Chapter 8

Data Analysis

Collecting, analyzing, and displaying data is critical to numerous career fields. Scientists collecting information about a new chemical's boiling point, teachers analyzing students' test scores, and a politician looking at polling data, all have something in common. They are looking at data points and trying to see trends and draw conclusions about that data. This chapter discusses how to analyze data points and display the data in different types of graphs.

Goal Setting

When you watch the news or read the newspaper, how does data get displayed? What kinds of graphs and charts do you notice? What type of data are the charts describing? What point do you think the chart is trying to make? How does the chart reinforce the story it is displayed with?

How do you see charts and graphs being used on the Internet? If a graph or chart wasn't used, how would you list the data? Why does displaying the data graphically make more sense?

LESSON 8.1 Calculate Measures of Central Tendency

LESSON OBJECTIVES

- Calculate the mean, median, mode, and range of a data set
- Find a missing data item given the mean and other data
- Calculate a mean based on frequency counts
- Calculate a weighted average

CORE SKILLS & PRACTICES

- Interpret Data Displays

Key Terms

mean
average; the sum of all values in a data set divided by the number of values

median
the middle number of an ordered data set; in a data set with an even number of values, the average of the two middle values

mode
the value(s) that occur most often in a data set

Vocabulary

range
the difference between the greatest and least values in a data set

weighted average
an average of a data set in which some items carry more importance (weight) than others

Key Concept

A measure of central tendency is a number that can be used to summarize a group of numbers. Mean, median, and mode are measures of central tendency calculated in different ways.

Measures of Central Tendency

Mean, median, and mode are different measures of central tendency. They all attempt to show some kind of central point in the data. Some cars can calculate how many miles per gallon a driver gets based on his or her driving habits. This number is a mean.

Mean (Average)

The most frequently encountered measure of central tendency is the **mean**. The mean of a data set, also called the average, is the sum of all the data items, divided by the number of items.

$$\text{mean} = \frac{\text{sum of data items}}{\text{number of data items}}$$

Example 1: Finding the Mean

Let's say that the high temperatures on three days were 78°F, 81°F, and 87°F. What is the average temperature of the 3 days?

Step 1 Add the temperatures together.

$$78 + 81 + 87 = 246$$

Step 2 Divide 246 by the number 3 because there are 3 temperatures.

$$\frac{246}{3} = 82$$

The mean temperature for these three days is 82°F.

Median

The **median** of a group of numbers is the number that is in the middle when they are ordered from least to greatest value. In an odd-numbered group of items, the median is always the middle value.

Example 2: Odd Number of Items

In a group of five numbers, the median is the third-greatest value. So, we first order the numbers from least to greatest and then select the number in the middle.

21, 19, 37, 24, 31

Arrange in order: 19, 21, 24, 31, 37

The middle item, 24, is the median.

Example 3: Even Number of Items

If there is an even-numbered group of items, such as six numbers, there is no single number in the middle. In this case, the median is the mean of the two numbers closest to the middle.

8, 12, 19, 23, 30, 37

To find the median of an even-numbered set:

Step 1 Add the two numbers closest to the middle. In this example, they are 19 and 23.

$19 + 23 = 42$

Step 2 Divide the sum by 2. We divide by 2 because there are 2 numbers in the middle. The median is 21.

$\frac{42}{2} = 21$

Mode

The mode of a set of data items is the value that appears most often in the set.

45, 41, 47, 50, 41, 59, 47, 60, 41

41 is the mode of the data.

If two values appear more often than any others, and the values appear the same number of times, both values are the mode.

88, 79, 86, **85**, 79, 94, **85**, 77

Both 79 and 85 are modes of the data.

If each value appears only once in the set, the data set has no mode.

101, 98, 123, 85, 107, 91, 82

There is no mode of the data.

CORE SKILL

Interpret Data Displays

Being able to take a chart or table of data and determine a measure of central tendency can help you understand the data itself.

Bread Prices: 1 Loaf			
March	April	May	June
$2.70	$2.54	$2.78	$2.82

Look at the prices of bread presented in the table. What is the median price of a loaf of bread over the four-month period?

Range

In addition to the mean, median, and mode of a group of numbers, it is often helpful to know the **range**.

The **range** of a set of data items is the difference between the least and greatest values.

1991, 1995, 1998, 2002, 2005, 2009

least value — greatest value

range = greatest value − least value
= 2009 − 1991
= 18

The range of a group of numbers is not a measure of central tendency. The range shows the spread of the data. The greater the range, the greater the span of the data. If the range is smaller, then the span of data is smaller.

Think about Math

Directions: Use the following data:

13, 30, 30, 32, 40, 47

Match the measures on the left with the values on the right.

1.	Mean	A.	30
2.	Median	B.	31
3.	Mode	C.	32
4.	Range	D.	34

Finding a Missing Data Item

Sometimes an average is a goal you want to achieve, and you need to know what values will achieve the average you want. If you want to score at least a 90% in a class, you can determine what score you need on each individual test or project.

Setting an Average as a Goal

Example 4: Find the Percent Needed to Meet Goal

You want to earn an 88% in a class. On the first three tests you scored a 79%, 85%, and 90%. What percent would you need on the fourth test to earn an 88%? One way to find the answer is to write an equation.

Step 1 Write what you know as an equation, using n for the unknown score. The average will be the sum of the three scores plus n, divided by 4. Set the equation equal to 88.

$$\frac{79 + 85 + 90 + n}{4} = 88$$

Step 2 Add the known test scores together.

$$\frac{254 + n}{4} = 88$$

Step 3 Multiply both sides by the number of tests, in this case 4.

$$\left(\frac{254 + n}{4} = 88\right) \times 4$$
$$254 + n = 352$$

Step 4 Finally, subtract 254 from both sides of the equals sign. This will be the missing value. To earn an 88%, you would need at least a 98%.

Determining if an Average is Achievable

To determine if an average is achievable, follow the same steps as if you were trying to find a missing value.

Example 5: Find Out if Average is Achievable

Cara worked 7 hours on Monday, 6 on Tuesday, 5 on Wednesday, and 7 on Thursday. How many hours must she work on Friday to average 10 hours a day for the workweek?

Cara's Hours

Mon.	Tues.	Wed.	Thurs.	Fri.
7	6	5	7	?

Step 1 Write what you know as an equation, using n for Cara's hours on Friday. The average will be the sum of the hours from Monday to Thursday plus n, divided by 5. This will equal the average, 10.

$$\frac{7 + 6 + 5 + 7 + n}{5} = 10$$

Step 2 First, add the numbers on the left side of the equation.

$$\frac{25 + n}{5} = 10$$

Step 3 Next, multiply both sides by 5.

$$\left(\frac{25 + n}{5} = 10\right) \times 5$$
$$25 + n = 50$$

Step 4 Finally, get the variable by itself. To do this, subtract 25 from both sides of the equals sign. The result is 25. Cara cannot work 25 hours in a day. Therefore, she will not reach an average of 10 hours a day.

WORKPLACE SKILL

Plan and Organize

One thing that is important in running a business is the ability to determine trends in sales to prepare for the future. Tracking trends on the day, week, month and even year level can greatly reduce waste and save money towards other parts of a business.

Martin is a florist and is preparing for an upcoming holiday. In preparation, he bought 55 dozen roses. Because the flowers will wilt within a week of delivery to his shop, Martin must sell all of his roses within the week. Martin sold 5, 7, and 11 dozen roses on Monday, Tuesday, and Wednesday, respectively. How many roses must he sell, on average, on Thursday and Friday in order to sell all of his roses by the end of the week?

CALCULATOR SKILL

On the TI-30XS MultiView™ calculator, you can input data using the stat data button. After entering the data, one number per row, press 2nd stat data, then 1, displaying 1-Variable statistics. The screen will show the mean, median, minimum, and maximum (so you can find the range yourself). The mean, however, is not calculated.

Think about Math

Directions: Answer the following questions.

1. What must the golfer score to average 76 for the three rounds?

Golf Scores

Round 1	Round 2	Round 3
78	80	?

A. 68
B. 70
C. 79
D. There is no way.

2. How many points out of 100 must you score on the final test to average 96 for the three quizzes?

Test Scores

Quiz 1	Quiz 2	Quiz 3
91	89	?

A. 90
B. 96
C. 100
D. There is no way.

Weighted Averages

In some cases, certain values are given more weight than others. This happens often in classrooms. For example, when figuring semester grades, a teacher often gives more weight to the final exam than the first quiz of the semester. So, even if the score is the same on both tests, the final exam will have a larger impact on the semester grade. The average of a data set in which some values are given more weight than others is called a **weighted average.**

Finding a Mean Using Frequency Counts

When you want to find the average number of times a value occurs in a specific set of data, you can use frequency counts to find your information.

A class of students was asked how many television sets were in their house. The answers ranged between 1 and 4. What is the mean number of sets per house?

X				
X				
X	X			
X	X	X	X	
X	X	X	X	
1	2	3	4	

First, determine the total number of televisions. Do this by multiplying the number of X's by the number of televisions for each column. Then, add the products together.

$$1 \times 5 = 5$$
$$2 \times 3 = 6$$
$$3 \times 2 = 6$$
$$4 \times 2 = 8$$
$$5 + 6 + 6 + 8 = 25$$

Next, count the total number of X's. Remember, each X represents a student surveyed. There are 12 students that were surveyed.

Finally, divide the total number of televisions (25) by the number of students surveyed (12). The mean number of televisions per house is 2.08.

$$\frac{25}{12} = 2.08$$

Finding a Weighted Average

Your teacher announces that your grade for the course will be determined by the average of your test scores, with the final exam counting double. Suppose you have test scores of 88, 72, and 85, and you score a 90 on the final exam. How will your test scores be averaged?

First, find the sum of weighted scores, multiply each item by its weight. The first three scores have a weight of 1; the last score has a weight of 2.

$$1(88) + 1(72) + 1(85) + 2(90) = 425$$

Next, find the total number of weighted items. Count each test according to its weight. Three items with a weight of 1 and one item with a weight of 2 gives 5 as the total number of weighted items.

425 total points
$1 + 1 + 1 + 2 = 5$
5 weighted tests

Finally, divide the weighted sum of the scores by the total number of weighted tests to find the mean.

You now know the weighted average of the test scores.

$$\frac{425}{5} = 85$$

Think about Math

Directions: Answer the following questions.

1. A carwash station sold 80 regular carwashes at \$8 and 20 premium carwashes at \$10. What was the average price of a carwash sold?

A. \$8.00
B. \$8.40
C. \$9.00
D. \$10.00

2. What is the average of the test scores shown if the final test counts double?

Test 1	Test 2	Final
91	87	95

A. 90
B. 91
C. 92
D. 93

WORKPLACE SKILL

Understand Business Fundamentals

A business cannot operate without making a profit on each of its products. Some companies mark up the price of the products so that they can guarantee a certain percentage of profit, or a certain amount of profit.

Lisa sells two types of clothing: t-shirts and collared shirts. For each t-shirt she sells, she makes a profit of \$4.50. For each collared shirt, she makes a profit of \$7.50. If she sells 140 t-shirts and 60 collared shirts in a month, what is the average profit Lisa will make that month?

