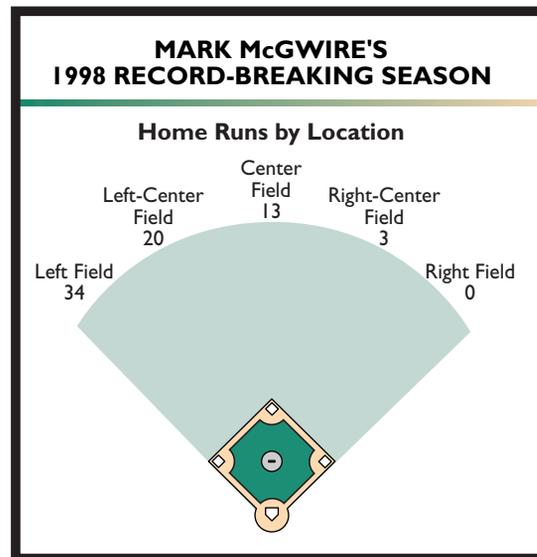


Charts combine pictures and information. Geometric figures and arrows can help you understand how, when, and where events took place.

▶ Study this chart from the sports page of a newspaper.

Example: In 1998, Mark McGwire hit more home runs than any individual had ever hit in a single season. The chart shows the locations of his 70 home runs. To which location did he hit nearly 20% of his home runs?

Answer: You're right if you said **Center Field**. Find 20% of 70: $70 \times 0.2 = 14$, which is nearest the 13 home runs hit to center field.



SKILL PRACTICE

Use the information from the table to answer questions 1 through 3 below.

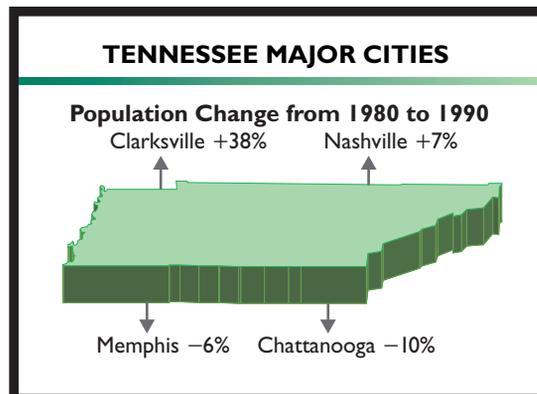
POPULATION OF THE FIVE LARGEST U.S. CITIES						
City	1990	1980	1970	1960	1950	1900
New York	7,322,564	7,071,639	7,895,563	7,781,984	7,891,957	3,437,202
Los Angeles	3,485,557	2,968,528	2,811,801	2,479,015	1,970,358	102,479
Chicago	2,783,726	3,005,072	3,369,357	3,550,404	3,620,962	1,698,575
Houston	1,629,902	1,595,138	1,233,535	938,219	596,163	44,633
Philadelphia	1,585,577	1,688,210	1,949,996	2,002,512	1,071,605	1,293,697

Source: Bureau of the Census, U.S. Department of Commerce

- Write *True* or *False* for each of the following statements.
 - In 1960 the population of Chicago was greater than that of Los Angeles.
 - The population of Houston tripled in size between 1950 and 1960.
 - The population of Philadelphia has increased continually since 1900.
 - The population of New York decreased from 1970 to 1980.
- Which city's population increased by the greatest number from 1900 to 1990?
- In 1990 the population of New York was about ____ times the population of Houston.

(1) $2\frac{1}{2}$	(4) 4
(2) 3	(5) $4\frac{1}{2}$
(3) $3\frac{1}{2}$	

Use the chart below to answer items 4 and 5.

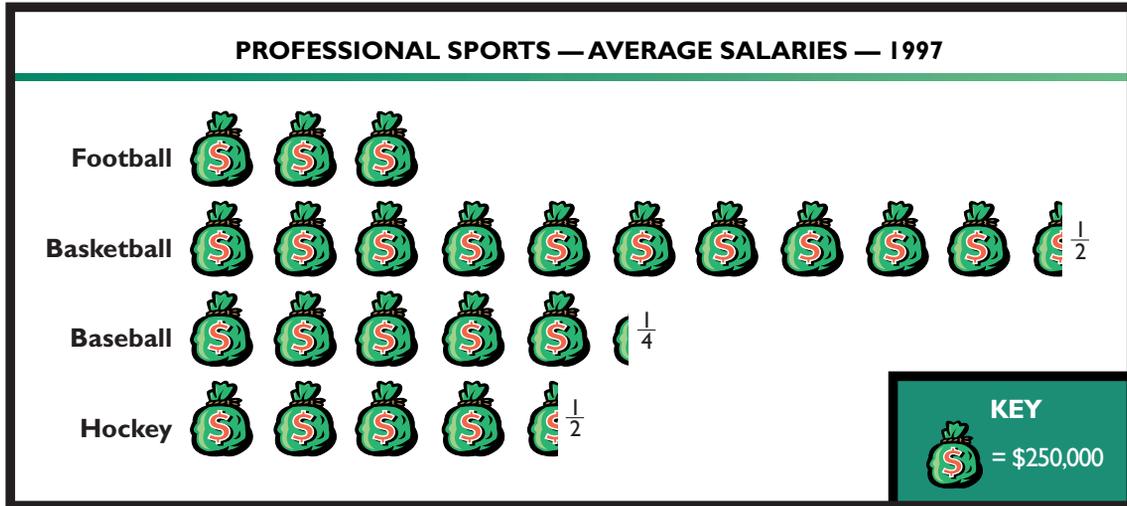


- Which city experienced the smallest change in population?
- Using the chart, is there a way to know which city has the greatest population now? Explain.

