10 Data Displays

"I took a survey of pet owners on how many times per day you should treat your dog to a biscuit."

"What do you think?"
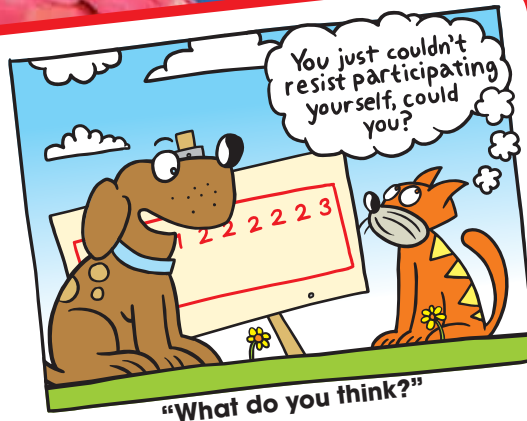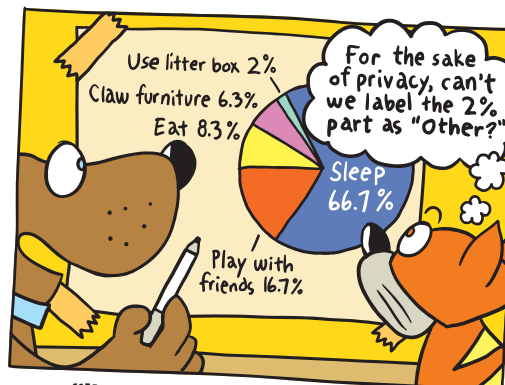
"I've completed a circle graph analyzing what you do each day."

What You Learned Before

"Okay, I have the box. But I need your help to complete my box-and-whisker plot."

I don't like where this is going.

## Analyzing Bar Graphs (3.MD.3)

Example 1 **The bar graph shows the favorite colors of the students in a class. How many students said their favorite color is blue?**

The height of the bar labeled "Blue" is 8.

⋮ So, 8 students said their favorite color is blue.

Favorite Color

Try It Yourself

1. What color was chosen the least?

2. How many students said green or red is their favorite color?

3. How many students did *not* choose yellow as their favorite color?

4. How many students are in the class?
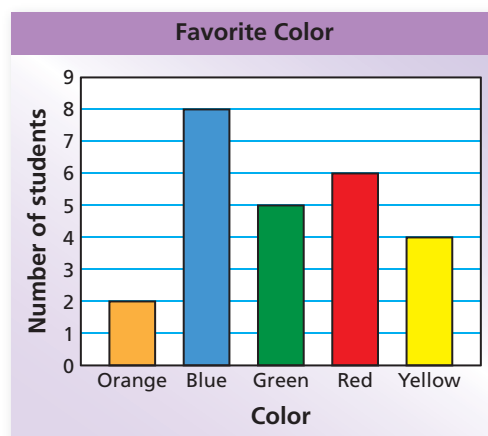
Finding Percents (6.RP.3c)

Example 2 **The circle graph shows the favorite fruits of the students in a class. There are 20 students in the class. How many students said their favorite fruit is an orange?**
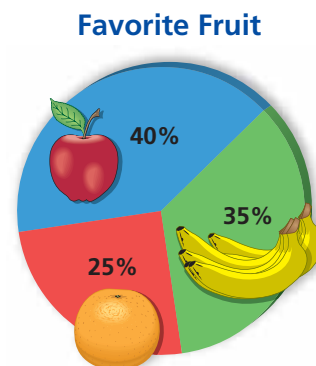
Find 25% of 20.

$$25\% \text{ of } 20 = \frac{1}{4} \cdot 20 = \frac{1 \cdot \overset{5}{20}}{\underset{1}{4}} = 5$$

⋮ So, 5 students said their favorite fruit is an orange.

Favorite Fruit

40%

35%

25%

Try It Yourself

5. How many students said their favorite fruit is an apple?

6. How many students said their favorite fruit is a banana?

Essential Question How can you use place values to represent data graphically?

1 ACTIVITY: Making a Data Display

Work with a partner. The list below gives the ages of these women when they became first ladies of the United States.

THE WHITE HOUSE
WASHINGTON

Frances Cleveland — 21
Caroline Harrison — 56
Ida McKinley — 49
Edith Roosevelt — 40
Helen Taft — 48
Ellen Wilson — 52
Florence Harding — 60
Grace Coolidge — 44
Lou Hoover — 54
Eleanor Roosevelt — 48
Elizabeth Truman — 60

Mamie Eisenhower — 56
Jacqueline Kennedy — 31
Claudia Johnson — 50
Patricia Nixon — 56
Elizabeth Ford — 56
Rosalynn Carter — 49
Nancy Reagan — 59
Barbara Bush — 63
Hillary Clinton — 45
Laura Bush — 54
Michelle Obama — 45

COMMON CORE

Data Displays
In this lesson, you will
● make and interpret stem-and-leaf plots.
Applying Standard
6.SP.4

a. The incomplete data display shows the ages of the first ladies in the left column of the list above.

What do the numbers to the left of the line represent? What do the numbers to the right of the line represent?

Ages of First Ladies

2	1
3	
4	0 4 8 8 9
5	2 4 6
6	0 0

b. This data display is called a *stem-and-leaf plot.* What numbers do you think represent the *stems? leaves?* Explain your reasoning.

c. Complete the stem-and-leaf plot using the remaining ages in the right column. Order the numbers to the right of the line in numerical order.

d. **REASONING** Write a question about the ages of first ladies that would be easier to answer using a stem-and-leaf plot than a dot plot.

2 ACTIVITY: Making a Back-to-Back Stem-and-Leaf Plot

Work with a partner. The table below shows the ages of presidents of the United States from 1885 to 2009 on their first inauguration day.

Ages of Presidents										
47	55	54	42	51	56	55	51	54	51	60
62	43	55	56	61	52	69	64	46	54	47

a. On your stem-and-leaf plot from Activity 1(c), draw a vertical line to the left of the display. Represent the ages of the presidents by including numbers to the left of the line.

b. Find the median ages of both the first ladies and the presidents of the United States.

c. Compare the distribution of each data set.

3 ACTIVITY: Conducting an Experiment

Math Practice 4

Interpret Results

How can you use the stem-and-leaf plot to interpret your results? Explain.

Work with a partner. Use two number cubes to conduct the following experiment.

- Toss the cubes and find the product of the resulting numbers.
- Repeat this process 30 times. Record your results.

a. Use a stem-and-leaf plot to organize your results.

b. Describe the distribution of the data.

What Is Your Answer?

4. IN YOUR OWN WORDS How can you use place values to represent data graphically?

5. How can you display data in a stem-and-leaf plot whose values range from 82 through 129?

Practice

Use what you learned about stem-and-leaf plots to complete Exercises 4 and 5 on page 438.

Key Vocabulary
stem-and-leaf plot,
    p. 436
stem, p. 436
leaf, p. 436

Key Idea

Stem-and-Leaf Plots

A **stem-and-leaf plot** uses the digits of data values to organize a data set. Each data value is broken into a **stem** (digit or digits on the left) and a **leaf** (digit or digits on the right).

A stem-and-leaf plot shows how data are distributed.

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

Key: $2\,|\,0 = 20$

The *key* explains what the stems and leaves represent.

EXAMPLE 1 Making a Stem-and-Leaf Plot

	A	B
1	DATE	MINUTES
2	JULY 9	55
3	JULY 9	3
4	JULY 9	6
5	JULY 10	14
6	JULY 10	18
7	JULY 10	5
8	JULY 10	23
9	JULY 11	30
10	JULY 11	23
11	JULY 11	10
12	JULY 11	2
13	JULY 11	36

Make a stem-and-leaf plot of the length of the 12 cell phone calls.

Step 1: Order the data.

2, 3, 5, 6, 10, 14, 18, 23, 23, 30, 36, 55

Step 2: Choose the stems and the leaves. Because the data values range from 2 to 55, use the *tens* digits for the stems and the *ones* digits for the leaves. Be sure to include the key.

Step 3: Write the stems to the *left* of the vertical line.

Step 4: Write the leaves for each stem to the *right* of the vertical line.

Cell Phone Call Lengths

Order the stems vertically. The stem for data values less than 10 is 0.

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

Write the leaves horizontally.

Include stems without leaves.

Key: $1\,|\,4 = 14$ minutes

On Your Own

Now You're Ready
Exercises 4–9

1. Make a stem-and-leaf plot of the hair lengths.

Hair Length (centimeters)									
5	1	20	12	27	2	30	5	7	38
40	47	1	2	1	32	4	44	33	23

Multi-Language Glossary at BigIdeasMath.com

EXAMPLE **2** **Interpreting a Stem-and-Leaf Plot**

Test Scores

Stem	Leaf
6	6
7	0 5 7 8
8	1 1 3 4 4 6 8 8 9
9	0 2 9
10	0

Key: 9 | 2 = 92 points

The stem-and-leaf plot shows student test scores. (a) How many students scored less than 80 points? (b) How many students scored at least 90 points? (c) How are the data distributed?

a. There are five scores less than 80 points:
66, 70, 75, 77, and 78.

∴   Five students scored less than 80 points.

b. There are four scores of at least 90 points:
90, 92, 99, and 100.

∴   Four students scored at least 90 points.

c. There are few low test scores and few high test scores.
So, most of the scores are in the middle.

🔴 **On Your Own**

Now You're Ready
Exercises 12–15

2. Use the grading scale at the right.

    a. How many students received a B on the test?

    b. How many students received a C on the test?

> A: 90–100
> B: 80–89
> C: 70–79
> D: 60–69
> F: 59 and below

EXAMPLE **3** **Making Conclusions from a Stem-and-Leaf Plot**

Which statement is *not* true?

Ⓐ Most of the plants are less than 20 inches tall.

Ⓑ The median plant height is 11 inches.

Ⓒ The range of the plant heights is 35 inches.

Ⓓ The plant height that occurs most often is 11 inches.

Plant Heights

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

Key: 1 | 5 = 15 inches

There are 15 plant heights. So, the median is the eighth data value, 10 inches.

∴   The correct answer is Ⓑ.

🔴 **On Your Own**

3. You are told that three plants are taller than 20 inches. Is the statement true? Explain.

Check It Out
Help with Homework
BigIdeasMath.com

✓ Vocabulary and Concept Check

1. **VOCABULARY** The key for a stem-and-leaf plot is $3\,|\,4 = 34$. Which number is the stem? Which number is the leaf?

2. **WRITING** Describe how to make a stem-and-leaf plot of the data values 14, 22, 9, 13, 30, 8, 25, and 29.

3. **WRITING** How does a stem-and-leaf plot show the distribution of data?
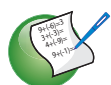
Practice and Problem Solving

Make a stem-and-leaf plot of the data.

1 **4.**

Books Read			
26	15	20	9
31	25	29	32
17	26	19	40

5.

Hours Online			
8	12	21	14
18	6	15	24
12	17	2	0

6.

Test Scores (%)				
87	82	95	91	69
88	68	87	65	81
97	85	80	90	62

7.

Points Scored				
58	50	42	71	75
45	51	43	38	71
42	70	56	58	43

8.

Bikes Sold			
78	112	105	99
86	96	115	100
79	81	99	108

9.

Minutes in Line			
4.0	2.6	1.9	3.1
3.6	2.2	2.7	3.8
1.6	2.0	3.1	2.9

10. **ERROR ANALYSIS** Describe and correct the error in making a stem-and-leaf plot of the data.

    51, 25, 47, 42, 55, 26, 50, 44, 55

    ✗
Stem	Leaf
2	5 6
4	2 4 7
5	0 1 5 5

    Key: $4\,|\,2 = 42$

11. **PUPPIES** The weights (in pounds) of eight puppies at a pet store are 12, 24, 17, 8, 18, 31, 24, and 15. Make a stem-and-leaf plot of the data. Describe the distribution of the data.

VOLLEYBALL The stem-and-leaf plot shows the number of *digs* for the top 15 players at a volleyball tournament.

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

Key: 5 | 0 = 50 digs

2 **12.** How many players had more than 60 digs?

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

14. Describe the distribution of the data.

15. Which data value is the outlier? Describe how the outlier affects the mean.

16. REASONING Each stem-and-leaf plot below has a mean of 39. Without calculating, determine which stem-and-leaf plot has the lesser mean absolute deviation. Explain your reasoning.

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

Key: 4 | 1 = 41

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

Key: 5 | 3 = 53

17. TEMPERATURE The stem-and-leaf plot shows the daily high temperatures (in degrees Fahrenheit) for the first 15 days of a month.