Vocabulary Review

Directions: Write the missing term in the blank.

average	**mean**	**median**
mode	**range**	**weighted average**

1. The most frequently appearing data value in a data set is called the _____.
2. When a data set has an odd number of values, the _____ is the middle value when the data set is ordered from least to greatest.
3. The difference between the greatest and least values in a data set is the _____ of the data set.
4. If you add all of the data values in a set and then divide by the total number of values in the set, you have calculated the _____ of the data set. This value is also called the _____.
5. A value based on a data set in which some values carry more weight than others is a(n) _____.

Skill Review

Directions: Read each problem and complete the task.

1. The rainfall in four successive months was 10.2 in., 7.7 in., 5.1 in., and 12.0 in. What was the mean monthly rainfall for the four-month period?
2. You have a data set of 8 values, arranged from least to greatest. Because there is an even number of values, there is no single value in the middle. Explain how to find the median of this data set.
3. What is the mode of the following set of numbers?

   8, 12, 8, 4, 9, 12, 15

   A. 8
   B. 12
   C. 8 and 12
   D. There is no mode.
4. What is the range of the following set of numbers?

   −7.1, 4.0, 8.5, −2.3, −9.1, 0.1
5. A web site had 12,000 hits the first day and 16,000 the second day. How many hits must it have on the third day to average 20,000 hits a day for the three days?

   A. 20,000
   B. 24,000
   C. 28,000
   D. 32,000
6. Your grade in a course is the average of two quizzes and a final exam, which counts double. So the instructor will add the grades for the two quizzes, twice the grade for the final exam, and divide by:

   A. 2
   B. 3
   C. 4
   D. 5

Skill Practice

Directions: Read each problem and complete the task.

1. Listed below is the frequency chart for a set of data. What is the mode of the data?

```
  x
  x x
x x x x
x x x x x
0 1 2 3 4
```

2. Which of the following could be negative? Select all that apply.

   A. Mean
   B. Median
   C. Mode
   D. Range
3. Fill in the four data items based on the following information:

   Mean: 55
   Median: 51
   Mode: 48

   _____ _____ _____ _____
4. In a town of 100 residents, 99 have less than $1000 and one is a millionaire. Which measure of central tendency would best represent the net worth of a typical resident?

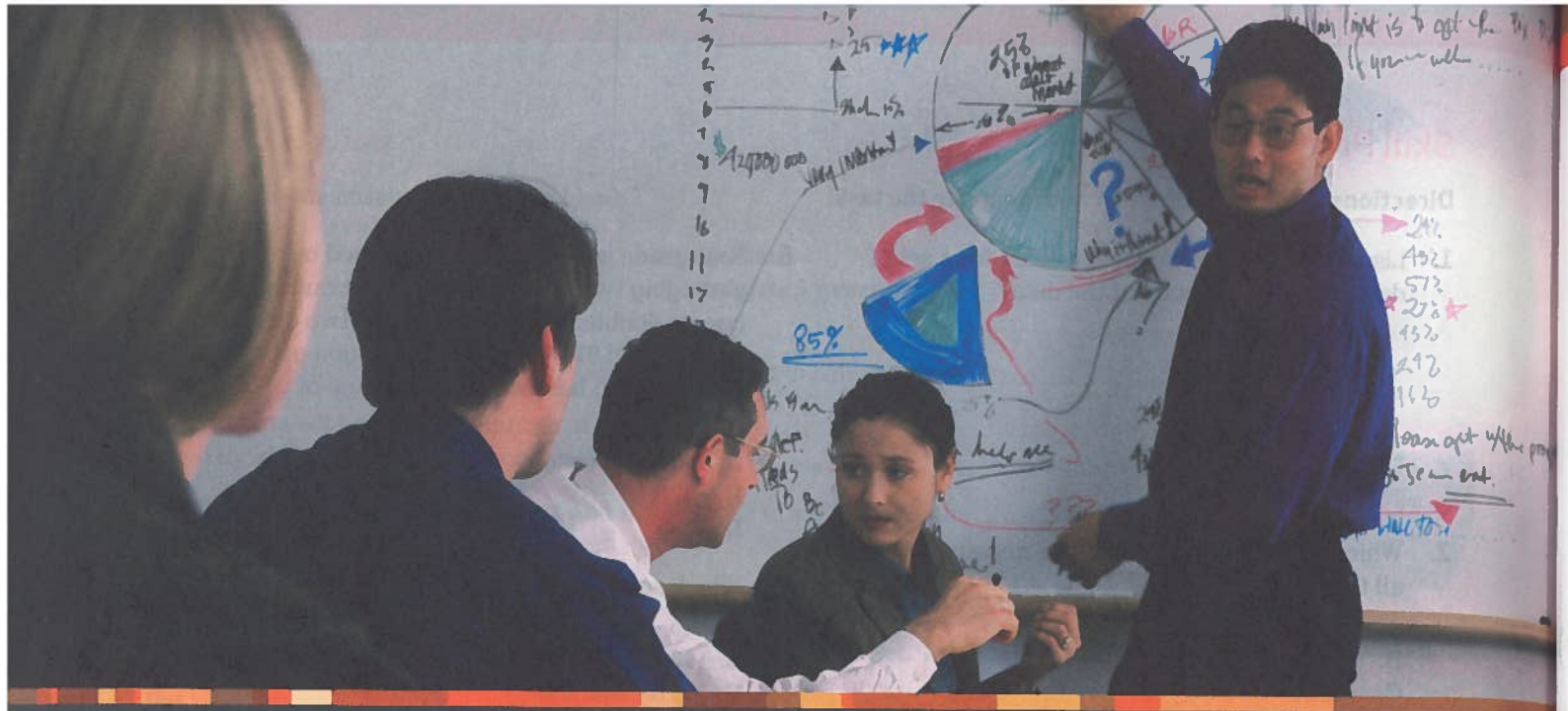
   A. Mean
   B. Median
   C. Mode
   D. None of the above
5. A bakery sold 400 bagels on Monday, 650 on Tuesday, and 350 on Wednesday. How many bagels, on average, must the bakery sell during the next two days to have average sales of 500 bagels for the five days?
6. Your grade in a course is determined by averaging two quizzes and a final exam, which counts double. Your grades on the two quizzes were 87 and 91. What grade must you get on the final exam to have a course average of 94?

   A. 91
   B. 94
   C. 97
   D. 99
7. Which set has the largest range?

   A. 25, 35, 45, 55
   B. 10, 20, 40, 80
   C. 1, 10, 100, 100
   D. 2, 20, 60, 100
8. A data set has values 5, 6, 8, 9, 10 with frequencies 2, 1, 4, 2, 3, respectively. What is the mean of the data set?

   A. 8
   B. 7.6
   C. 5
   D. 2.4
9. A certain web site is hoping to have at least 5,000 page views per week on average. So far, the web site has had 2,200 views last week and 3,100 views this week. What is the minimum number of views that the web site needs to receive this week to obtain its goal over a three-week period?
10. What is the median of the following set?

    1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144



LESSON 8.2 Display Categorical Data

LESSON OBJECTIVES

- Interpret and display data in a bar graph
- Interpret and display data in a circle graph

CORE SKILLS & PRACTICES

- Interpret Data Displays
- Interpret Graphs

Key Terms

bar graph
a graph that uses the length of bars to represent data values

circle graph
a graph that uses sections of a circle to represent data values

Vocabulary

legend
A key printed on a graph or chart that shows the meanings of colors, symbols or markings used

Key Concept

Bar graphs and circle graphs are convenient ways of displaying data that fall into categories. Both types of graphs allow the viewer to see data at a glance. Bar graphs are appropriate to show the absolute size of various categories. Circle graphs show what percentage of the total is made up by the various categories.

Bar Graphs

Data is everywhere. Data helps you understand your performance in a video game as well as compares the amount of electricity used each month. Bar graphs compare the sizes or values of different categories in a way that can be seen at a glance.

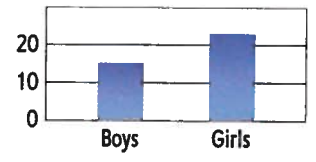
Reading a Bar Graph

A **bar graph** is a data display that compares the relative size of data in different categories, such as the number of people who like one movie over another or the populations of local high schools.

A bar graph can use either vertical (up and down) or horizontal (side to side) bars to show data. One side, or axis, is labeled with numbers. The categories are listed along the other axis.

The length of the bar for each category corresponds to its number. If the end of a bar falls between two numbers, estimate where it lies between the two numbers.

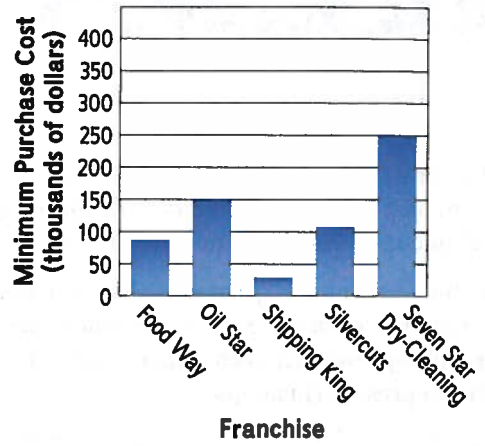
School Band Members



Interpreting a Bar Graph

Graphs can contain a lot of information, but we have to know how to read them correctly. We want to use the given bar graph to find the minimum cost to purchase a Silvercuts franchise.

Minimum Cost to Purchase a Franchise for Selected Companies



Example 1: Interpreting Information

Step 1 Find the bar representing the purchase cost for Silvercuts. In the graph, the top of the bar for Silvercuts is a little higher than the $100,000 mark. It is about one-fifth the distance between 100 and 150. Since the distance between 100 and 150 is 50, we find one-fifth of 50 which is 10.

Step 2 The bar goes just past the 100 mark which means the 10 is added to the 100. You might estimate the length of the bar for Silvercuts to be 100 plus 10, or 110.

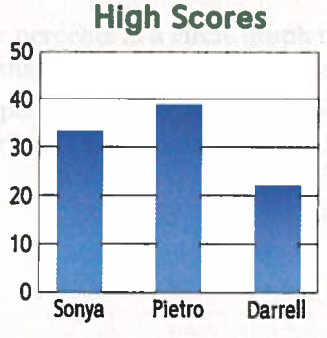
Step 3 Because the data are represented in thousands of dollars, a reading of 110 on the graph means the minimum cost to purchase a Silvercuts franchise is about $110,000.

Setting up a Bar Graph

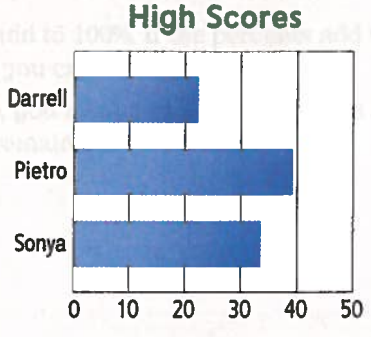
Example 2: Creating a Bar Graph

Step 1 When creating a bar graph, the first choice to make is whether to use vertical or horizontal bars. Notice that the data are the same in both of these bar graphs.

