have provided years of enjoyment from this stunning structure. What would have become of the Great Pyramid if a small calculation had been incorrect?

When an architect designs a building, he thinks of the needs and the desires of his client and plans a structure that is both useful and visually interesting. He studies surrounding buildings, climate, and land-use ordinances so that he may thoughtfully plan every visible detail and use his creativity to make the building blend with its surroundings.

As a businessman, an architect must be very accurate in figuring the cost and the amount of time it will take to complete the entire project he has been hired to build. Being a good communicator is necessary as he works with contractors, planners, engineers, landscapers, and government officials. Today much of the planning and communication can be accomplished using advanced technology.

God made humans to build things. Much is written in the Bible about the beautiful temple that Solomon built. Many hours were spent planning and building this earthly temple. As Christians, we declare His glory when we create things that are strong and beautiful. We imitate His goodness by helping others. If God calls you to be an architect, you will have the opportunity to design buildings that help people who need places to live, work, and worship.

The great Creator displayed His architectural skill and design when He created the heavens and the earth and all that dwell in them in just six days. The Bible says in John 14:1–3, "Let not your heart be troubled: ye believe in God, believe also in me. In my Father's house are many mansions: if it were not so, I would have told you. I go to prepare a place for you. And if I go and prepare a place for you, I will come again, and receive you unto myself; that where I am, there ye may be also." We cannot imagine the beautiful mansions the heavenly Architect is preparing for His people!