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

Key: 6 | 7 = 67°F

   a. Find and interpret the mean absolute deviation of the data.

   b. After you include the daily high temperatures for the rest of the month in the stem-and-leaf plot, the mean absolute deviation increases. Where do you think most of the data values for the rest of the month are located in the stem-and-leaf plot? Explain.

18. **Critical Thinking** The back-to-back stem-and-leaf plot shows the 9-hole golf scores for two golfers. Only one of the golfers can compete in a tournament. Use measures of center and measures of variation to give reasons why you would choose each golfer.

Rich		Will
7 5	3	
8 5 4 3 2 1	4	2 3 4 4 6 7 7 8 9
5 0	5	0

Key: 1 | 4 | 2 = 41 and 42 strokes

Fair Game Review What you learned in previous grades & lessons

Draw the solid. *(Section 8.1)*

19. square pyramid

20. hexagonal prism

21. MULTIPLE CHOICE In a bar graph, what determines the length of each bar? *(Skills Review Handbook)*

   Ⓐ frequency   Ⓑ data value   Ⓒ leaf   Ⓓ change in data

10.2 Histograms

Essential Question How can you use intervals, tables, and graphs to organize data?

1 ACTIVITY: Conducting an Experiment

Work with a partner.

a. Roll a number cube 20 times. Record your results in a tally chart.

b. Make a bar graph of the totals.

c. Go to the board and enter your totals in the class tally chart.

d. Make a second bar graph showing the class totals. Compare and contrast the two bar graphs.

Tally Chart	
1	
2	
3	
4	
5	
6	

Key: | = 1   𝍷𝍷𝍷 = 5

2 ACTIVITY: Using Intervals to Organize Data

Work with a partner. You are judging a paper airplane contest. A contestant flies a paper airplane 20 times. You record the following distances:

20.5 ft, 24.5 ft, 18.5 ft, 19.5 ft, 21.0 ft, 14.0 ft, 12.5 ft, 20.5 ft, 17.5 ft, 24.5 ft,

19.5 ft, 17.0 ft, 18.5 ft, 12.0 ft, 21.5 ft, 23.0 ft, 13.5 ft, 19.0 ft, 22.5 ft, 19.0 ft

a. Complete the tally chart and the bar graph of the distances.

Tally Chart		
Interval	**Tally**	**Total**
10.0 − 12.9		
13.0 − 15.9		
16.0 − 18.9		
19.0 − 21.9		
22.0 − 24.9		

Paper Airplane Contest
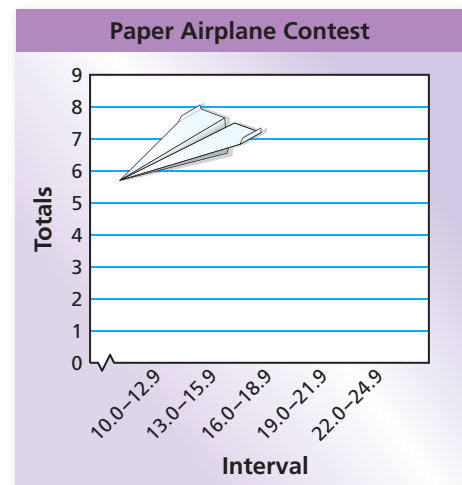
b. Make a different tally chart and bar graph of the distances. Use the following intervals:

10.0–11.9, 12.0–13.9, 14.0–15.9, 16.0–17.9, 18.0–19.9, 20.0–21.9, 22.0–23.9, 24.0–25.9

c. Which graph do you think represents the distances better? Explain.

The tally chart in Activity 2 is also called a *frequency table*. A **frequency table** groups data values into intervals. The **frequency** is the number of values in an interval.

3   ACTIVITY: Developing an Experiment

Work with a partner.

a. Make the airplane shown from a single sheet of $8\frac{1}{2}$-by-11-inch paper. Then design and make your own paper airplane.

1. Fold in half. Then unfold.

2. Fold corners.

3. Fold corners again.

4. Fold in half.

5. Fold wings out on both sides.

6. Fold wing edges up.
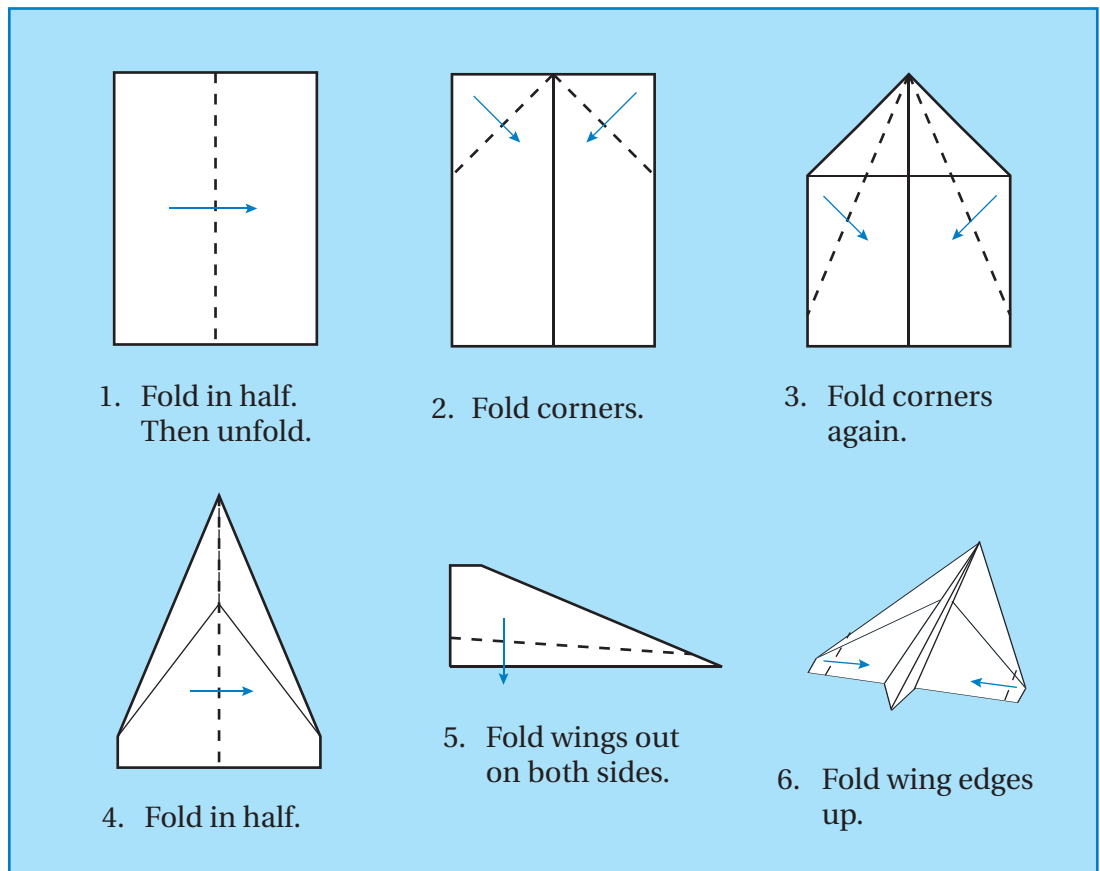
b. **PRECISION** Fly each airplane 20 times. Keep track of the distance flown each time.

c. **MODELING** Organize the results of the flights using frequency tables and graphs. Which airplane flies farther? Explain your reasoning.

What Is Your Answer?

4. **IN YOUR OWN WORDS** How can you use intervals, tables, and graphs to organize data?

5. What intervals could you use in a graph that displays data whose values range from 40 through 59?

Practice

Use what you learned about organizing data into intervals to complete Exercises 4 and 5 on page 445.

10.2 Lesson

Key Vocabulary
frequency table, *p. 441*
frequency, *p. 441*
histogram, *p. 442*

Key Idea

Histograms

A **histogram** is a bar graph that shows the frequency of data values in intervals of the same size.

The height of a bar represents the frequency of the values in the interval.

CDs Owned
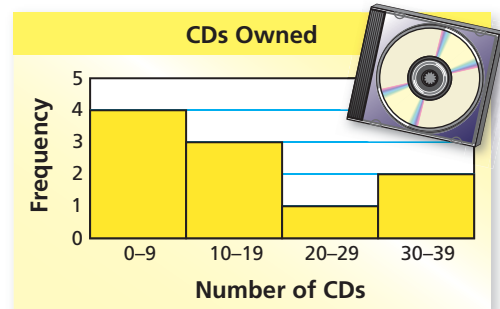
EXAMPLE 1 Making a Histogram

The frequency table shows the numbers of laps that people in a swimming class completed today. Display the data in a histogram.

Number of Laps	Frequency
1–3	11
4–6	4
7–9	0
10–12	3
13–15	6

Step 1: Draw and label the axes.

Step 2: Draw a bar to represent the frequency of each interval.

Laps Completed
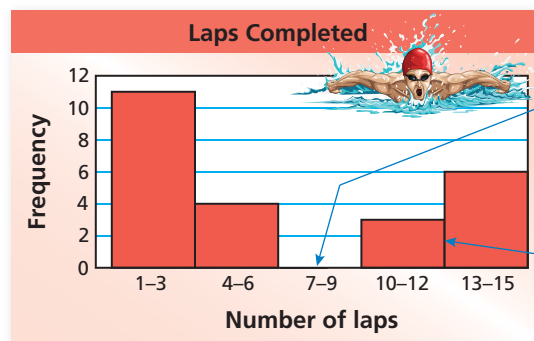
Include any interval with a frequency of 0. The bar height is 0.

There is no space between the bars of a histogram.

On Your Own

Now You're Ready
Exercises 6–8

1. The frequency table shows the ages of people riding a roller coaster. Display the data in a histogram.

Age	10–19	20–29	30–39	40–49	50–59
Frequency	16	11	5	2	4

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EXAMPLE 2 Using a Histogram

**The histogram shows the winning speeds at the Daytona 500.
(a) Which interval contains the most data values? (b) How many of the
winning speeds are less than 140 miles per hour? (c) How many of the
winning speeds are at least 160 miles per hour?**

Daytona 500 Winning Speeds
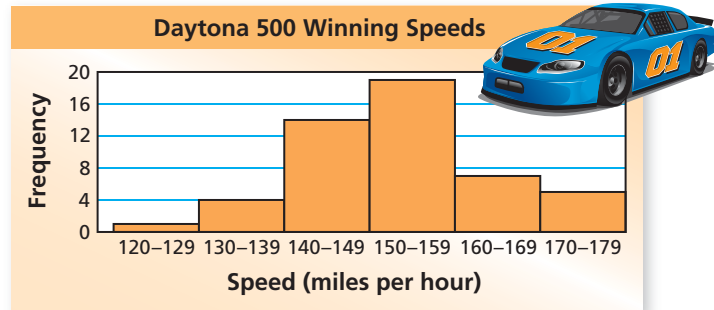
a. The interval with the tallest bar contains the most data values.

⋮ So, the 150–159 miles per hour interval contains the most
   data values.

b. One winning speed is in the 120–129 miles per hour interval, and
   four winning speeds are in the 130–139 miles per hour interval.

⋮ So, 1 + 4 = 5 winning speeds are less than 140 miles per hour.

c. Seven winning speeds are in the 160–169 miles per hour
   interval, and five winning speeds are in the 170–179 miles
   per hour interval.

⋮ So, 7 + 5 = 12 winning speeds are at least 160 miles per hour.

On Your Own

Now You're Ready
Exercises 10–13

2. The histogram shows the numbers of hours that students
   in a class slept last night.

   a. How many students slept at least 8 hours?

   b. How many students slept less than 12 hours?

Amount of Sleep
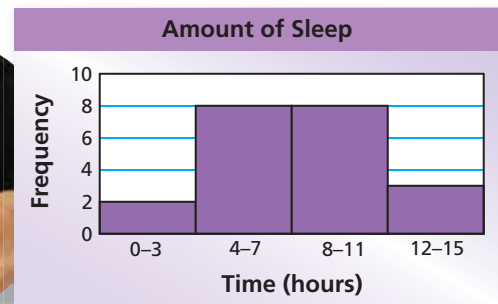
EXAMPLE 3 **Comparing Data Displays**

The data displays show how many push-ups students in a class completed for a physical fitness test. Which data display can you use to find how many students are in the class? Explain.