High Scores



High Scores



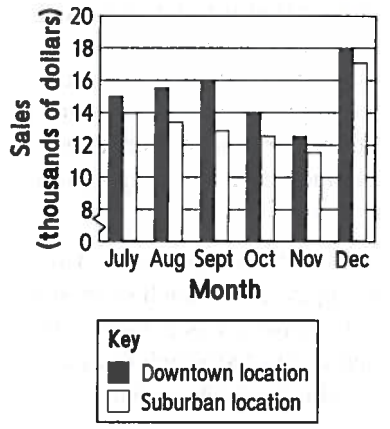
CORE SKILL

Interpret Data Displays

To show similar information about two or more things, you can use a double bar graph. This graph shows money earned in sales at the two locations of Herman's Gift Shop during the last six months of the year. The key, or **legend**, shows the meaning of the graph's colors, symbols, or markings (in this case showing the difference between the two stores).

To find the months where a store earned at most $13,000, look for months where either the black bar or the white bar indicates $13,000 or less.

Sales at Herman's Gift Shops



For September, the suburban sales appear to be about $13,000. For October, suburban sales are below $13,000. For November, both downtown and suburban sales are below $13,000. There were 3 months during which sales at either location of Herman's Gift Shops are at or below $13,000.

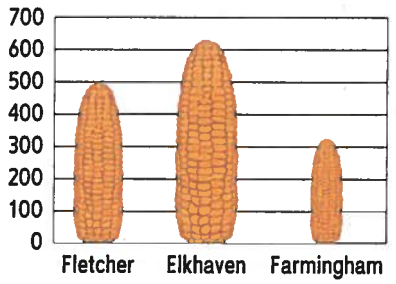
Now you try. The store managers receive a sales prize every time their location sells $15,000 or more in a month. Which managers received bonuses in which months?

CORE SKILL

Interpret Graphs

Sometimes a designer replaces the bars in a bar graph with a graphic. The result can be misleading.

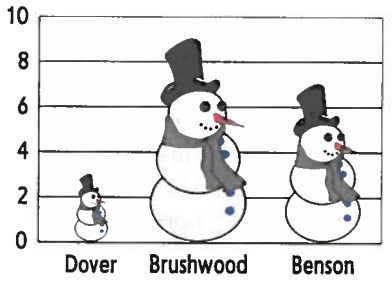
Corn Production by County



Corn production in Elkhaven County was nearly twice that in Farmingham County. However, using a two-dimensional graphic as a bar means that the ear of corn that is twice is tall is also twice as wide and has four times the area. That gives the impression that Elkhaven County produced four times as much corn as Farmingham County.

Look at the graph below. How many times as much snow fell in Brushwood as in Dover? How many times as much does the graphic make it appear?

February Snowfalls in Nearby Towns



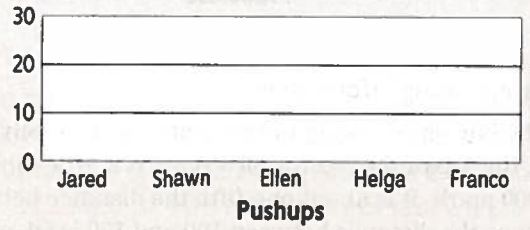
Step 2 Next you must determine the range of the data to be displayed. Start at zero at one end of an axis. The greatest value at the other end of the axis should be at least as great as the highest value in your data set.

Pushups

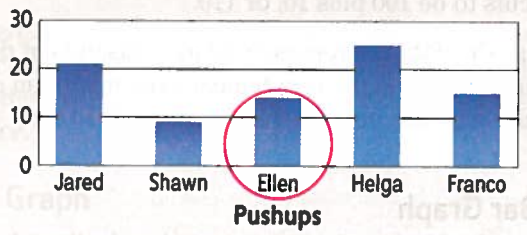
Jared	Shawn	Ellen	Helga	Franco
21	9	14	25	15
	(low)		(high)	

Step 3 Now determine the scale of the axis. The greater the values of data, the greater the scale should be. For this graph a scale of 10 is used since the values of the data are fairly small.

Step 4 Between the least and the greatest values you need to insert lines at regular intervals. Then, on the other axis, label what each bar will represent (names) and include a label to tell what all the bars represent (pushups).



Step 5 Once you have placed the categories under the horizontal axis and the range of values along the vertical axis, draw bars to represent the data in each category.



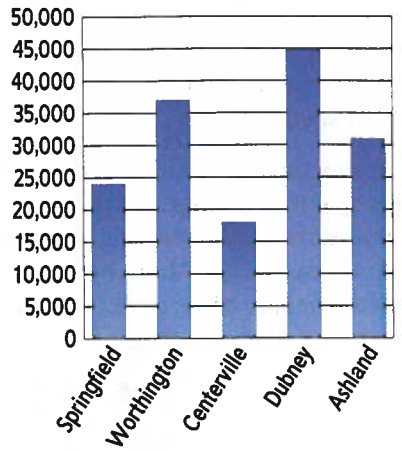
If a value lies between two lines on the vertical axis, estimate the proper distance according to the part that lies between the lines. For instance, a value of 14 should be less than halfway between the lines for 10 and 20.

Think about Math

Directions: Answer the following question.

1. What is the approximate difference in population between Dubney and Centerville?
   A. 25,000
   B. 28,000
   C. 31,000
   D. 35,000

Population of Nearby Towns



Circle Graphs

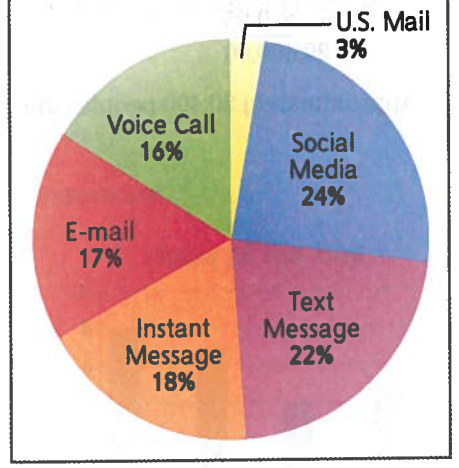
If you have ever completed a survey you have helped build a circle graph. Circle graphs are excellent ways to look at data of a whole. For example, if you determined that 60% of your friends prefer country music you could show this on a circle graph. A **circle graph** shows what portion of the whole, or 100%, each category takes up by dividing the whole into wedges of different sizes.

Reading a Circle Graph

In a circle graph, a circle is divided into wedges. Each wedge or section represents a fraction of the total—the larger the section, the greater the fraction of the whole represented. This type of graph allows the viewer to compare the sizes of the parts more easily.

Normally each wedge is marked with a percent mark showing what percent it is of the circle. If a wedge is too small, a callout is used, consisting of a line from inside the wedge to label the information on the outside of the wedge, like the label for U.S. Mail.

Modes of Communication



All the percents in a circle graph must add to 100%. If the percents add up to more than 100%, there is a mistake and you cannot draw the graph.

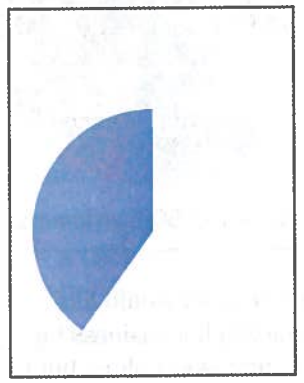
If the percents add up to less than 100%, you must add a category such as "Other" or "Undetermined" to hold the remainder.

TEST-TAKING SKILL

Circle Graphs

When reading a circle graph, look for an indication of what the whole represents, such as: "Survey of 500 Women" or "Total: 2000." If you need to find the number of units represented by a sector, multiply the total units by the percent that sector represents.

If the sectors aren't labeled with percents, you can estimate the size of the sector by comparing it with common fractions. For example, this sector is larger than a third $\left(33\frac{1}{3}\%\right)$ but smaller than a half (50%). You might estimate it as 40%.

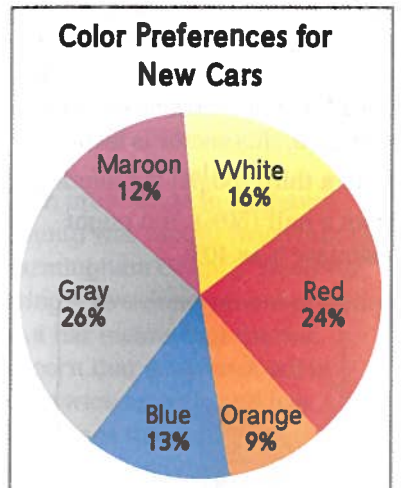


Based on this chart, about how many people interviewed rarely wear a hat?

WORKPLACE SKILL

Find Information in Workplace Graphics

Circle graphs are often used in the workplace to summarize information. A car salesman creates a graph showing the percentage of customers who prefer new cars in each of the colors most commonly available.

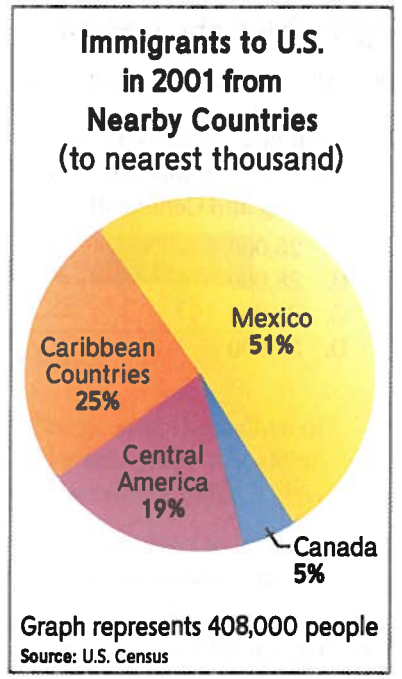


The salesman would like to simplify his business by carrying fewer colors, but he doesn't want to lose more than 20% of his potential customers. What would you advise him and why?

Interpreting a Circle Graph

Frequently the amount represented by the total circle is also given. To find the actual number represented by a section, multiply the total amount for the graph by the fraction or percent for that section.

For example, the circle graph shows people who immigrated to the United States from other countries in North America in 2001. About how many of those people came from Canada?



Example 3: Interpreting Data

Step 1 Observe the percent of immigrants from Canada given in the graph. It states that approximately 5% of the 408,000 came from Canada.

Step 2 Next, convert 5% to a decimal, 0.05.

Step 3 Multiply 0.05 by 408,000.

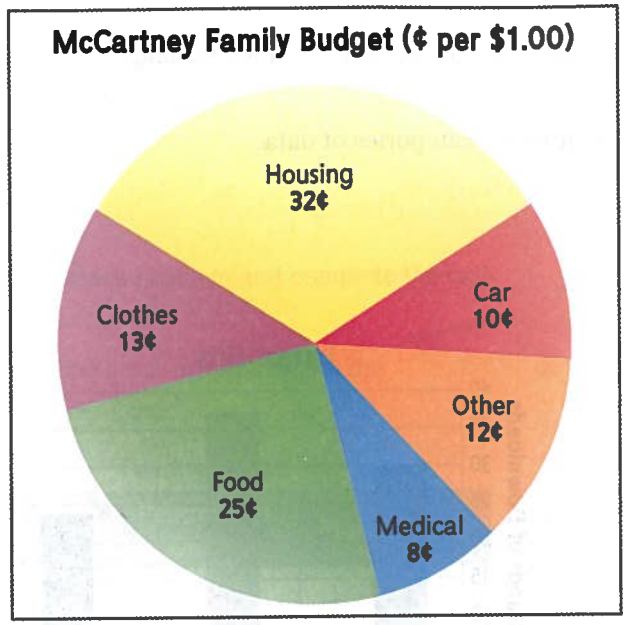
$$\begin{array}{r} 408{,}000 \\ \times\ 0.05 \\ \hline 20{,}400.00 \end{array}$$

Approximately 20,400 people came from Canada.

Displaying Financial Data in a Circle Graph

A circle graph can also be used to show data displayed as cents per dollar.

When a circle graph is divided into percents the sections must total 100%. Likewise, when a circle graph representing parts of a dollar is divided by cents the sections must total $1.00.



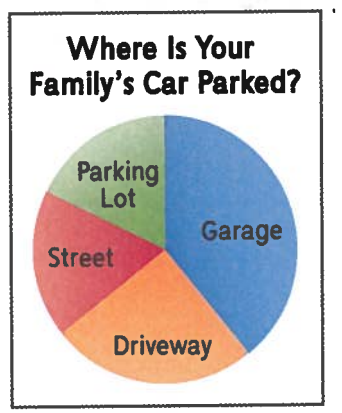
The circle graph shows that for each $1.00 the McCartney family spends, $0.25 goes to food. If you know the total monthly budget for the McCartney family, you can calculate how much money they spend on each component.

For example, if their monthly budget is $3,650 then you can calculate the amount spent on housing by multiplying the total by the cent per dollar.

$\$3{,}650 \times \$0.32 = \$1{,}168$

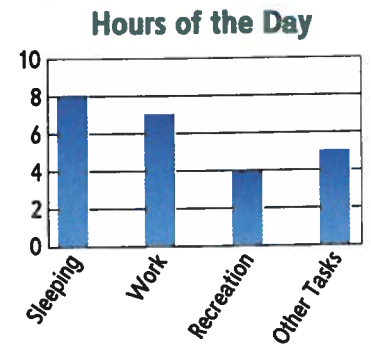
Think about Math

Directions: Choose the best answer to the questions.



1. Which wedge of the circle graph is close to 25%?

   A. Garage C. Street
   B. Driveway D. Parking Lot

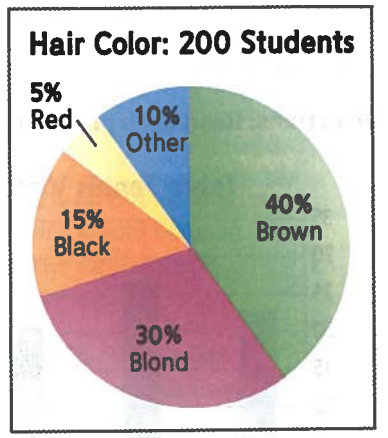


2. Use the information in this bar graph to create a circle graph.

CALCULATOR SKILL

Using a Calculator for Circle Graphs

Consider the following circle graph that describes the percentage of 200 students with different hair colors. Use a calculator to find the number of students that have each hair color.



Example 4: Using a Calculator

Step 1 Change the percent to a decimal. (Divide the percent number by 100.)

Step 2 Enter the number you want to find a percent of.

Step 3 Press the multiply button ×.

Step 4 Enter the decimal version of the percent.

Step 5 Press ENTER.

How many students have each hair color described in the graph?

Vocabulary Review

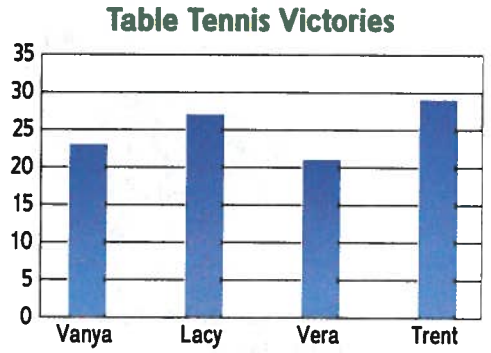
Directions: Write the missing term in the blank.

bar graph **circle graph** **graph legend**

1. You can show how parts of something are related to the whole with a _____.
2. A key called a _____ is used to identify the colors, symbols, and markings on a bar graph.
3. A _____ shows the relative size of different categories of data.

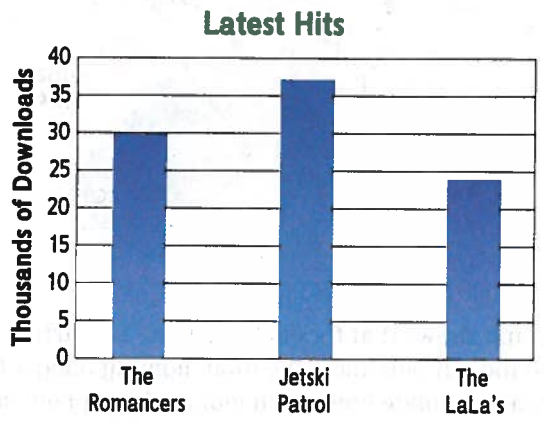
Skill Review

Directions: Read each problem and complete the task.



1. Who had the second-highest score?
   A. Vanya
   B. Lacy
   C. Vera
   D. Trent

2. If Vanya and Trent played as a team and Lacy and Vera played as a team, which team won?
   A. Vanya and Trent
   B. Lacy and Vera
   C. It was a tie.
   D. It cannot be determined.



3. The downloads for The LaLa's are what portion of the downloads for the Romancers?
   A. 60%
   B. 75%
   C. 80%
   D. 125%

Survey of 200 Coffee Drinkers

Black	Sugar	Cream	Cream & Sugar
15%	10%	30%	45%

4. How many of the coffee drinkers surveyed like their coffee black?
5. How many people surveyed drink their coffee with sugar or cream but not both?
6. Make a circle graph of the data.

Skill Practice

Directions: Read each problem and complete the task.

1. You are making a bar graph to show the following data:

Favorite Pizza

Pepperoni	Pepper and Onion	Plain Cheese
37	24	19

What will be the minimum and maximum values on the vertical scale to the left? At what interval will you set ticks? At what interval will you set numbers? Explain your choices.

2. Observe the following data.

Money Raised by Candidates

Gomez	Nguyen	Bernacke
$290,000	$5,500	$4,300

Why will these data be hard to display as a bar graph?

3. In a survey of favorite colors, 45 out of 250 like the color green. What percent would be used to help make the sector of the circle graph represent green?
4. A sector in a circle graph is 37% of the whole. How many people out of 1,200 does this cover?
   A. 370
   B. 400
   C. 444
   D. 475
5. If you start at 12 o'clock and lay out a sector of 37.5%, where on the clock face would that sector end?
6. Which of these data sets would be displayed better as a bar graph and which as a circle graph?
   A. Market share of cellphone brands
   B. Amount spent by different cities on the arts
   C. Internet usage in different countries
   D. Percent of reasons given for calling 911

LESSON 8.3 Display One-Variable Data

LESSON OBJECTIVES

- Interpret and display data in a dot plot, histogram, and box plot

CORE SKILLS & PRACTICES

- Interpret Data Displays
- Model with Mathematics

Key Terms

dot plot
a data display that uses a number line and dots, or other symbols, to show how often each data value occurs in a data set

histogram
a display of data that have been divided into intervals

box plot
a display that shows the range and distribution of a data set

first quartile
the median of the lower half of a data set

third quartile
the median of the upper half of a data set

Vocabulary

distribution
a description of how the data values in a set are spread out

median
the middle number of an ordered data set; in a data set with an even number of values, the average of the two middle values

Key Concept

Dot plots, histograms, and box plots are different ways to display one-variable data, data in which only one quantity is measured. Each display highlights different characteristics of the data set.

Dot Plots

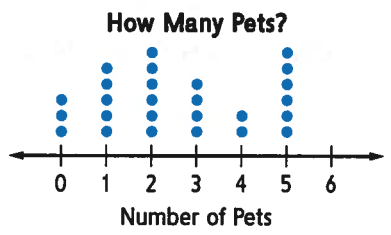
Data is very important to businesses. If you have ever completed an online survey from a receipt, your information has been placed on a dot plot. Dot plots clearly display important pieces of information.

Reading Dot Plots

A **dot plot** is a data display that uses a number line to show how often each data value occurs in a data set. In a dot plot, each data value is represented by a dot or other symbol above the number line.

Example 1: Reading a Dot Plot

Ms. Morgan asked each student in her homeroom how many pets he or she has. She used the students' answers to make the dot plot shown. How many students in Ms. Morgan's homeroom have two pets?



Count the number of dots above 2 on the number line. There are six dots above the number 2, so six students have two pets.

Displaying Data in Dot Plots

It is relatively straightforward to make a dot plot from a set of data. Draw a number line and place a dot above the line for each data value.

Example 2: Making a Dot Plot

Baseball Games Attended									
6	1	0	2	2	1	4	3	1	0
2	5	2	1	1	3	2	4	3	1

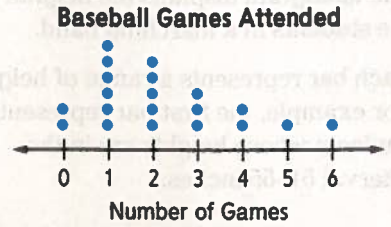
The table shows the number of baseball games that 20 of Gabriel's friends attended last season. Make a dot plot of the data.

Step 1 Sort the data values in order from least to greatest:

0, 0, 1, 1, 1, 1, 1, 1, 2, 2, 2, 2, 2, 3, 3, 3, 4, 4, 5, 6

Step 2 The least value is 0 and the greatest value is 6, so draw a number line from 0 to 6.

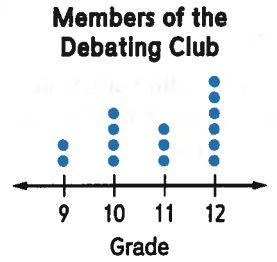
Step 3 Draw a dot above the number line for each data value. For example, two of Gabriel's friends responded 0, so there are 2 dots above 0.



Step 4 Label the values on the number line and give the dot plot a title.

Think about Math

Answer the following questions based on the information in the dot plot.



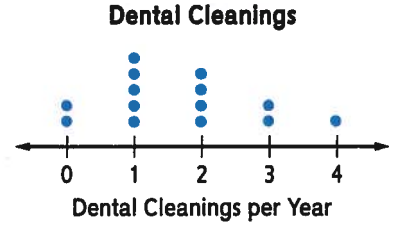
1. What percent of the debating club are in grade 11?
2. How many more debaters are in grade 12 than in grade 9?

CORE SKILL

Interpret Data Displays

A dot plot contains a lot of information about a data set. Because a dot plot shows every data value in a set, you can use a dot plot to find the range, mean, median, and mode of a data set. You can also use a dot plot to make comparisons within a data set.

A dental clinic surveyed several clients and asked them how many dental cleanings they have per year. The clients' responses are shown in the dot plot.



Use the dot plot to compare the number of clients who have at least two cleanings per year with the total number of clients surveyed. What fraction of the clients surveyed have at least two cleanings per year?