Push-Ups

Push-Ups
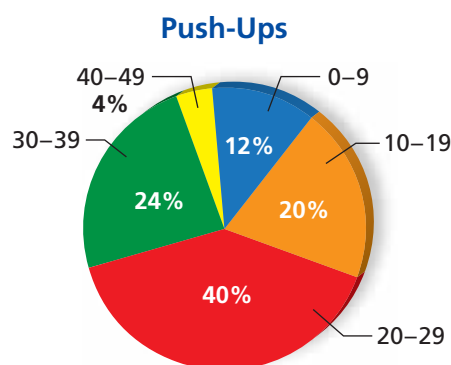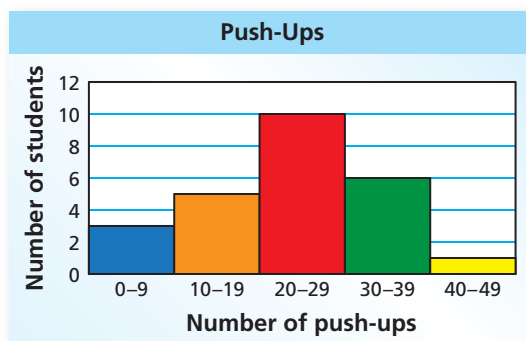
⋮⋮ You can use the histogram because it shows the number of students in each interval. The sum of these values represents the number of students in the class. You cannot use the circle graph because it does not show the number of students in each interval.

EXAMPLE 4 **Making Conclusions from Data Displays**

Which statement *cannot* be made using the data displays in Example 3?

(A) Twelve percent of the class completed less than 10 push-ups.

(B) Five students completed at least 10 and at most 19 push-ups.

(C) At least one student completed more than 39 push-ups.

(D) Twenty-nine percent of the class completed 30 or more push-ups.

The circle graph shows that 12% completed 0–9 push-ups. So, Statement A can be made.

In the histogram, the bar height for the 10–19 interval is 5, and the bar height for the 40–49 interval is 1. So, Statements B and C can be made.

The circle graph shows that 24% completed 30–39 push-ups, and 4% completed 40–49 push-ups. So, 24% + 4% = 28% completed 30 or more push-ups. Statement D cannot be made.

⋮⋮ The correct answer is (D).

● **On Your Own**

Now You're Ready
Exercises 14 and 15

3. In Example 3, which data display should you use to describe the portion of the entire class that completed 30–39 push-ups?

4. Make two more conclusions from the data displays in Example 3.

✔ Vocabulary and Concept Check

1. **VOCABULARY** Which graph is a histogram? Explain your reasoning.

2. **REASONING** Describe the outliers in the histogram.

3. **REASONING** How can you tell when an interval of a histogram has a frequency of zero?

Expense Report

Amount ($): 100, 75, 50, 25, 0
Rent, Food, Car, Other
Expenses

Test Scores

Number of students: 50, 40, 30, 20, 10, 0
Score: 1–20, 21–40, 41–60, 61–80, 81–100
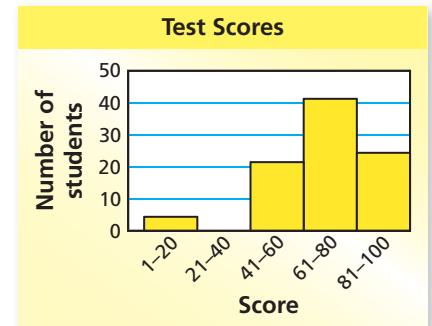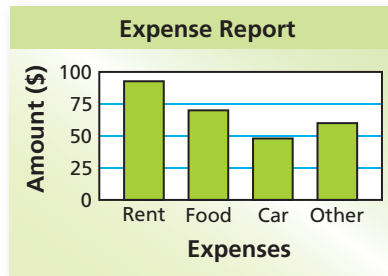
✎ Practice and Problem Solving

Make a tally chart and a bar graph of the data.

4.

Members of Book Clubs			
6	17	13	19
13	9	18	24
11	15	21	14

5.

Points Scored				
42	45	57	39	55
38	48	36	48	46
51	29	45	54	42

Display the data in a histogram.

① 6.

States Visited	
States	Frequency
1–5	12
6–10	14
11–15	6
16–20	3

7.

Chess Team	
Wins	Frequency
10–13	3
14–17	4
18–21	4
22–25	2

8.

Movies Watched	
Movies	Frequency
0–1	5
2–3	11
4–5	8
6–7	1

9. **ERROR ANALYSIS** Describe and correct the error made in displaying the data in a histogram.

Confirmed Flu Cases per School	
Cases	Frequency
0–2	3
3–5	7
6–8	9
9–11	12

✗

Frequency: 14, 12, 10, 8, 6, 4, 2, 0
Cases: 0–2, 3–5, 6–8, 9–11
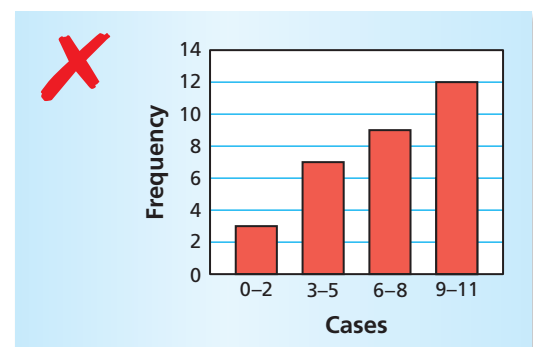
② 10. **MAGAZINES** The histogram shows the number of magazines read last month by the students in a class.

a. Which interval contains the fewest data values?

b. How many students are in the class?

c. What percent of the students read less than six magazines?

d. Can you find the mean or the median of the data? Explain.

Magazines
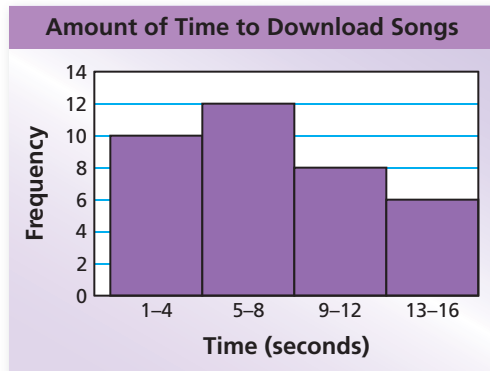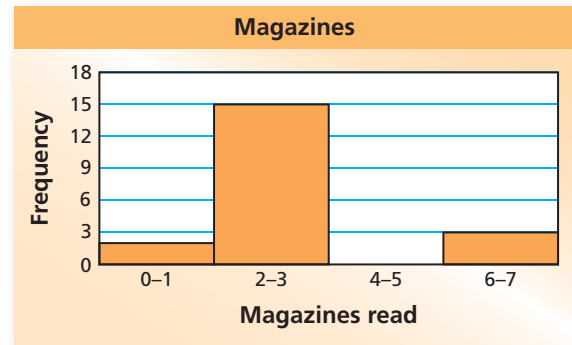
11. **ERROR ANALYSIS** Describe and correct the error made in reading the histogram.

Amount of Time to Download Songs

✗ 12% of the songs took 5–8 seconds to download.

12. **VOTING** The histogram shows the percent of the voting-age population that voted in a recent presidential election. Explain whether the graph supports each statement.

a. Only 40% of one state voted.

b. In most states, between 50% and 64.9% voted.

c. The mode of the data is between 55 and 59.9.

Presidential Election
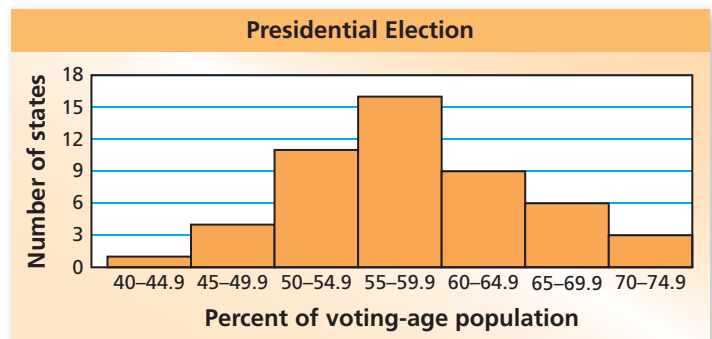
13. **PROBLEM SOLVING** The histograms show the areas of counties in Pennsylvania and Indiana. Which state do you think has the greater area? Explain.

Pennsylvania

Indiana
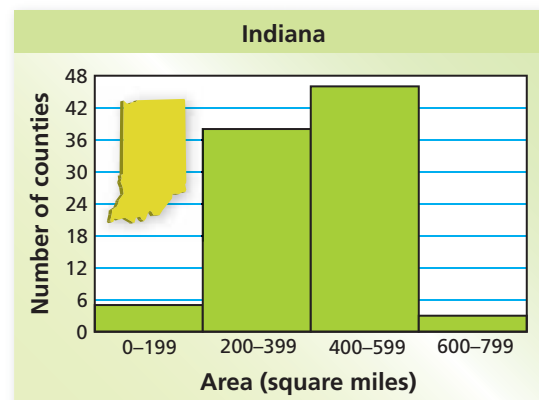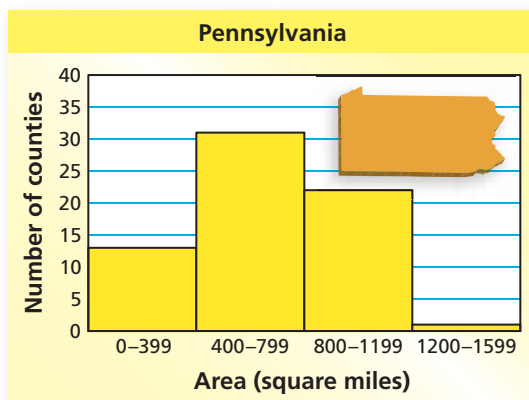
③ **14.** **GARBAGE** The data displays show how many pounds of garbage apartment residents produced in 1 week. Which data display can you use to find how many residents produced more than 25 pounds of garbage? Explain.
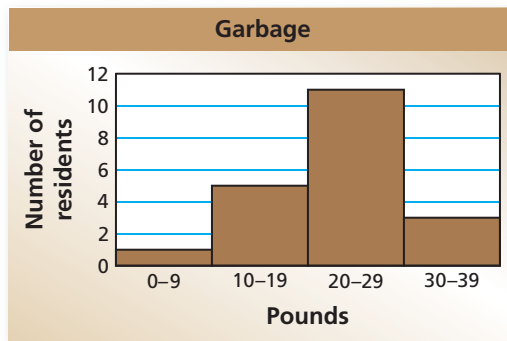
Garbage

Garbage

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

Key: 1 | 5 = 15 pounds

15. **REASONING** Determine whether you can make each statement by using the data displays in Exercise 14. Explain your reasoning.

   a. One resident produced 10 pounds of garbage.

   b. Twelve residents produced between 20 and 29 pounds of garbage.

16. **NUMBER SENSE** Can you find the range and the interquartile range of the data in Exercise 7? If so, find them. If you cannot find them, explain why not.

17. **CRITICAL THINKING** The table shows the weights of guide dogs enrolled in a training program.

   a. Make a histogram of the data starting with the interval 51–55.

   b. Make another histogram of the data using different-sized intervals.

   c. Compare and contrast the two histograms.

Weights (pounds)					
81	88	57	82	70	85
71	51	82	77	79	77
83	80	54	80	81	73
59	84	75	76	68	78
83	78	55	67	85	79

18. **Logic** What are the possible values for the median in Exercise 10?

Fair Game Review What you learned in previous grades & lessons

Find the percent of the number. *(Section 5.6)*

19. 25% of 180   **20.** 30% of 90   **21.** 16% of 140   **22.** 64% of 80

23. **MULTIPLE CHOICE** Which is the solution of the inequality represented by "Four times a number *n* is at least 28"? *(Section 7.7)*

   Ⓐ $n < 7$ Ⓑ $n > 7$ Ⓒ $n \le 7$ Ⓓ $n \ge 7$

You can use a **word magnet** to organize information associated with a vocabulary word. Here is an example of a word magnet for histogram.

Histogram

A histogram is a bar graph that shows the frequency of data values in intervals of the same size.

The height of a bar represents the frequency of the values in the interval.

You can make a histogram from a frequency table. A frequency table groups data values into intervals. The frequency is the number of data values in an interval.

The histogram shows the number of times students were absent from homeroom this year.

Homeroom Absences

Frequency
15
10
5
0

0–1 2–3 4–5 6–7
Number of absences
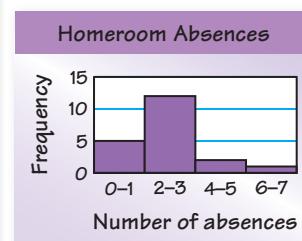
On Your Own

Make a word magnet to help you study this topic.

1. stem-and-leaf plot

After you complete this chapter, make word magnets for the following topics.

2. shapes of distributions

3. box-and-whisker plot

4. Choose three other topics that you studied earlier in this course. Make a word magnet for each topic.

Wags tail   BEAGLE   ♥'s Treats
Cool   Genius
4 Legs   0 Fleas

I see "humble" didn't make the list.
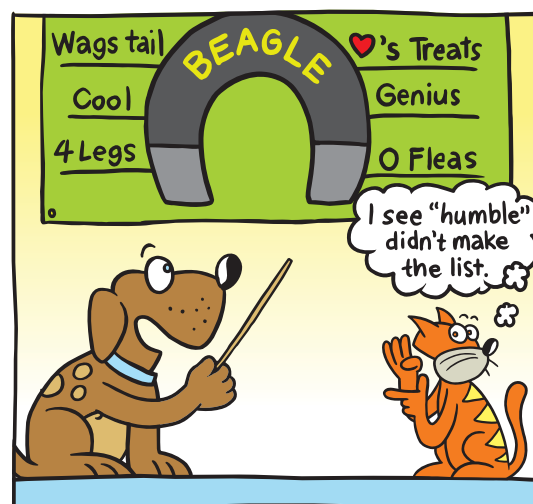
"How do you like the word magnet I made for 'Beagle'?"

Make a stem-and-leaf plot of the data.   *(Section 10.1)*

1.

Cans Collected Each Month			
80	90	84	92
76	83	79	59
68	55	58	61

2.

Miles Driven Each Day				
21	18	12	16	10
16	9	15	20	28
35	50	37	20	11

3.

Ages of Tortoises			
86	99	100	124
92	85	110	130
115	129	83	104

4.

Kilometers Run Each Day				
6.0	5.6	6.2	3.0	2.5
3.5	2.0	5.0	3.9	3.1
6.2	3.1	4.5	3.8	6.1

Display the data in a histogram.   *(Section 10.2)*

5.

Soccer Team Goals	
Goals per Game	Frequency
0–1	5
2–3	4
4–5	0
6–7	1

6.

Minutes Practiced	
Minutes	Frequency
0–19	8
20–39	10
40–59	11
60–79	2

7.

Poems Written for Class	
Poems	Frequency
0–4	6
5–9	16
10–14	4
15–19	2
20–24	2

8. WEIGHTS The weights (in ounces) of nine packages are 7, 22, 16, 12, 6, 18, 15, 13, and 25. Make a stem-and-leaf plot of the data. Describe the distribution of the data.   *(Section 10.1)*

9. REBOUNDS The histogram shows the number of rebounds per game for a middle school basketball player this season.   *(Section 10.2)*

Rebounds per Game

  a. Which interval contains the most data values?

  b. How many games did the player play this season?

  c. What percent of the games did the player have 4 or more rebounds?
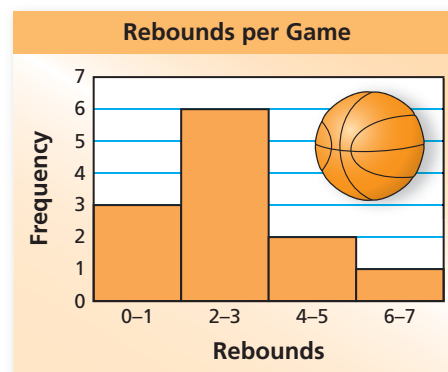
Stem	Leaf
0	6 8 8 9
1	0 1 2 3 7 8
2	0

Key: 0|9 = 9 hours

10. STAGE CREW The stem-and-leaf plot shows the number of hours 11 stage crew members spent building sets. Find the mean, median, mode, range, and interquartile range of the data.   *(Section 10.1)*

Essential Question How can you describe the shape of the distribution of a data set?

1 ACTIVITY: Describing the Shape of a Distribution

```
-7253
-7290
-7200
-1192
-1142

-3500
-2531
-2079
-5897
-5341
-1392
-5406
-7875
-7335
-0494
-9018
-2184
-2367
```

```
-8678
-2063
-2911
-2103
-4328
-7826
-7957
-7246
-2119
-7845
-1109
-9154
```

Work with a partner. The lists at the left show the last four digits of a set of phone numbers in a phone book.

a. Create a list that represents the last digit of each phone number shown. Make a dot plot of the data.

b. In your own words, how would you describe the shape of the distribution? What single word do you think you can use to identify this type of distribution? Explain your reasoning.

2 ACTIVITY: Describing the Shape of a Distribution

COMMON CORE

Data Displays
In this lesson, you will
• describe shapes
  of distributions.
Learning Standards
6.SP.2
6.SP.4

Work with a partner. The lists at the right show the first three digits of a set of phone numbers in a phone book.

a. Create a list that represents the first digit of each phone number shown. Make a dot plot of the data.

b. In your own words, how would you describe the shape of the distribution? What single word do you think you can use to identify this type of distribution? Explain your reasoning.

c. In your dot plot, draw a vertical line through the middle of the data set. What do you notice?

d. Repeat part (c) for the dot plot you constructed in Activity 1. What do you notice? Compare the distributions from Activities 1 and 2.

```
538-
438-
664-
761-
868-

735-
694-
599-
725-
556-
555-
456-
736-
664-
576-
664-
664-
725-
```

```
664-
664-
538-
855-
664-
538-
654-
654-
725-
538-
799-
764-
```

The Meaning of a Word ● Skewed

When something is **skewed**,   it has a slanted direction or position.

3 ACTIVITY: Describing the Shape of a Distribution

Work with a partner. The table shows the ages of cellular phones owned by a group of students.

a. Make a dot plot of the data.

b. In your own words, how would you describe the shape of the distribution? Compare it to the distributions in Activities 1 and 2.

c. Why do you think this type of distribution is called a *skewed distribution*?

Ages of Cellular Phones (years)				
0	1	0	6	4
2	3	5	1	1
0	1	2	3	1
0	0	1	1	1
7	1	4	2	2
0	2	0	1	2

4 ACTIVITY: Finding Measures of Center

Math Practice 3

Use Prior Results
How is the distribution of the data related to the mean and the median?

Work with a partner.

a. Find the means and the medians of the data sets in Activities 1–3.

b. What do you notice about the means and the medians of the data sets and the shapes of the distributions? Explain.

c. Which measure of center do you think best describes the data set in Activity 2? in Activity 3? Explain your reasoning.

d. Using your answers to part (c), decide which measure of variation you think best describes the data set in Activity 2. Which measure of variation do you think best describes the data set in Activity 3? Explain your reasoning.

What Is Your Answer?

5. **IN YOUR OWN WORDS** How can you describe the shape of the distribution of a data set?

6. Name two other ways you can describe the distribution of a data set.

Practice

Use what you learned about shapes of distributions to complete Exercises 3 and 4 on page 454.

10.3 Lesson

You can use dot plots and histograms to identify shapes of distributions.

Key Ideas

Symmetric and Skewed Distributions

Study Tip

If all the dots of a dot plot or bars of a histogram are about the same height, then the distribution is a *flat*, or *uniform*, distribution. A uniform distribution is also symmetric.

Skewed left	*Symmetric*	*Skewed right*
tail		tail
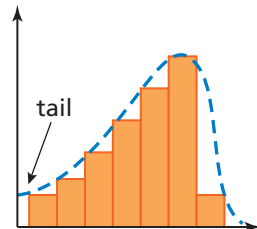
- The "tail" of the graph extends to the left.
- Most data are on the right.
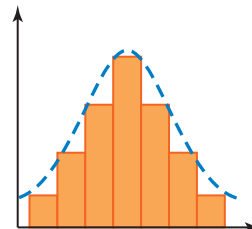
- The left side of the graph is a mirror image of the right side of the graph.
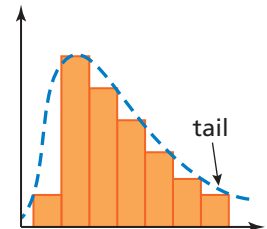
- The "tail" of the graph extends to the right.
- Most data are on the left.

EXAMPLE 1   Describing the Shapes of Distributions

Describe the shape of each distribution.

a.   **Daily Snowfall Amounts**
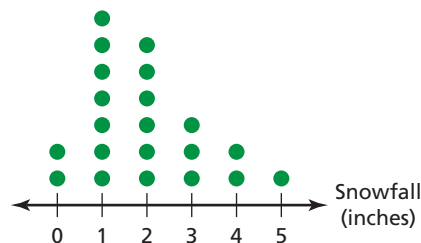
Snowfall (inches)
0 1 2 3 4 5

Most of the data are on the left, and the tail extends to the right.

∴ So, the distribution is skewed right.

b.   **Passes Thrown**

Frequency: 0, 5, 10, 15, 20
Number of passes: 0–9, 10–19, 20–29, 30–39, 40–49, 50–59, 60–69
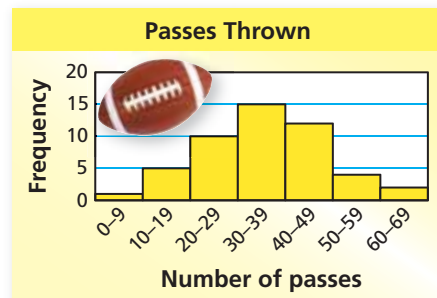
The left side of the graph is approximately a mirror image of the right side of the graph.

∴ So, the distribution is symmetric.

On Your Own

Now You're Ready
Exercises 5–8

1. Describe the shape of the distribution.

Daily Spam Emails Received

Number of emails
1 2 3 4 5 6
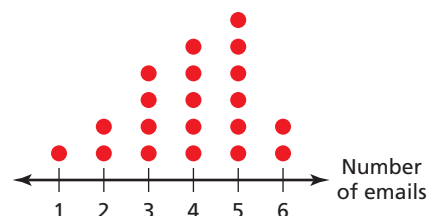
EXAMPLE 2

Describing the Shape of a Distribution

Ages	Frequency
10–13	1
14–17	3
18–21	7
22–25	12
26–29	20
30–33	18
34–37	3

The frequency table shows the ages of people watching a comedy in a theater. Display the data in a histogram. Describe the shape of the distribution.

Draw and label the axes. Then draw a bar to represent the frequency of each interval.

Most of the data are on the right, and the tail extends to the left.

⋮• So, the distribution is skewed left.

Comedy Attendance
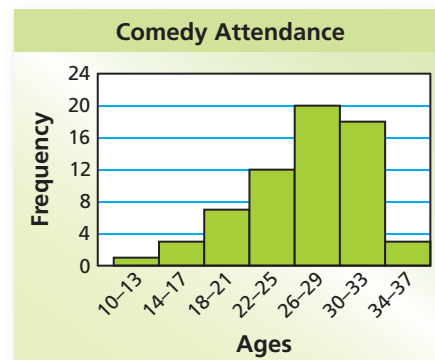
EXAMPLE 3 Comparing Shapes of Distributions

The histogram shows the ages of people watching an animated movie in the same theater as in Example 2.

a. **Describe the shape of the distribution.**

Most of the data are on the left, and the tail extends to the right.

⋮• So, the distribution is skewed right.

Animated Movie Attendance
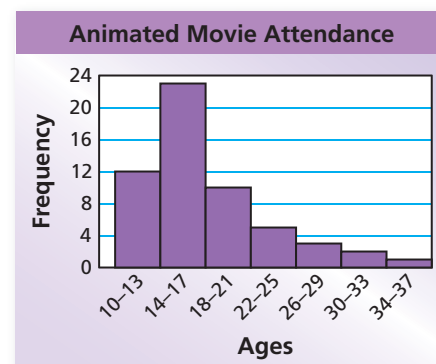
b. **Which movie has an older audience?**

The intervals in the histograms are the same. Most of the data for the animated movie are on the left, while most of the data for the comedy are on the right. This means that the people watching the comedy are generally older than the people watching the animated movie.

⋮• So, the comedy has an older audience.

On Your Own

Now You're Ready
Exercise 9

2. The frequency table shows the ages of people watching a historical movie in a theater.

Ages	10−19	20−29	30−39	40−49	50−59	60−69
Frequency	3	18	36	40	14	5

a. Display the data in a histogram. Describe the shape of the distribution.

b. Compare the distribution of the data to the distributions in Examples 2 and 3. What can you conclude?

✓ Vocabulary and Concept Check

1. **VOCABULARY** How does the shape of a symmetric distribution differ from the shape of a skewed distribution?

2. **VOCABULARY** For a distribution that is skewed right, which direction does the tail extend? Where do most of the data lie?
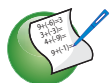
Practice and Problem Solving

Make a dot plot of the data. In your own words, how would you describe the shape of the distribution?

3.