Histograms

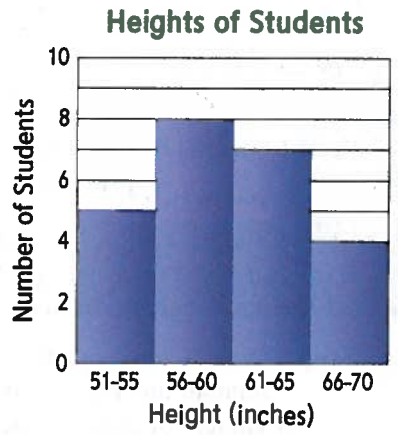
The census is taken every ten years. This important data tells a lot about the population of the United States. For example, a recent census confirmed that a large majority of the US population is less than 30 years of age. This is the type of information you would find in a histogram.

Reading Histograms

A histogram is a data display similar to a bar graph, but the data is grouped into intervals or ranges. Also, notice how the bars touch.

The histogram displays the heights of the students in a marching band.

Each bar represents a range of heights. For example, the first bar represents students whose heights are in the interval 51–55 inches.



Example 3: Reading a Histogram

How many of the students in the marching band are between 56 and 60 inches tall?

Step 1 Locate the bar labeled 56–60.

Step 2 Look for the height of the bar. The bar is at 8 students.
Therefore, there are 8 students between 56 and 60 inches tall.

Displaying Data in Histograms

To make a histogram from a given data set, you must decide how to divide the data into equally-sized intervals. Note that there may be more than one reasonable way to divide the data set.

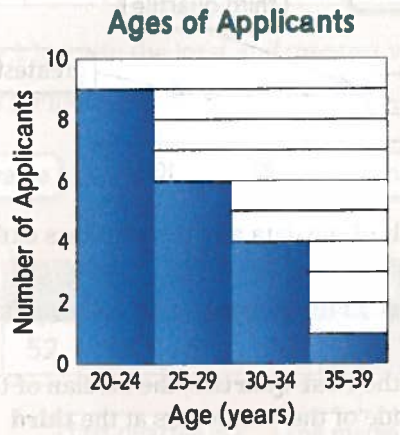
Example 4: Making a Histogram

The ages in years of last month's applicants to the Ferndale Police Academy are as follows: 32, 24, 34, 22, 20, 26, 22, 27, 30, 24, 25, 38, 25, 21, 32, 24, 29, 23, 23, 27. Make a histogram of the data.

Step 1 Sort the data values in order from least to greatest:

20, 21, 22, 22, 23, 23, 24, 24, 24, 25, 25, 26, 27, 27, 29, 30, 32, 32, 34, 38

Step 2 Divide the data values into equally sized intervals of 5 years: 20–24, 25–29, 30–34, and 35–39 years of age. Use these intervals to draw the horizontal axis of the histogram.



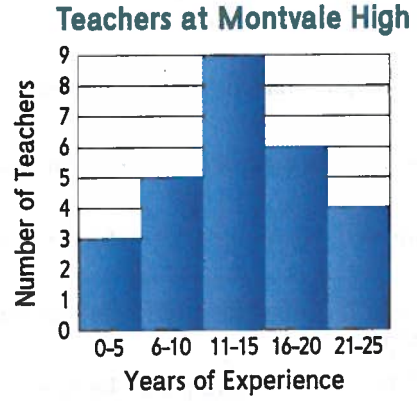
This histogram shows that applicants to the police academy are skewed toward younger applicants.

Step 3 Draw a bar to show the number of applicants in each interval. For example, there are 9 applicants aged 20–24, so the height of the first bar is 9. Each bar should be of equal width. The bars should touch but not overlap.

Step 4 Label the axes and give the histogram a title.

Think about Math

The histogram shows the years of experience of teachers at Montvale High School. Answer the following questions based on the information in the histogram.



1. How many teachers have between 0 and 10 years of experience?
2. What percent of teachers have 11 to 20 years of experience?

WORKPLACE SKILL

Make Decisions Based on Workplace Graphics

Sofia is considering a new seating plan for her restaurant. The restaurant has space for no more than 15 tables. Sofia has tables that seat two people, tables that seat four people, and tables that seat six people. She must decide among four different seating plan options:

Option 1: 10 tables of four and 5 tables of six

Option 2: 3 tables of two, 7 tables of four, and 5 tables of six

Option 3: 5 tables of two, 8 tables of four, and 2 tables of six

Option 4: 5 tables of two and 10 tables of four

Last night, the restaurant served a total of 30 tables during dinner hours. Sofia recorded the number of people at each table.

Number of People	Number of Tables
1	3
2	7
3	7
4	9
5	3
6	1

Make a histogram of Sofia's data. Then use the histogram to recommend one of the four seating plan options. Use your histogram to justify your recommendation.

CALCULATOR SKILL

When displaying data in a box plot, you need to find the median of the data set. When there is an odd number of data values, the median is the middle value when the data are ordered from least to greatest. When there is an even number of data values, the median is the mean of the two middle values. You may also have to calculate the mean of two middle values when finding the first or third quartile.

To find the mean of two numbers, such as 7 and 12.5, add the two numbers and then divide by 2. Be careful when using a calculator to perform these operations. If you enter 7 + 12.5/2, you will get an incorrect answer because the order of operations. It will divide 12.5 by 2 and then add 7.

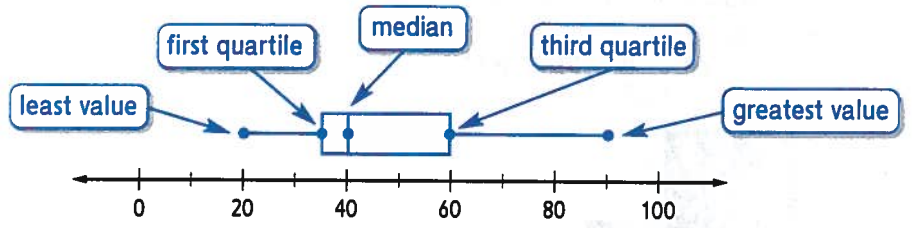
One way to fix this is to use parentheses when entering the numbers into a calculator: (7 + 12.5)/2. Another method is to enter the sum 7 + 12.5, press enter or ◄►, and then divide the answer by 2.

Box Plots

One of the best things about the weather is all the rich data it provides. However, all that data can be challenging to manage and interpret. Box plots consolidate large amounts of data into a graphic.

Features of a Box Plot

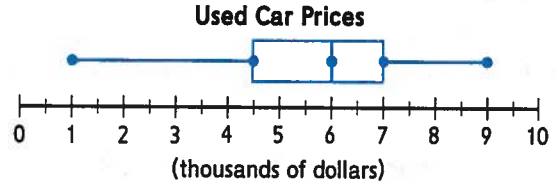
The **distribution** of a data set refers to how the data values in the set are spread out. A **box plot**, sometimes called a box-and-whisker plot, is a data display that uses a box and two line segments (the "whiskers") to show the range and the distribution of a data set.



- The box represents the middle half of the data and the whiskers extend to the least and greatest data values.
- The box is divided by a vertical line at the **median**, the middle value when the data values are in order.
- The left side of the box occurs at the **first quartile**, the median of the lower half of the data. The right side of the box occurs at the **third quartile**, the median of the upper half of the data.
- The left whisker, then, represents the bottom quarter (25%) of the data, the box represents the middle half (50%), and the right whisker represents the top quarter (25%).

Reading Box Plots

The box plot shown displays data about the final sales prices of several used cars sold at a dealership last month.



- You can see from the box plot that the median price of a used car last month was $6,000.
- The left whisker ends at 1. The lowest sales price for a used car last month was $1,000.
- The right whisker ends at 9. The highest price for a used car last month was $9,000.
- The box goes from 4.5 to 7. Half of the used cars sold last month had prices between $4,500 and $7,000.
- One-quarter (25%) of the used cars had prices between $1,000 and $4,500, and one-quarter (25%) had prices between $7,000 and $9,000.

Displaying Data in Box Plots

To create a box plot from a given data set, you must identify the least value, first quartile, median, third quartile, and greatest value. These five values will determine how you draw the box and whiskers.

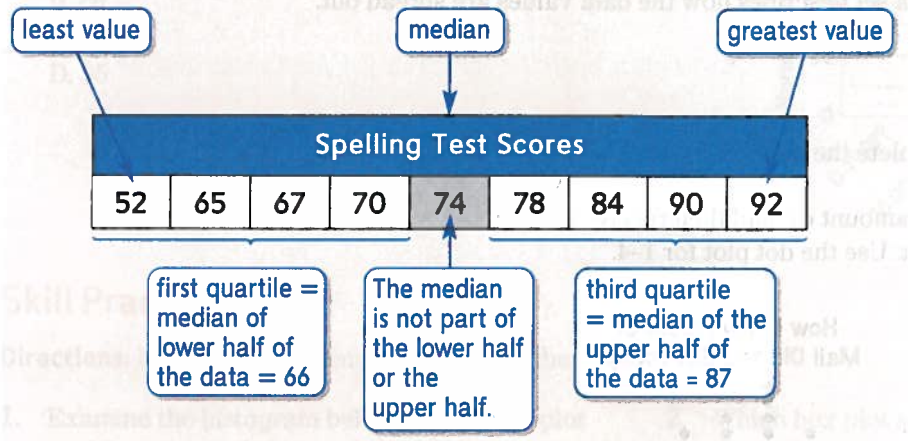
Example 5: Making a Box Plot

The table shows Lisa's scores on her last nine spelling tests, in order from least to greatest. Make a box plot of the data.

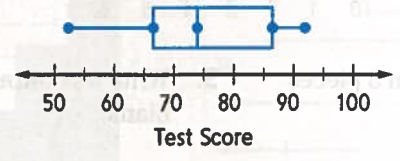
Spelling Test Scores								
52	65	67	70	74	78	84	90	92

Step 1 Identify the least and greatest values and the median.

Step 2 Find the first and third quartiles.

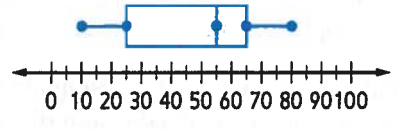


Step 3 All of the data values are between 50 and 100, so draw a number line from 50 to 100. Above the number line, draw a box from the first quartile to the third quartile. Draw a line inside the box at the median, 74. Draw the whiskers from the box to the least and greatest values. Add labels and a title to the box plot.



Think about Math

Answer the following questions based on the information in the box plot.



1. What are the least and greatest values of the data set?
2. What are the first and third quartiles?
3. What is the median?

CORE PRACTICE

Model with Mathematics

Sometimes a data value is extremely different from the other data values in the set. A data value like this is called an *outlier*. In a box plot, an outlier is indicated with an asterisk. A whisker does not extend to the outlier, but instead stops at the least or greatest data value that is not an outlier. The outlier is not used to calculate the median, the first quartile, or the third quartile.

The weights in pounds of several pumpkins grown at Wilson Farm are given below:

20, 28, 25, 23, 32, 15, 22, 55, 17, 31, 21, 39

Identify the outlier. Then make a box plot of the data that shows the outlier.

Vocabulary Review

Directions: Write the missing term in the blank.