Miles Run per Day										
1	4	2	0	3	2	1	2	4	2	3
2	1	6	3	2	4	0	5	3	1	5

4.

Raffle Tickets Sold							
15	12	16	15	13	14	16	13
13	16	14	12	15	12	14	

Describe the shape of each distribution.

① 5.

Class Sizes

6.

Heights of Plants

7.

Travel Time to School

8.

Ages of People at a Concert
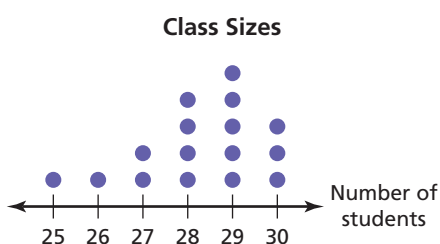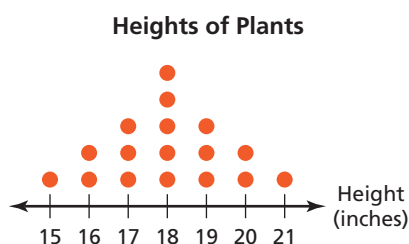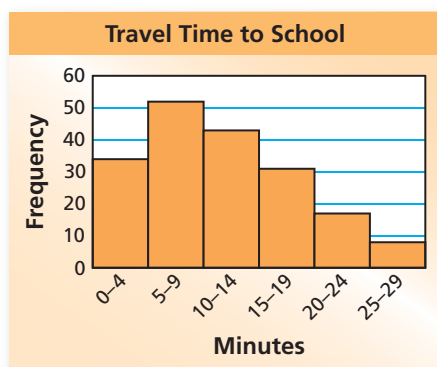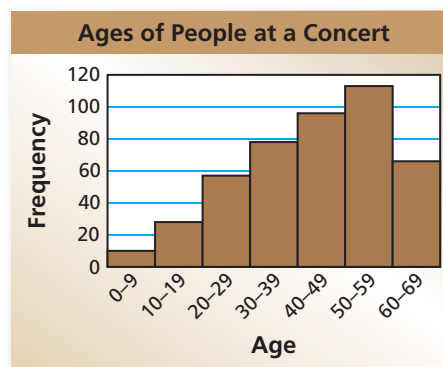
② ③ 9. **POLICE** The frequency table shows the years of service for the police officers of Jones County and Pine County. Display the data for each county in a histogram. Describe the shape of each distribution. Which county's police force has less experience? Explain.

Years of Service	0–3	4–7	8–11	12–15	16–19	20–23	24–27
Frequency for Jones County	7	15	17	12	8	5	3
Frequency for Pine County	3	5	9	14	10	6	2

10. **REASONING** What is the shape of the
distribution of the restaurant waiting
times? Explain your reasoning.

Restaurant Waiting Times

11. **LOGIC** Are all distributions either
approximately symmetric or skewed?
Explain. If not, give an example.

12. **REASONING** Can you use a stem-and-leaf plot
to describe the shape of a distribution? Explain
your reasoning.
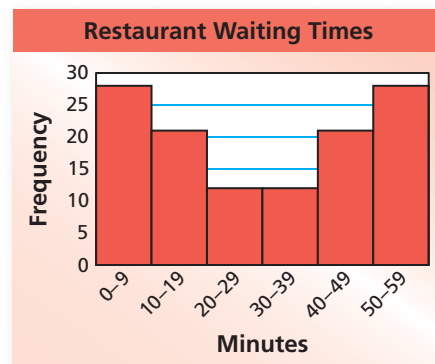
13. **CHARITY** The table shows the donation amounts received by a charity
in one day.

Donations (dollars)												
20	15	40	70	20	5	25	50	47	20	62	55	40
10	50	18	20	100	40	80	60	20	80	3	30	50
25	30	10	33	20	50	7	35	40	25	70		

a. Make a histogram of the data starting with the interval 0–14. Describe the
shape of the distribution.

b. A company adds $5 to each donation. Make another histogram starting
with the same first interval as in part (a). Compare the shape of this
distribution with the distribution in part (a). Explain any differences
in the distributions.

14. **Critical Thinking** Describe the shape of the distribution of each bar graph. Match
the letters A, B, and C with the mean, the median, and the mode of the data
set. Explain your reasoning.

a.

b.
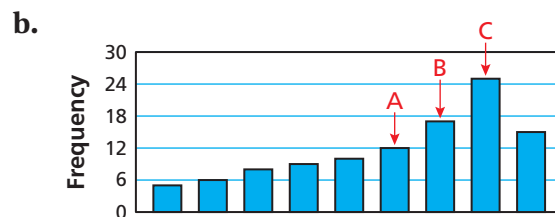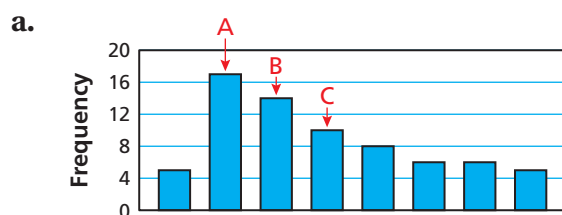
Find the median, first quartile, third quartile, and interquartile range of the
data. *(Section 9.4)*

15. 68, 74, 67, 72, 63, 70, 78, 64, 76

16. 39, 48, 33, 24, 30, 44, 36, 41, 28, 53

17. **MULTIPLE CHOICE** Sixty people participate in a trivia contest. How many
four-person teams can be formed? *(Section 7.3)*

Ⓐ 15   Ⓑ 56   Ⓒ 64   Ⓓ 240

You can use a measure of center and a measure of variation to describe the distribution of a data set. The shape of the distribution can help you choose which measures are the most appropriate to use.
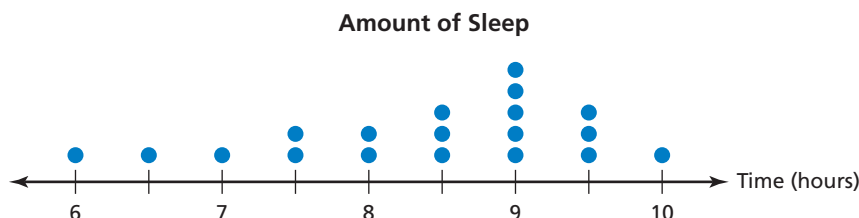
🔑 Key Idea

Math Practice 2

Understand Quantities

What effect can outliers have on the mean? on the median? Explain.

Choosing Appropriate Measures

The mean absolute deviation (MAD) uses the mean in its calculation. So, when a data distribution is *symmetric*,

- use the mean to describe the center and
- use the MAD to describe the variation.

The interquartile range (IQR) uses quartiles in its calculation. So, when a data distribution is *skewed*,

- use the median to describe the center and
- use the IQR to describe the variation.

EXAMPLE 1 **Choosing Appropriate Measures**

The dot plot shows the average number of hours students in a class sleep each night.

Amount of Sleep

Time (hours)

COMMON CORE

Data Displays

In this extension, you will
- choose appropriate measures of center and variation to represent data sets.

Learning Standard
6.SP.5d

a. What are the most appropriate measures to describe the center and the variation?

Most of the data values are on the right clustered around 9, and the tail extends to the left. The distribution is skewed left.

⋮ So, the median and the interquartile range are the most appropriate measures to describe the center and the variation.

b. Describe the center and the variation of the data set.

The median is 8.5 hours. The first quartile is 7.5, and the third quartile is 9. So, the interquartile range is $9 - 7.5 = 1.5$ hours.

⋮ The data are centered around 8.5 hours. The middle half of the data varies by no more than 1.5 hours.

EXAMPLE **2** **Choosing Appropriate Measures**

Bordering States	Frequency
0–1	3
2–3	13
4–5	22
6–7	10
8–9	2

The frequency table shows the number of states that border each state in the United States.

a. **Display the data in a histogram.**

Draw and label the axes. Then draw a bar to represent the frequency of each interval.

Number of Bordering States for Each State in the U.S.
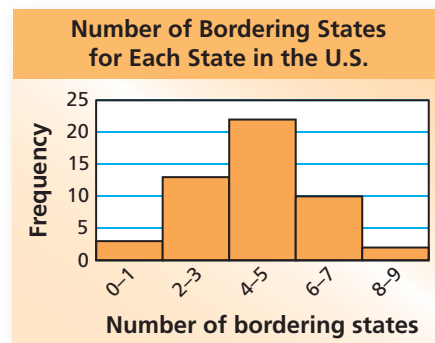
b. **What are the most appropriate measures to describe the center and the variation?**

The left side of the graph is approximately a mirror image of the right side of the graph. The distribution is symmetric.

So, the mean and the mean absolute deviation are the most appropriate measures to describe the center and the variation.

Practice

Choose the most appropriate measures to describe the center and the variation. Find the measures you chose.

1. **Prices of Jeans**
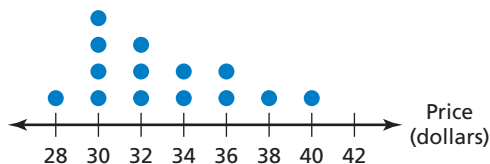
2. **Weekly Biking Times**
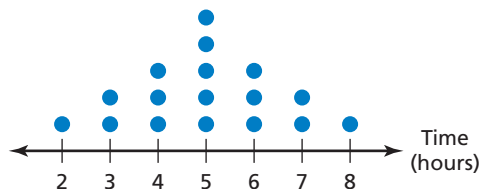
3. **REASONING** Can you find the exact values of the mean and the mean absolute deviation for the data in Example 2? Explain.

4. **GAS MILEAGE** The frequency table shows the gas mileages of several vehicles made by a company.

   a. What are the most appropriate measures to describe the center and the variation?

   b. What conclusions can you make?

5. **OPEN-ENDED** Construct a dot plot for which the mean is the most appropriate measure to describe the center of the distribution.

Mileage (miles per gallon)	Frequency
10–14	2
15–19	1
20–24	6
25–29	8
30–34	10
35–39	3

10.4 Box-and-Whisker Plots

Essential Question How can you use quartiles to represent data graphically?

1 ACTIVITY: Drawing a Box-and-Whisker Plot

Work with a partner.

The numbers of pairs of footwear owned by each student in a sixth grade class are shown.

Numbers of Pairs of Footwear			
2	5	12	3
7	2	4	6
14	10	6	28
5	3	2	4
9	25	4	10
8	15	5	8

a. Order the data set from least to greatest. Then write the data on a strip of grid paper with 24 boxes.

b. Use the strip of grid paper to find the median, the first quartile, and the third quartile. Identify the least value and the greatest value in the data set.

c. Graph the five numbers that you found in part (b) on the number line below.
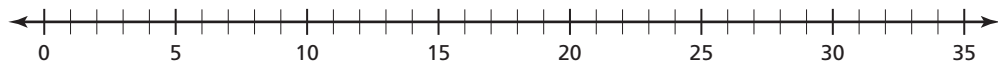
d. The data display shown below is called a *box-and-whisker plot*. Fill in the missing labels and numbers. Explain how a box-and-whisker plot uses quartiles to represent the data.
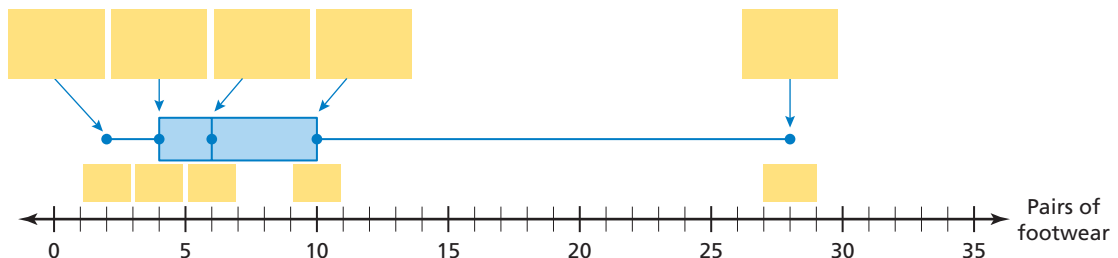
e. Using only the box-and-whisker plot, which measure(s) of center can you find for the data set? Which measure(s) of variation can you find for the data set? Explain your reasoning.

f. Why do you think this type of data display is called a box-and-whisker plot? Explain.

Have your class conduct a survey. Each student will write on the chalkboard the number of pairs of footwear that he or she owns.

Now, work with a partner to draw a box-and-whisker plot of the data.
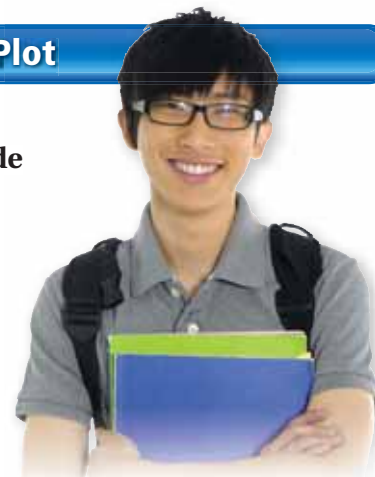
Math Practice 7

View as Components

What do the different components of a box-and-whisker plot represent?

Work with a partner. The box-and-whisker plots show the test score distributions of two sixth grade achievement tests. The same group of students took both tests. The students took one test in the fall and the other in the spring.

a. Compare and contrast the test results.

b. Decide which box-and-whisker plot represents the results of which test. How did you make your decision?

```
                        52      65    75  80           100

                30      45   55      70                 100

       0    10    20    30    40    50    60    70    80    90    100   Test score
```
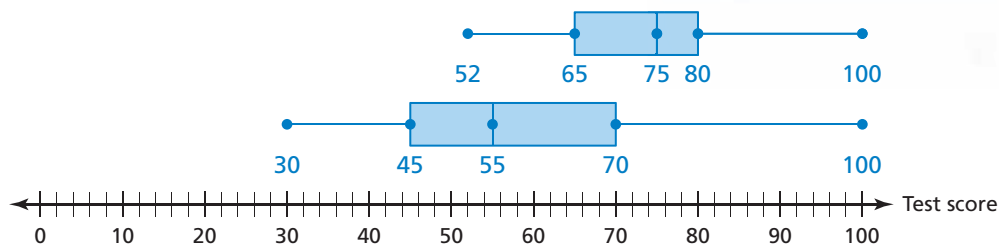
What Is Your Answer?

4. IN YOUR OWN WORDS How can you use quartiles to represent data graphically?

5. Describe who might be interested in test score distributions like those shown in Activity 3. Explain why it is important for such people to know test score distributions.

Practice   Use what you learned about box-and-whisker plots to complete Exercise 4 on page 463.

Key Vocabulary
box-and-whisker plot, *p. 460*
five-number summary, *p. 460*

Key Idea

Box-and-Whisker Plot

A **box-and-whisker plot** represents a data set along a number line by using the least value, the greatest value, and the quartiles of the data. A box-and-whisker plot shows the *variability* of a data set.
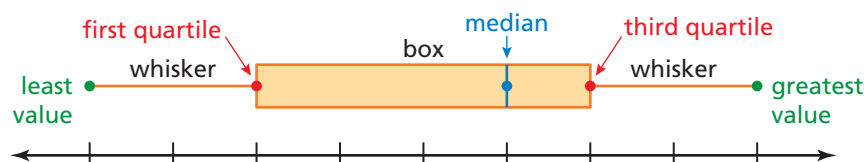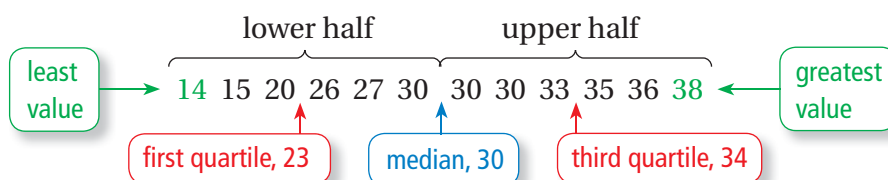

The five numbers that make up the box-and-whisker plot are called the **five-number summary** of the data set.

EXAMPLE 1 Making a Box-and-Whisker Plot

Make a box-and-whisker plot for the ages (in years) of the spider monkeys at a zoo:

$$15, 20, 14, 38, 30, 36, 30, 30, 27, 26, 33, 35$$

Step 1: Order the data. Find the median and the quartiles.

Step 2: Draw a number line that includes the least and greatest values. Graph points above the number line that represent the five-number summary.

Step 3: Draw a box using the quartiles. Draw a line through the median. Draw whiskers from the box to the least and the greatest values.
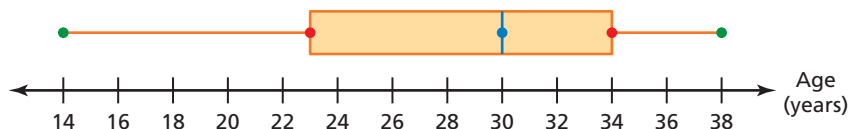
On Your Own

Now You're Ready
Exercises 5–8

1. A group of friends spent 1, 0, 2, 3, 4, 3, 6, 1, 0, 1, 2, and 2 hours online last night. Make a box-and-whisker plot for the data.

The figure shows how data are distributed in a box-and-whisker plot.

About $\frac{1}{4}$ of the data are in each whisker. About $\frac{1}{2}$ of the data are in the box. About $\frac{1}{4}$ of the data are in each whisker.

first quartile   third quartile

Study Tip

A long whisker or box indicates that the data are more spread out.
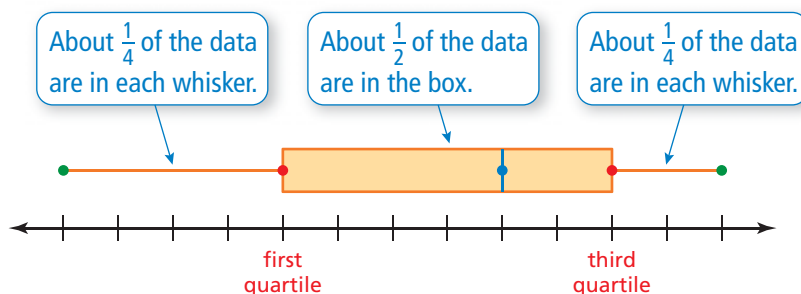
EXAMPLE **2** **Analyzing a Box-and-Whisker Plot**

The box-and-whisker plot shows the body mass index (BMI) of a sixth grade class.

BMI
17 18 19 20 21 22 23 24 25 26 27 28
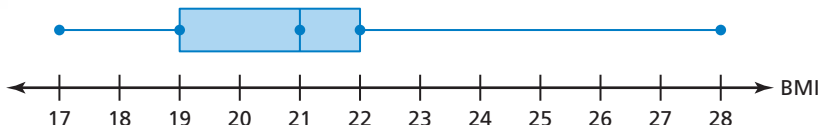
a. What fraction of the students have a BMI of at least 22?

The right whisker represents students who have a BMI of at least 22.

∴ So, about $\frac{1}{4}$ of the students have a BMI of at least 22.

b. Are the data more spread out below the first quartile or above the third quartile? Explain.

The right whisker is longer than the left whisker.

∴ So, the data are more spread out above the third quartile than below the first quartile.

c. Find and interpret the interquartile range of the data.

$$\text{interquartile range} = \text{third quartile} - \text{first quartile}$$
$$= 22 - 19 = 3$$

∴ So, the middle half of the students' BMIs varies by no more than 3.

On Your Own

Now You're Ready
Exercises 11 and 12

2. The box-and whisker plot shows the heights of the roller coasters at an amusement park. (a) What fraction of the roller coasters are between 120 feet tall and 220 feet tall? (b) Are the data more spread out below or above the median? Explain. (c) Find and interpret the interquartile range of the data.

Height (feet)
80 100 120 140 160 180 200 220 240 260
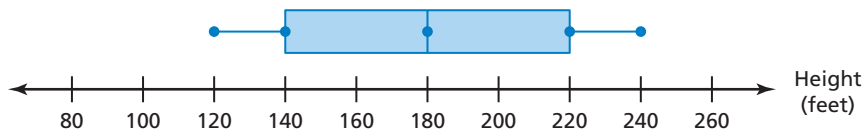
A box-and-whisker plot also shows the shape of a distribution.

Key Ideas

Shapes of Box-and-Whisker Plots

| *Skewed left* | *Symmetric* | *Skewed right* |

- Left whisker longer than right whisker
- Most data on the right
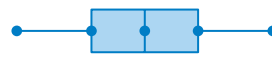
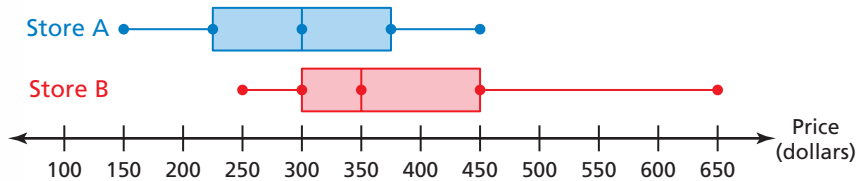- Whiskers about same length
- Median in the middle of the box

- Right whisker longer than left whisker
- Most data on the left

EXAMPLE 3 Comparing Box-and-Whisker Plots

The double box-and-whisker plot represents the prices of snowboards at two stores.

a. Identify the shape of each distribution.

For Store A, the whisker lengths are equal. The median is in the middle of the box. The data on the left are the mirror image of the data on the right. So, the distribution is symmetric.

For Store B, the right whisker is longer than the left whisker, and most of the data are on the left side of the display. So, the distribution is skewed right.

b. Which store's prices are more spread out? Explain.

Both boxes appear to be the same length. So, the interquartile range of each data set is equal. However, the range of the prices in Store B is greater than the range of the prices in Store A. So, the prices in Store B are more spread out.

On Your Own

3. The double box-and-whisker plot represents the life spans of crocodiles and alligators at a zoo. Identify the shape of each distribution. Which reptile's life spans are more spread out? Explain.
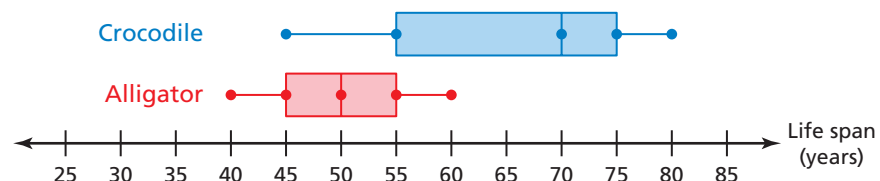
Vocabulary and Concept Check

1. **VOCABULARY** Explain how to find the five-number summary of a data set.

2. **NUMBER SENSE** In a box-and-whisker plot, what fraction of the data is greater than the first quartile?

3. **DIFFERENT WORDS, SAME QUESTION** Which is different? Find "both" answers.

Is the distribution skewed right?

Is the left whisker longer than the right whisker?

Age (years)
17 18 19 20 21 22 23

Are the data more spread out below the first quartile than above the third quartile?

Does the lower fourth of the data vary more than the upper fourth of the data?
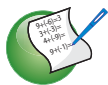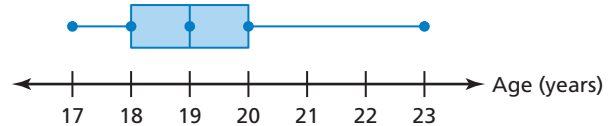
Practice and Problem Solving

4. The box-and-whisker plots represent the daily attendance at two beaches during July. Compare and contrast the attendances for the two beaches.

Beach 1
Beach 2

Attendance
40 50 60 70 80 90 100 110 120 130 140 150
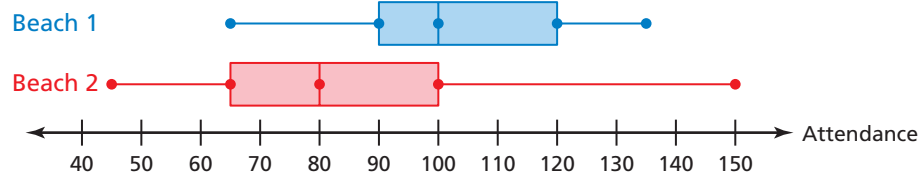
**Make a box-and-whisker plot for the data.**

5. Ages of teachers (in years): 30, 62, 26, 35, 45, 22, 49, 32, 28, 50, 42, 35

6. Quiz scores: 8, 12, 9, 10, 12, 8, 5, 9, 7, 10, 8, 9, 11

7. Donations (in dollars): 10, 30, 5, 15, 50, 25, 5, 20, 15, 35, 10, 30, 20

8. Ski lengths (in centimeters): 180, 175, 205, 160, 210, 175, 190, 205, 190, 160, 165, 195

9. **ERROR ANALYSIS** Describe and correct the error in making a box-and-whisker plot for the data.