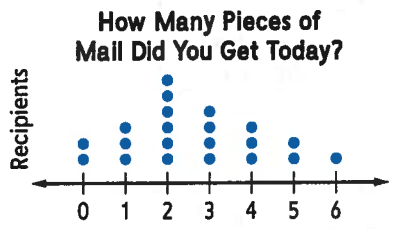
dot plot	**histogram**	**box plot**	**first quartile**
third quartile	**distribution**	**median**	

1. The median of the upper half of a data set is the _____.
2. A _____ is a display that shows the range and distribution of a data set.
3. A _____ is a display that shows how often each data value occurs.
4. The median of the lower half of a data set is the _____.
5. A _____ shows data that have been divided into intervals.
6. The middle of an ordered data set is the _____ of the data set.
7. The _____ of a data set describes how the data values are spread out.

Skill Review

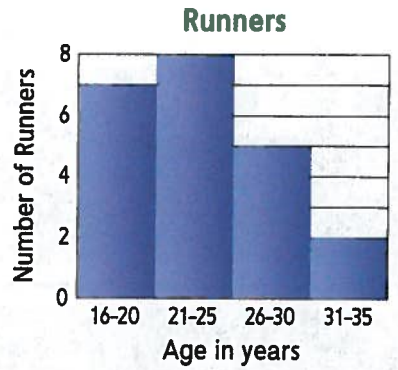
Directions: Read each problem and complete the task.

Several people were surveyed about the amount of mail they received today. Their responses are shown in the dot plot. Use the dot plot for 1–4.



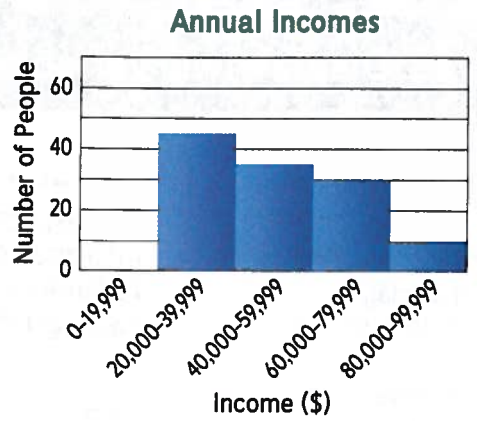
1. How many people received fewer than 3 pieces of mail?
   A. 4
   B. 11
   C. 13
   D. 15
2. What is the median of the data?
   A. 2
   B. 3
   C. 4
   D. 11
3. Write *less than*, *greater than*, or *equal to* in each blank.
   a. The range of the data is _____ 5.
   b. The number of people surveyed is _____ 25
   c. The mean of the data is _____ the median.
   d. The number of people who received at least 4 pieces of mail is _____ the number of people who received 2 pieces of mail.
4. Find the least value, the first quartile, the median, the third quartile, and the greatest value. Use these values to make a box plot of the data.

5. The histogram shows data about the ages of runners participating in a race. How many runners are in the race?



A. 21
B. 22
C. 23
D. 35

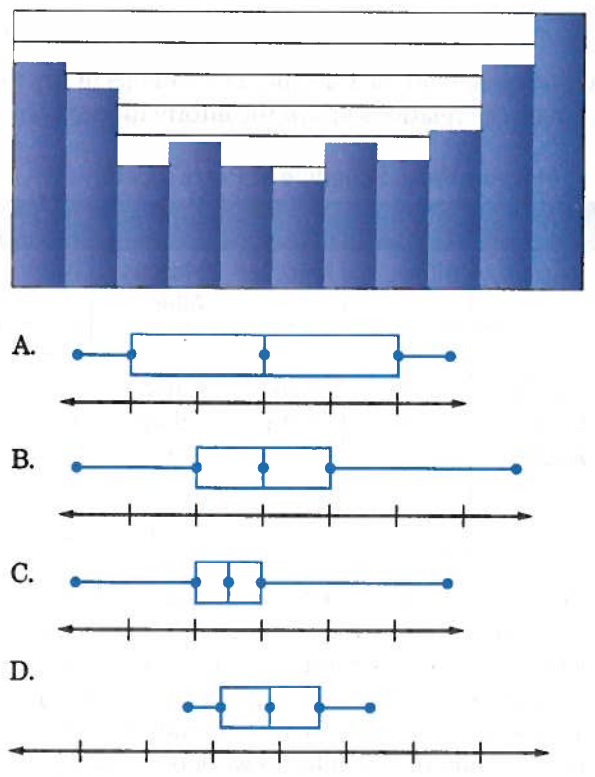
6. Sandy, Jackson, and Gina were looking at a histogram about annual incomes, and each had a different interpretation about the range of the histogram. Sandy says that you cannot determine the range of a data set from a histogram. Jackson disagrees. He says that the range of the data shown in the histogram is \$99,999 because the greatest data value is \$99,999 and the least data value is \$0. Gina says the range is \$79,999 because there are no data values in the first interval, so the least value is \$20,000. Who is correct? Explain.



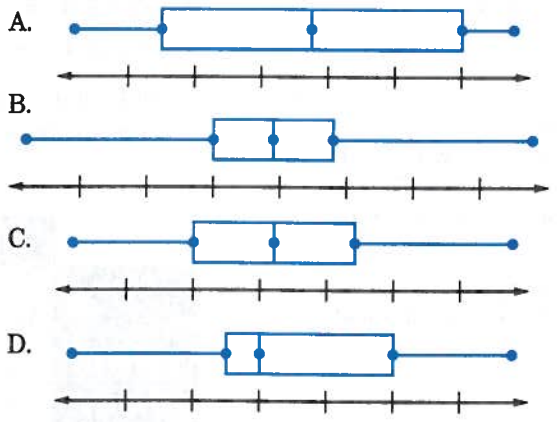
Skill Practice

Directions: Read each problem and complete the task.

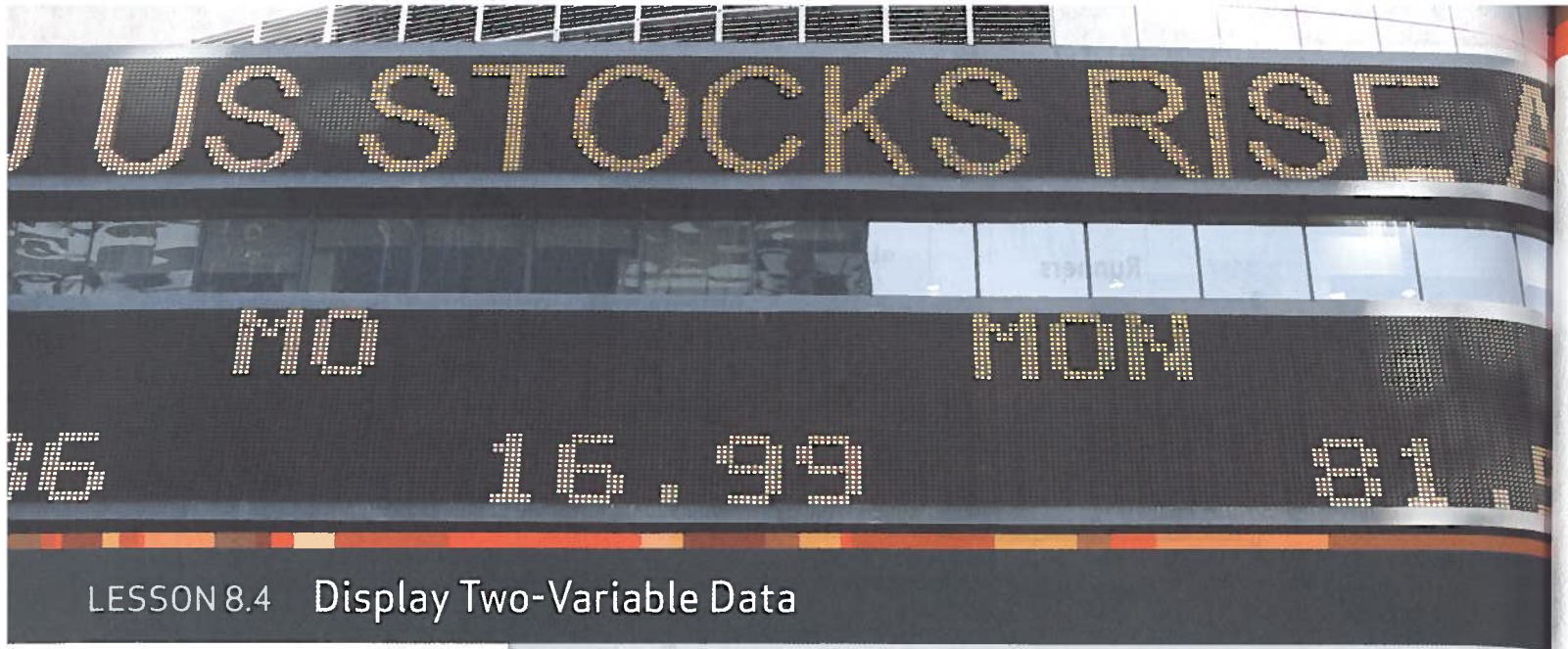
1. Examine the histogram below. Which box plot could represent the same data as the histogram?



2. Which box plot shows data that are clustered around the median?



3. Ursula has data about the ages at which people graduate from college. The ages range from 16 to 65 years. Ursula decides to make a histogram and to divide the data into intervals of 2 years. Do you think this is a good way to divide the data? Explain.
4. Suppose you have a data set on the recent sales prices of single-family homes in your county. What would be the advantages of displaying the data in a histogram? What would be the advantages of a box plot?



LESSON 8.4 Display Two-Variable Data

LESSON OBJECTIVES

- Interpret and display two-variable data in tables
- Interpret and display two-variable data in scatter plots
- Interpret and display two-variable data in line graphs

CORE SKILLS & PRACTICES

- Build Lines of Reasoning
- Interpret Graphs

Key Terms

scatter plot
a graph that plots two-variable data items on the coordinate plane to show a general trend

line graph
a graph displaying two-variable data that change continuously over time

Vocabulary

positive trend
as one variable increases, the other variable tends to increase

negative trend
as one variable increases, the other variable tends to decrease

no trend
there is no pattern between two variables

Key Concept

Tables, scatter plots, and line graphs are all ways to show information that relates one thing to another, like temperature to time of day or height to weight. We call these displays of two-variable data, because there are two related items.

Tables

Tables can be used to organize information in two ways at once. Similar to a crossword puzzle, the rows organize the items in one way and the columns in another. Each item is placed in a cell that is in the right row and the right column for that item.

Reading a Table

Tables are a useful way to organize information and make it easier to read.

To understand what a table shows, read the title and the headings of the rows and the columns. They explain the relationships of the information shown.

Morning Work Schedule at Petra's Cafe

	Sun.	Tues.	Wed.	Thurs.	Fri.	Sat.
Cook	Marcus Allen	Marcus	Allen	Marcus	Marcus Allen	Allen
Bus staff	Stan			Stan	Stan	Stan
Waiters	Alicia Adolfo Connie Greta	Adolfo Lana Alicia	Adolfo Allen Lana	Alicia Greta Lana	Alicia Adolfo Connie	Connie Adolfo
Host	Lana				Lana	Lana

The title of the table tells us that the table contains information about the schedule for people who work at a restaurant. The rows of the table represent the different jobs the people have; cook, bus staff, and so on. The columns represent the days of the week the restaurant is open. The boxes within the table show the names of people scheduled for each job on each day. The shaded box shows the names of waiters scheduled to work on Tuesday.