✗ 2, 6, 3, 3, 7, 4, 6, 9, 6, 8, 5, 8

2 3 4 5 6 7 8 9
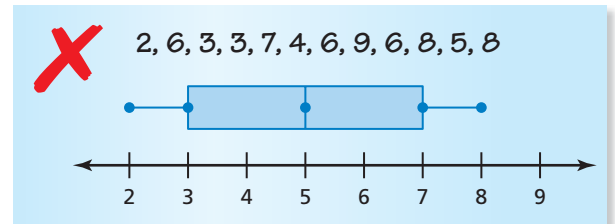
10. **CAMPING** The numbers of days 12 friends went camping during the summer are 6, 2, 0, 10, 3, 6, 6, 4, 12, 0, 6, and 2. Make a box-and-whisker plot for the data. What is the range of the data?

② **11.** **DUNK TANK** The box-and-whisker plot represents the numbers of gallons of water needed to fill different types of dunk tanks offered by a company.
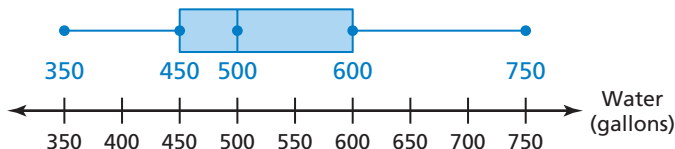
a. What fraction of the dunk tanks require at least 500 gallons of water?

b. Are the data more spread out below the first quartile or above the third quartile? Explain.

c. Find and interpret the interquartile range of the data.

12. **BUILDINGS** The box-and-whisker plot represents the heights (in meters) of the tallest buildings in Chicago.
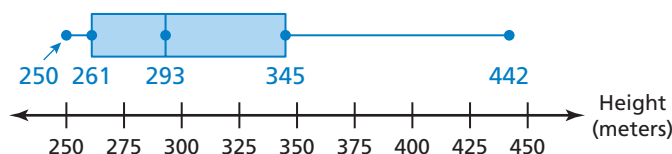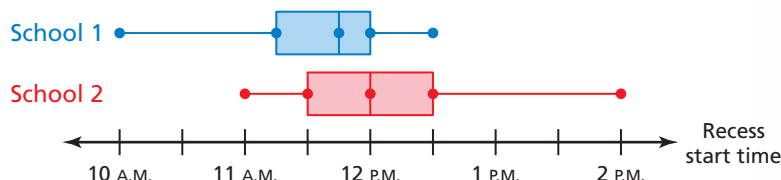

a. What percent of the buildings are no taller than 345 meters?

b. Is there more variability in the heights above 345 meters or below 261 meters? Explain.

c. Find and interpret the interquartile range of the data.

Identify the shape of the distribution. Explain.

③ **13.**   **14.**

15.   **16.**

17. **RECESS** The double box-and-whisker plot represents the start times of recess for two schools.


a. Identify the shape of each distribution.

b. Which school's start times for recess are more spread out? Explain.

c. Which school is more likely to have recess before lunch? Explain.

Make a box-and-whisker plot for the data.

18. Temperatures (in °C): 5, 1, 4, 0, 9, 0, −8, 5, 2, 4, −1, 10, 7, −5

19. Checking account balances (in dollars): 30, 0, −10, 50, 20, 90, −15, 40, 100, 45, −20, 70

20. **REASONING** The data set in Exercise 18 has an outlier. Describe how removing the outlier affects the box-and-whisker plot.

21. **CHOOSE TOOLS** What are the most appropriate measures to describe the center and the variation of the distribution in Exercise 12?

22. **OPEN-ENDED** Write a data set with 12 values that has a symmetric box-and-whisker plot.

23. **CRITICAL THINKING** When would a box-and-whisker plot *not* have one or both whiskers?

24. **STRUCTURE** Draw a histogram that could represent the distribution shown in Exercise 15.

25. **REASONING** The double box-and-whisker plot represents the runs scored per game by two softball teams during a 32-game season.
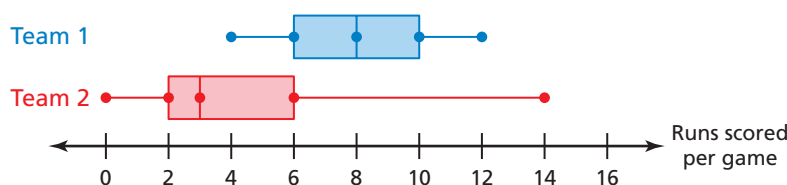
a. Which team is more consistent at scoring runs? Explain.

b. In how many games did Team 2 score 6 runs or less?

c. Team 1 played Team 2 once during the season. Which team do you think won? Explain.

d. Which team do you think has the greater mean? Explain.

26. *Choose Tools* A market research company wants to summarize the variability of the SAT scores of graduating seniors in the United States. Do you think the company should use a stem-and-leaf plot, a histogram, or a box-and-whisker plot? Explain.

Fair Game Review What you learned in previous grades & lessons

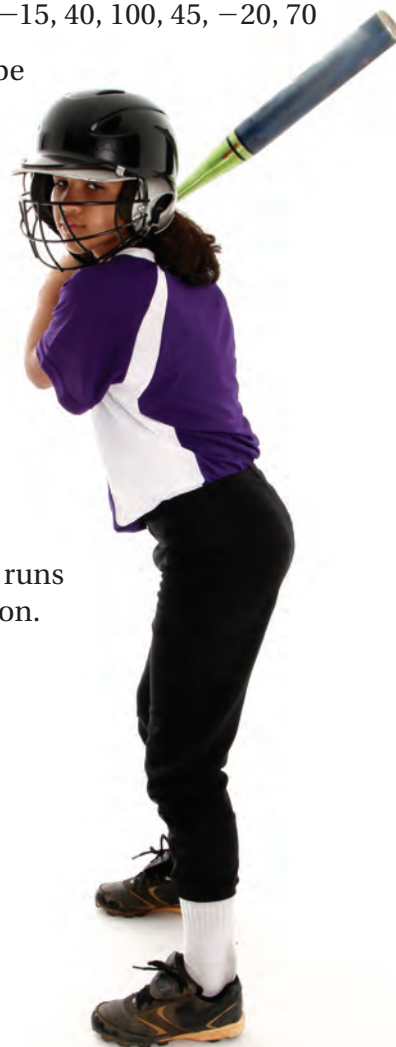**Copy and complete the statement using < or >.** *(Section 6.3)*

27. $-\dfrac{2}{3}$ ▮ $-\dfrac{3}{4}$

28. $-2\dfrac{1}{5}$ ▮ $-2\dfrac{1}{6}$

29. -5.3 ▮ -5.5

30. **MULTIPLE CHOICE** Which of the following items is most likely represented by a rectangular prism with a volume of 1785 cubic inches? *(Section 8.4)*
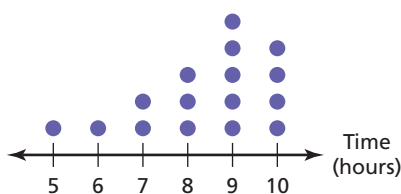
Ⓐ closet

Ⓑ computer tower

Ⓒ filing cabinet

Ⓓ your math book

Describe the shape of each distribution. *(Section 10.3)*

1. Hours Worked
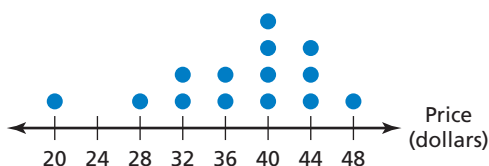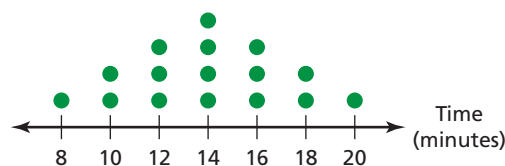

2. Museum Attendance
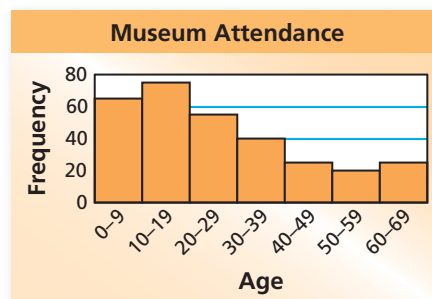
Choose the most appropriate measures to describe the center and the variation. Find the measures you chose. *(Section 10.3)*
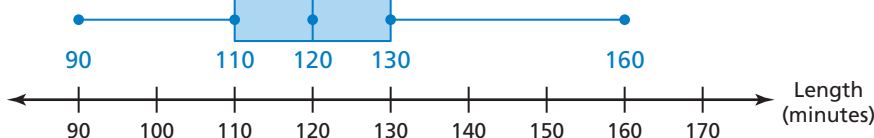
3. Prices of Shoes

4. Commute Times

Make a box-and-whisker plot for the data. *(Section 10.4)*

5. Science test scores: 85, 76, 99, 84, 92, 95, 68, 100, 93, 88, 87, 85

6. Shoe sizes: 12, 8.5, 9, 10, 9, 11, 11.5, 9, 9, 10, 10, 10.5, 8

7. MOVIES The box-and-whisker plot represents the lengths (in minutes) of movies being shown at a theater. *(Section 10.4)*

   a. What percent of the movies are no longer than 120 minutes?

   b. Is there more variability in the movie lengths longer than 130 minutes or shorter than 110 minutes? Explain.

   c. Find and interpret the interquartile range of the data.

8. EXPERIENCE The frequency table shows the years of experience of employees at two branches of a company. Display the data for each branch in a histogram. Describe the shape of each distribution. Which branch has less experience? Explain. *(Section 10.3)*

Years of Experience	0–2	3–6	7–10	11–14	15–18	19–22	23–26
Frequency at Branch A	10	25	14	20	8	5	2
Frequency at Branch B	3	6	8	10	15	25	8

Check It Out
Vocabulary Help
BigIdeasMath.com

Review Key Vocabulary

stem-and-leaf plot, *p. 436*   frequency table, *p. 441*   box-and-whisker plot, *p. 460*
stem, *p. 436*   frequency, *p. 441*   five-number summary, *p. 460*
leaf, *p. 436*   histogram, *p. 442*

Review Examples and Exercises

10.1 Stem-and-Leaf Plots (pp. 434–439)

Day	DVDs Rented
Sun	50
Mon	19
Tue	25
Wed	28
Thu	39
Fri	53
Sat	50

Make a stem-and-leaf plot of the number of DVDs rented each day at a store.

Step 1: Order the data. 19, 25, 28, 39, 50, 50, 53

Step 2: Choose the stems and the leaves. Because the data range from 19 to 53, use the *tens* digits for the stems and the *ones* digits for the leaves. Be sure to include the key.

Step 3: Write the stems to the *left* of the vertical line.

Step 4: Write the leaves for each stem to the *right* of the vertical line.

Order the stems vertically. The stem for data values less than 10 is 0.

Include stems without leaves.

DVDs Rented

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

Write the leaves horizontally.

Key: 2│5 = 25 DVDs

Exercises

Make a stem-and-leaf plot of the data.

1.

Hats Sold Each Day			
5	18	12	15
21	30	8	12
13	9	14	25

2.

Ages of Park Volunteers			
13	17	40	15
48	21	19	52
13	55	60	20

The stem-and-leaf plot shows the weights (in pounds) of yellowfin tuna caught during a fishing contest.

3. How many tuna weigh less than 90 pounds?

4. What is the median weight of the tuna?

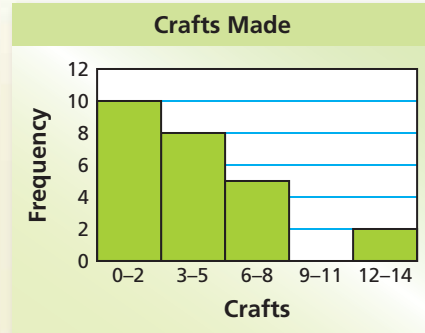| Stem	Leaf
7	6
8	0 2 5 7 9
9	5 6
10	2

Key: 8│5 = 85 pounds

10.2 Histograms (pp. 440–447)

The frequency table shows the number of crafts each member of a craft club made for a fundraiser. Display the data in a histogram.

Crafts	Frequency
0–2	10
3–5	8
6–8	5
9–11	0
12–14	2

Step 1: Draw and label the axes.

Step 2: Draw a bar to represent the frequency of each interval.

Crafts Made

Exercises

Display the data in a histogram.

5.

Heights of Gymnasts

Heights (in.)	Frequency
50–54	1
55–59	8
60–64	5
65–69	2

6.

Minutes Studied

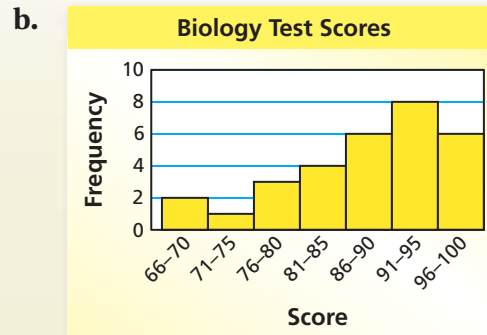| Minutes	Frequency
0–19	5
20–39	9
40–59	12
60–79	3

10.3 Shapes of Distributions (pp. 450–457)

Describe the shape of each distribution.
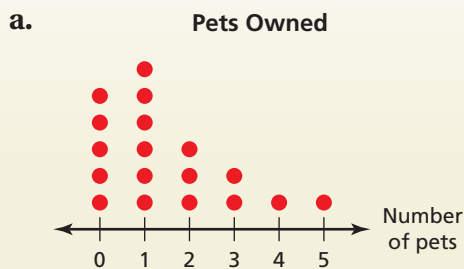
a. **Pets Owned**

Most of the data are on the left, and the tail extends to the right.

∴ So, the distribution is skewed right.
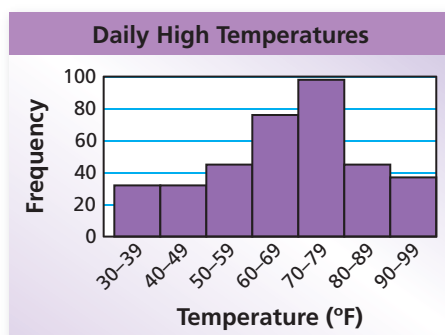
b. **Biology Test Scores**

Most of the data are on the right, and the tail extends to the left.

∴ So, the distribution is skewed left.

Exercises

7. Describe the shape of the distribution.

Daily High Temperatures

8. Choose the most appropriate measures to describe the center and the variation. Find the measures you chose.
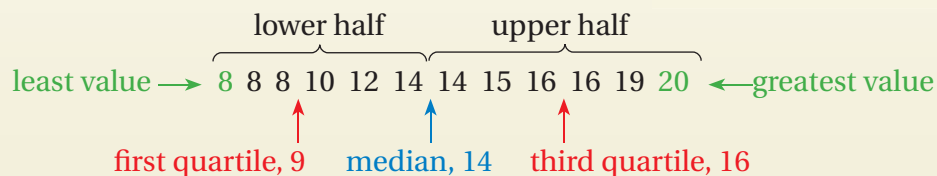

Students' Heights
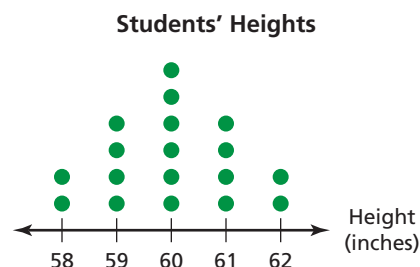
10.4 **Box-and-Whisker Plots** *(pp. 458–465)*

Make a box-and-whisker plot for the weights (in pounds) of pumpkins sold at a market.

16, 20, 14, 15, 12, 8, 8, 19, 14, 10, 8, 16

Step 1: Order the data. Find the median and the quartiles.

lower half   upper half

least value → 8 8 8 10 12 14 14 15 16 16 19 20 ←greatest value

first quartile, 9   median, 14   third quartile, 16

Step 2: Draw a number line that includes the least and the greatest values. Graph points above the number line that represent the five-number summary.

Step 3: Draw a box using the quartiles. Draw a line through the median. Draw whiskers from the box to the least and the greatest values.

Weight (pounds)
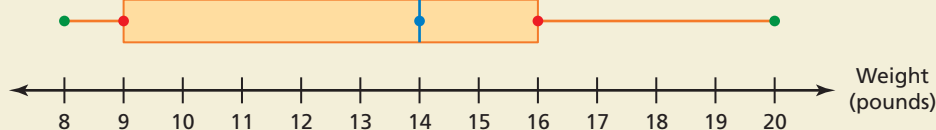
Exercises

Make a box-and-whisker plot for the data.

9. Ages of volunteers at a hospital: 14, 17, 20, 16, 17, 14, 21, 18

10. Masses (in kilograms) of lions: 120, 200, 180, 150, 200, 200, 230, 160

Make a stem-and-leaf plot of the data.

1.

Quiz Scores (%)			
96	88	80	72
80	94	92	100
76	80	68	90

2.

CDs Sold Each Day				
45	31	29	38	38
67	40	62	45	60
40	39	60	43	48

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

Cooking Time (minutes)

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

Key: 4|1 = 41 minutes

4. Display the data in a histogram.

Television Watched Per Week	
Hours	Frequency
0–9	14
10–19	16
20–29	10
30–39	8

5. WATER The dot plot shows the number of glasses of water that the students in a class drink in one day.

   a. Describe the shape of the distribution.

   b. Choose the most appropriate measures to describe the center and the variation. Find the measures you chose.

Water Consumed
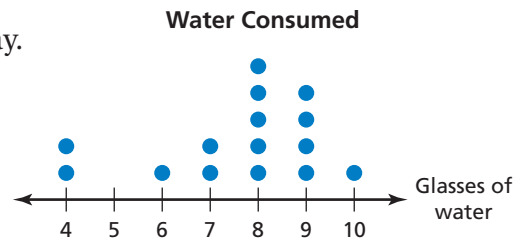
**Make a box-and-whisker plot for the data.**

6. Ages (in years) of dogs at a vet's office: 1, 3, 5, 11, 5, 7, 5, 9

7. Lengths (in inches) of fish in a pond: 12, 13, 7, 8, 14, 6, 13, 10

**8.** Hours practiced each week: 7, 6, 5, 4.5, 3.5, 7, 7.5, 2, 8, 7, 7.5, 6.5

9. CELL PHONES The double box-and-whisker plot compares the battery life (in hours) of two brands of cell phones.

   a. What is the range of the upper 75% of each brand?

   b. Which battery has a longer battery life? Explain.
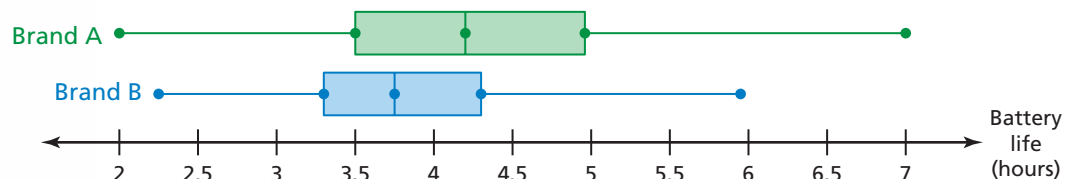
1. Research scientists are measuring the number of days lettuce seeds take to germinate. In a study, 500 seeds were planted. Of these, 473 seeds germinated. The box-and-whisker plot summarizes the number of days it took the seeds to germinate. What can you conclude from the box-and-whisker plot?   *(6.SP.4, 6.SP.5c)*
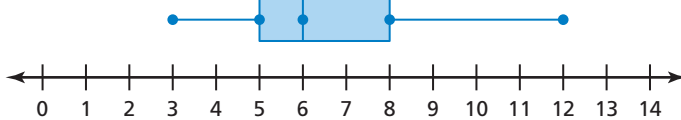
A. The median number of days for the seeds to germinate is 12.

B. 50% of the seeds took more than 8 days to germinate.

C. 50% of the seeds took less than 5 days to germinate.

D. The median number of days for the seeds to germinate was 6.

2. You are comparing the costs of buying bottles of water at the supermarket. Which of the following has the least cost per liter?   *(6.RP.3b)*

   F. six 1-liter bottles for $1.80

   G. one 2-liter bottle for $0.65

   H. eight $\frac{1}{2}$-liter bottles for $1.50

   I. twelve $\frac{1}{2}$-liter bottles for $1.98

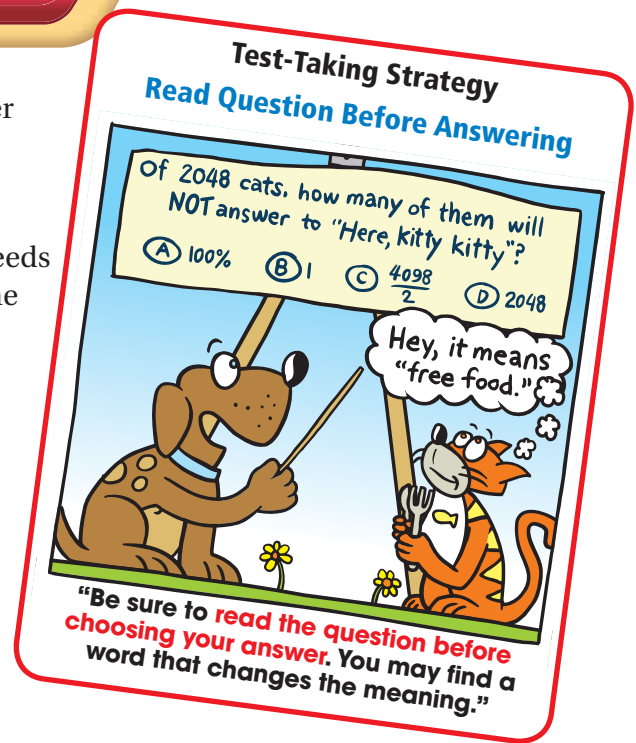3. What number belongs in the box to make the equation true?   *(6.NS.1)*

$$3\frac{1}{2} \div 5\frac{2}{3} = \frac{7}{2} \times \boxed{}$$

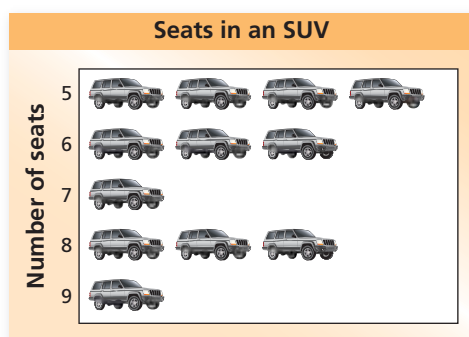**A.** $\frac{17}{3}$ **C.** $\frac{3}{17}$

B. $\frac{13}{2}$ **D.** $\frac{3}{2}$

4. What is the mean number of seats? *(6.SP.5c)*

Seats in an SUV

F. 2.4 seats

G. 5 seats

H. 6.5 seats

I. 7 seats

5. On Wednesday, the town of Mims received 17 millimeters of rain. This was x millimeters more rain than the town received on Tuesday. Which expression represents the amount of rain, in millimeters, the town received on Tuesday? *(6.EE.2a, 6.EE.6)*

A. $17x$

B. $17 - x$

C. $x + 17$

D. $x - 17$

6. One of the leaves is missing in the stem-and-leaf plot.

The median of the data set represented by the stem-and-leaf plot is 38. What is the value of the missing leaf? *(6.SP.4, 6.SP.5c)*

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

Key: 1 | 4 = 14

**7.** Which property is demonstrated by the equation below? *(6.EE.3)*

$$723 + (884 + 277) = 723 + (277 + 884)$$

F. Associative Property of Addition

G. Commutative Property of Addition

H. Distributive Property

I. Identity Property of Addition

8. A student took 5 tests this marking period and had a mean score of 92. Her scores on the first 4 tests were 90, 96, 86, and 92. What was her score on the fifth test?   *(6.SP.5c)*
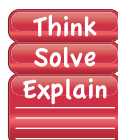
   A. 92

   B. 93

   C. 96

   D. 98

9. At the end of the school year, your teacher counted up the number of absences for each student. The results are shown in the histogram below.
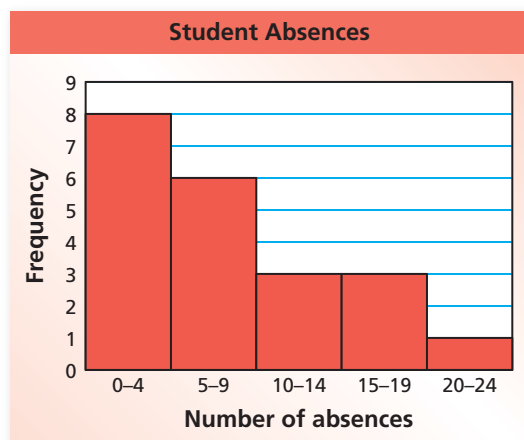
Student Absences

Based on the histogram, how many students had fewer than 10 absences? *(6.SP.4)*

10. The 16 members of a camera club have the ages listed below.   *(6.SP.4, 6.SP.5c)*

   40, 22, 24, 58, 30, 31, 37, 25, 62, 40, 39, 37, 28, 28, 51, 44

   Part A Order the ages from least to greatest.

   Part B Find the median of the ages.

   Part C Make a box-and-whisker plot for the ages of the camera club members.