Displaying Data in a Table

Put the following information in table form: Small cheese pizza, $7.50; medium cheese pizza, $8.50; large cheese pizza, $9.50. Small pepperoni pizza, $8.00; medium pepperoni pizza, $9.00; large pepperoni pizza, $10.00. Small pepper-and-onion pizza, $7.75; medium pepper-and-onion pizza, $8.75; large pepper-and-onion pizza, $9.75.

Example 1: Construct a Table

Step 1 Since all the prices are for pizza, we can put that information in the title of the table.

Step 2 Each price depends on the size and the topping. We will make a table with 3 columns for the 3 sizes and 3 rows for the 3 different toppings. There will be an additional row and column for labels.

Pizza Prices

	Small	Medium	Large
Cheese	$7.50	$8.50	$9.50
Pepperoni	$8.00	$9.00	$10.00
Pepper and Onion	$7.75	$8.75	$9.75

Step 3 Finally, we put each item in the row and column where it belongs. The table is complete. Customers can easily find the price of the pizza they want by looking along the row with the topping they like and down the column with the size they want.

Think about Math

Directions: Answer the following questions.

1. Use the following gas prices to make a table:
   Regular at ValuGas, $3.49; Premium at ValuGas, $3.79; Regular at Fuelfast, $3.59; Premium at Fuelfast, $3.69.
2. Luigi sells neckties in silk, cotton, and wool by 5 different designers. Describe a table that Luigi could use to show the price of each necktie.

WORKPLACE SKILL

Making a Business Decision Based on a Graphic

Evening Shift

	Tues.	Wed.	Thurs.	Fri.
Cook	Dan S.	Bailey	Dan S.	Dan S.
Bus staff			Roger	Roger
Waiters	Juana Maria	Juana Maria	Ali Mary	Ali Juana
Host				Maria

Petra organizes her workers by shift, job, and day of the week. This table shows Petra's current schedule for weekday evenings. If Petra wants to add a bus staff person so that every day is staffed, how much more will that cost her per week than what she's paying now? Bus staff persons make $9 per hour and work 6-hour shifts.

CALCULATOR SKILL

Finding a Range

When determining the scale of an axis for a scatter plot or line graph, a rule of thumb is to use no more than 10 tick marks to span the range of the data. Calculate the range of the data by subtracting the least value from the greatest value, and then divide by 10. This number tells you how much each tick mark will represent. (Note that you may sometimes want to round this number.)

Particularly if the numbers involve decimals, you may find it useful to use a calculator. As always, keep in mind that a calculator will follow the order of operations. If you enter *greatest value–least value*/2, you will get an incorrect answer. You can use parentheses, (*greatest value–least value*)/2, or you can press enter or ◄ ► after performing the subtraction and then divide by 10.

Given a data set of class rank plotted against GPA with GPAs ranging from 1.75 to 3.4, use a calculator to find the range of GPAs and then choose an appropriate scale for tick marks.

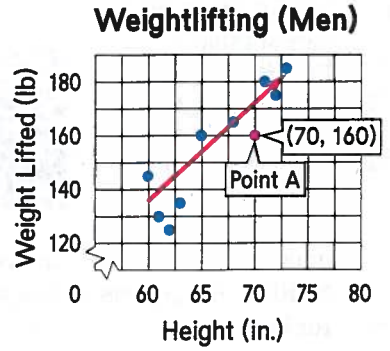
Scatter Plots

Do people who own more books tend to make more money? Scatter plots can answer questions like that by showing whether a lot of individual cases add up to a trend.

Reading a Scatter Plot

A **scatter plot** is a graph showing two values for each item, one value on the horizontal axis and one value on the vertical axis. Each item is shown as a point on the coordinate plane.

The scatter plot shows the heights in inches of 10 men at a gym and the weights in pounds they were able to lift. For each dot, you can read the height of a man by looking at the horizontal scale and the amount he could lift by looking across to the vertical scale. Point A, for instance, shows that one of the men was 70 inches tall and could lift 160 pounds.

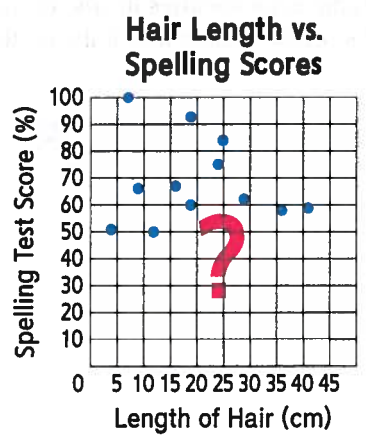


Interpreting Trends

When data is plotted on a scatter plot, it becomes possible to see whether the points form a trend, or a pattern showing a relation between the two values.

For instance, we see in the graph above that the values for weight lifted tend to increase as the values for height increase; the points cluster around an upward line. There is a **positive trend** if, as one variable increases, the other variable tends to increase.

A scatter plot can also show a **negative trend** if one variable increases as the other decreases. For instance, as a car increases in age, its resale value decreases. The points cluster around a downward line.



Some scatter plots show **no trend** if there is no relation between the two variables. The length of girls' hair has no relation to the girls' scores on a spelling test. The points don't cluster around an upward or downward line or show any pattern at all.

Displaying Data in a Scatter Plot

The scatter plot, if it shows a trend, will show how the y-values are related to the x-values.

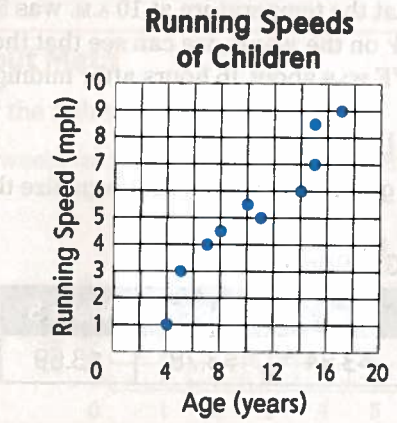
Example 2: Build a Scatter Plot

The plot will show whether the speed of the young runners is influenced by their age.

Age (yr)	4	5	7	8	10	11	14	15	15	17
Speed (mph)	1	3	4	4.5	5.5	5	6	7	8.5	9

Step 1 First, choose one category to be the x-values and one to be the y-values. For each axis, choose a range that will hold the data comfortably. For ages we choose 0–20 years. For speeds we choose 0–10 mph.

Step 2 Add enough lines and number labels to the axes to be able to accurately place the points, but still be readable. For the y-axis, we will set a whole-number label at every line. For the x-axis we will set an even-numbered label for every other line on the axis.



Step 3 Plot each data item as a point in the coordinate plane, using the age as an x-value and the speed as a y-value. Not surprisingly, the finished plot shows a positive trend: as the children's age increases, the speed also increases.

Think about Math

Directions: Answer the following questions.

1. What would you expect to see in a scatter plot correlating the daily pollen count with the price of silver?
   A. A positive trend
   B. A negative trend
   C. No trend

2. What would you expect to see in a scatter plot correlating the monthly rainfall with the incidence of forest fires?
   A. A positive trend
   B. A negative trend
   C. No trend

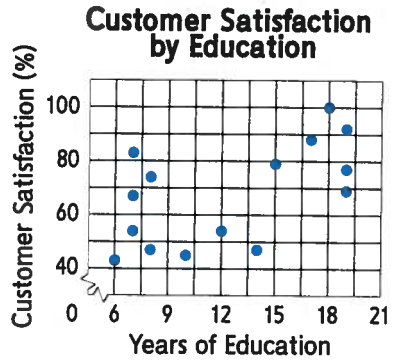
CORE SKILL

Build Lines of Reasoning

The manager of a customer service desk wants to know what makes a good customer service person. He has customer feedback forms about each of his workers showing customer satisfaction as a percent.

He has several theories about employee performance. One is that perhaps better-educated workers can guide customers more skillfully to the right outcome.

He decides to make a scatter plot. The x-axis will show the years of education of the workers and the y-axis will be the percent of satisfaction recorded by the customers.



Workers with more education were not significantly better and there is not an apparent trend. Apparently, at this company, other qualities matter more.

What are some other qualities of employees that you think would show a positive trend with customer satisfaction?

21ST CENTURY SKILL

Viewing Line Graphs Online

Perhaps the statistic most often viewed as a line graph in the United States is the Dow Jones Industrial Average, calculated from the buying and selling of 30 publicly traded stocks. The Dow, as it is often called, is looked to as a major index of the health of the U.S. economy. On trading days you can watch the Dow being charted in real time. Sites where you can find it include yahoo.com, marketwatch.com, money.cnn.com, and others.

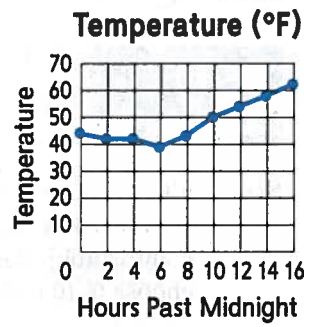
Find a current line graph of the Dow Jones Industrial Average. What is the most recent reading? When was it last updated? Describe any trends you see in the graph.

Line Graphs

The price of a share of stock, the outside temperature, and the number of visits to a website are all examples of continuous data that can go up and down at any time. Line graphs are a way of displaying continuous data and showing the upward and downward trends.

Reading a Line Graph

A **line graph** shows continuously changing data, especially data that change over time. A line graph is constructed by first sampling the data at intervals and plotting the results as points on a graph. Then lines are added, connecting the points to show that change is continuous.



The x-axis is often measured in time units, whether seconds or years. The y-axis shows the other variable—temperature, gas prices, or something else that is always changing.

We can read the time and temperature values of any point on the line using the horizontal and vertical scales. By looking up from the 10-hour mark on the x-axis, we can see that the temperature at 10 A.M. was 50°F. By looking across from the 60° mark on the y-axis, we can see that the time when the temperature reached 60°F was about 16 hours after midnight, or 4 P.M.

Displaying Data in a Line Graph

To display data in a line graph, you should first organize the data in a table.

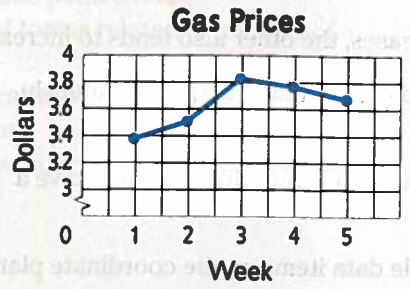
Gas Prices

Week 1	Week 2	Week 3	Week 4	Week 5
$3.39	$3.52	$3.84	$3.78	$3.69

Example 3: Build a Line Graph

Step 1 For each axis, choose a unit and a scale that display the data sensibly. Here the x-axis will be measured in weeks and the y-axis will show dollars. Since the data show relatively small changes, we indicate a jump between $0 and $3.00 with a break symbol (the zigzag line) in the y-axis.

Step 2 Add enough lines and number labels on the axes to make the graph readable, but not so many as to make the graph cluttered. On the x-axis, we will put a line and a label for each week. On the y-axis, we will put lines at intervals of $0.10 and labels at intervals of $0.20.

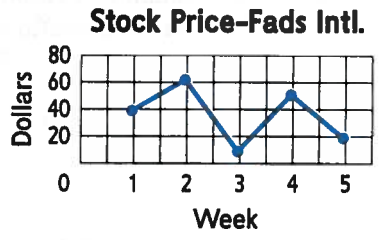


Step 3 Plot each item above the label for its time value. Plot the other value according to the vertical scale. Connect the points with lines from each to the next. The line graph is complete. We can see that during the weeks shown the price of gas first rose and then fell.

Think about Math

Directions: Answer the following questions.

1. How much per week, on average, did the stock price lose between Week 1 and Week 5?



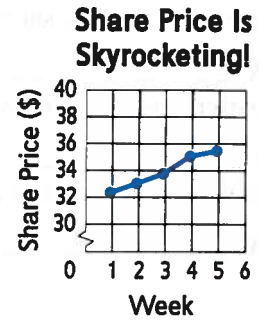
A. $4.00
B. $5.00
C. $10.00
D. $20.00

2. Erik kept track of the scores of his school's basketball team for a three-month season. Would a line graph be a good display for his data?

CORE SKILL

Interpret Graphs

Line graphs are open to manipulation. By including some data and not others or adjusting the axes, it is possible to change the general impressions made by the data.



This line graph of the share price of stock for Blurbo International is made to look like there is a significant increase. To highlight the general rise in price, the vertical scale starts at $30 rather than at $0. The line graph is stretched vertically making the increase appear larger. The magnitude of the increase would appear smaller if the scale started at $0.

Suppose that in Weeks 6 through 8, Blurbo's share price was decreasing. How could a rival company use this to manipulate data from those eight weeks to give the impression that Blurbo International's stock price is plummeting?

Vocabulary Review

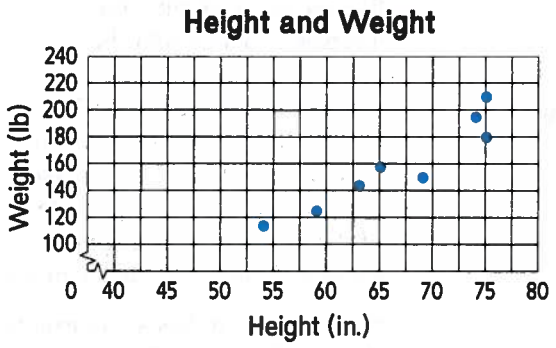
Directions: Identify the correct word to complete each definition.

scatter plot **line graph** **positive trend**
negative trend **no trend**

1. A _____ shows that as one variable increases, the other also tends to increase.
2. A _____ is a graph displaying two-variable data that change continuously over one variable such as time.
3. A _____ scatter plot shows the result of a scatter plot that does not have a pattern between the two variables.
4. A _____ is a graph that plots two-variable data items on the coordinate plane to show a general trend.
5. A _____ shows that as one variable increases, the other tends to decrease.

Skill Review

Directions: Read each problem and complete the task.
Use the scatter plot to answer questions 1 and 2.



1. How tall was the person who weighed 180 lb?
2. How many people weighed between 140 and 160 lb?
3. Which brand in which size is the best value?

Dish Detergent Prices

	12 oz	24 oz
Dazzle	$1.79	$3.25
Sparkle	$1.69	$3.29
Glimmer	$1.74	$3.35

4. Name two factors that would show a positive trend if graphed as a scatter plot.
5. Which of these would likely show a negative trend? Select all that apply.
   A. Number of hours spent playing video games related to grade point average
   B. Population of towns related to number of restaurants
   C. Mean temperatures related to distance north of the equator
   D. Age related to hours spent on the Internet

Skill Practice

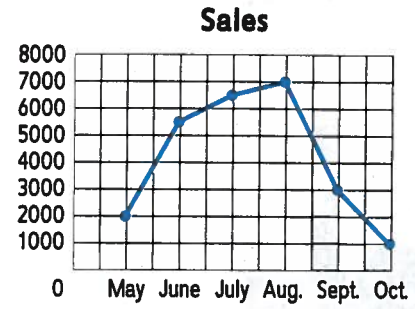
Directions: Read each problem and complete the task.

1. The table shows distances in miles between cities. Copy the table and fill in the blank cells.

	Wharton	Essex	Gardner
Wharton		6	
Essex			12
Gardner	5		

2. A dealer sells cars, vans, and trucks of several different manufacturers in a number of colors. He wants to list his offerings in a table. How should he set it up?
3. How could you make the modest gains in the stock price of Everest Enterprises seem more impressive?

4. Which item's sales are most likely shown in the graph?



   A. Snow shovels
   B. Bathing suits
   C. Leaf blowers
   D. Parkas

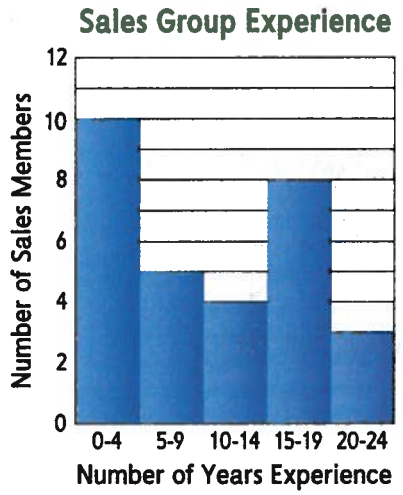
Directions: Choose the answer to each question.

1. Which statement is true about the data set below?

10	11	12	12	12
12	10	11	11	14
15	10	15	16	15

A. The mean is greater than the median.
B. The mean is less than median.
C. The mode is greater than the mean.
D. The median is greater than the mode.

2. A sales manager collected data about how many years of sales experience each member of his team had. He compiled the data in a histogram. _____ members had less than 15 years of sales experience.

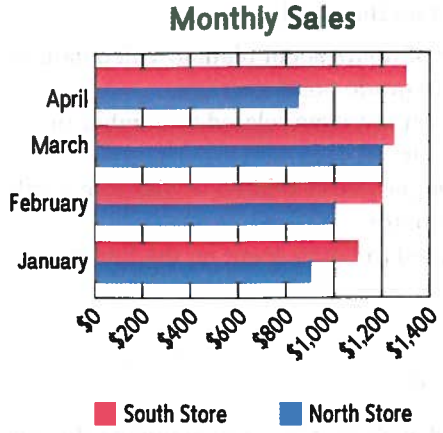


3. The menu prices are shown in the table below. How much would it cost to buy two small beef stew entrees and a large beans and rice entree?

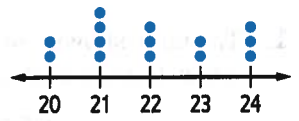
Menu Prices			
Entre	Small	Medium	Large
Chicken and Vegetables	$4.00	$5.00	$8.00
Beans and Rice	$2.50	$3.50	$6.00
Beef Stew	$4.50	$6.00	$7.00

A. $10.50
B. $13.00
C. $15.00
D. $16.50

4. The North Store sold _____ less than the South Store during the four months shown.



5. Which is the mean of this data?

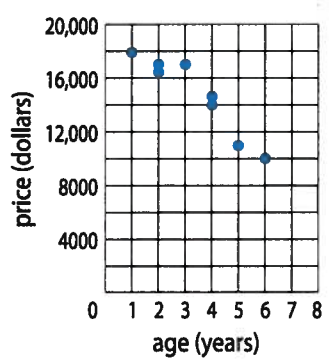


A. 24
B. 22
C. 20
D. 5

6. Andrea's class grade is based on two test grades and a final that counts double. She earned a 95% and 86% on her first two tests and an 84% on the final. What is her average for the class?

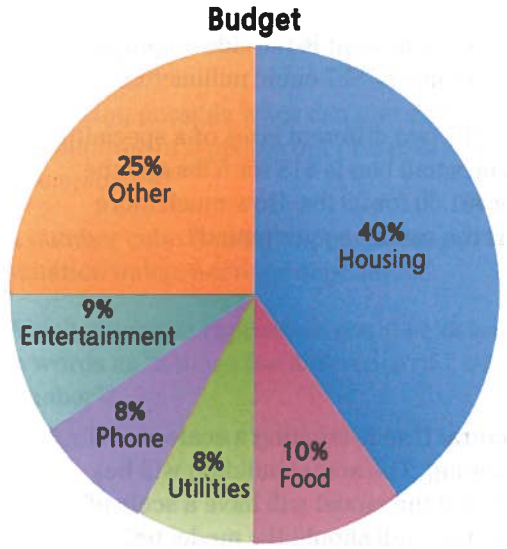
A. 86.6%
B. 88.3%
C. 87.25%
D. 116.33%

7. Mr. Blackburn sells used cars. He has collected data about the age of a car and its selling price. The scatter plot he uses to display the data shows a _____.

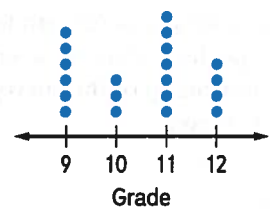


Directions: Choose the best answer to each question.

8. The Buchanan Family uses this circle graph to represent their family budget. They spend $1,200 each month on housing, so their entire budget is _____ each month.



9. The dot plot represents the number of high school students in Chorus. Which is true about the data set?

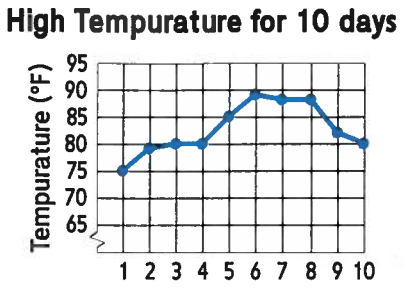


A. 35% of students are in the 10th grade.
B. There are 3 more 9th grade students than 12th grade students.
C. There are 20 students in Chorus.
D. 45% of the students are in the 10th and 11th grades.

10. Andrew wants to earn an 85% in a class. On the first four tests he scored a 92%, 82%, 75%, and 78%. What percent would he need to score on a fifth test to earn an 85%?

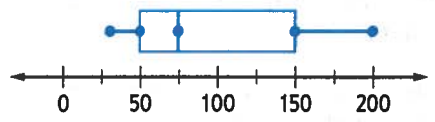
A. 93%
B. 38%
C. 82%
D. 98%

11. What is the difference between the highest temperature and the lowest temperature?



A. 5°
B. 9°
C. 14°
D. 75°

12. Which value is the median?



A. 25
B. 75
C. 100
D. 150

Check Your Understanding

On the following chart, circle the items you missed. The last column shows pages you can review to study the content covered in the question. Review those lessons in which you missed half or more of the questions.

Lesson	Item Number(s)			Review Page(s)
	Procedural	Conceptual	Problem Solving	
8.1 Calculate Measures of Central Tendency	6	1	10	254–261
8.2 Display Categorical Data	4		8	262–269
8.3 Display One-Variable Data	12	9	2, 5	270–277
8.4 Display Two-Variable Data	3	7	11	278–285