Answers and explanations start on page 323.

SKILL PRACTICE

Use the pictograph below to answer items 1 to 3.



Solve each problem.

- What was the approximate average salary of a professional hockey player in 1997?
 - \$1,125,000
 - \$1,132,500
 - \$1,500,000
 - \$1,875,000
 - \$2,625,000
- Based on the average salaries in 1997, about how much more did a basketball player earn than a football player?
 - \$1,125,000
 - \$1,132,500
 - \$1,500,000
 - \$1,875,000
 - \$2,625,000
- Write *True* or *False* for each of the following statements.
 - The average 1997 football salary was more than one million dollars.
 - The average 1997 baseball salary was nearly three times greater than the average football salary.
 - The average 1997 basketball salary was more than twice the average hockey salary.
 - There was a less than \$250,000 difference between the 1997 average baseball salary and hockey salary.

PROBLEM SOLVER Connection

On the GED Math Test, you will sometimes be asked to answer two or more questions based on one paragraph or one graphic. These **item sets** share the same set of information.

To avoid errors when solving item sets, keep in mind these questions:

- Did I read the direction line to see which test items are based on the graphic or paragraph?
- Did I read the title, key, and labels on the graphic *before* solving any problems?
- Did I work the problems one at a time, first determining what is asked in each question?
- Did I consider “What information do I need to solve this question?” (Note: You may not need all the information provided to solve any or all of an item set.)
- Did I solve the problem with the appropriate facts and operations?

Turn to page 197. How many item sets do you see? Which questions are part of the first item set?

Understanding Bar and Line Graphs



WORKPLACE LINK: Rondell works at AC Electronics. Recently, he suggested to his manager that the store could benefit from knowing which areas of the city their customers come from. He suggested asking customers for their zip codes during the store's weekend sale. Rondell volunteered to make a bar graph of the results for his manager's use.

Reading a Bar Graph

A **bar graph** uses bars to represent numerical information. To read the bars, you need to understand how to read the axis lines. A bar graph has two axis lines. One axis presents labels for the bars; the other axis shows a numerical scale. Always read the title and labels before you begin interpreting a graph.

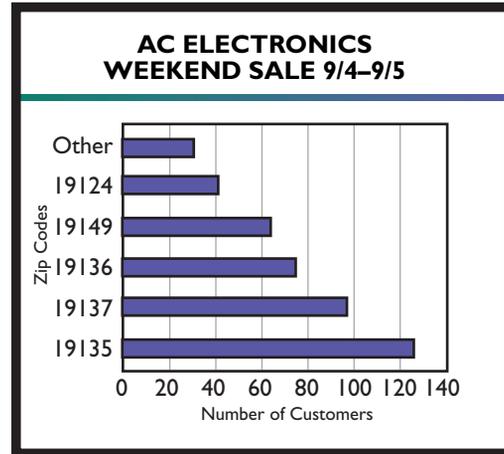
▶▶ Look at the graph that Rondell made for AC Electronics.

The **vertical axis** labels the bars with the customers' zip codes. The **horizontal axis** shows a scale labeled *Number of Customers*. To read the graph, find where the end of a bar falls on the scale.

Example: Approximately how many customers came from the 19137 area?

Find the bar labeled 19137. Imagine a line from the end of the bar to the scale. Read the scale carefully.

Answer: Since the end of the bar is near 100, the bar represents **about 95 customers**.



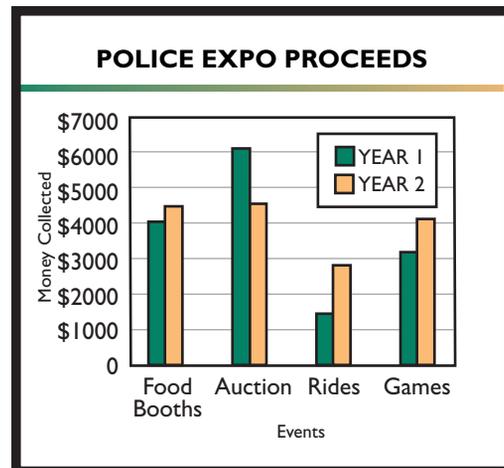
Reading Double-Bar and Stacked-Bar Graphs

Other kinds of bars can be used to make more detailed comparisons. In this **double-bar graph**, there are two bars for each event. The bars show the proceeds for the same event for two different years. Use the key to read the graph.

▶▶ Use the double-bar graph to see changes in performance.

Example: Which event showed a decrease in proceeds from Year 1 to Year 2?

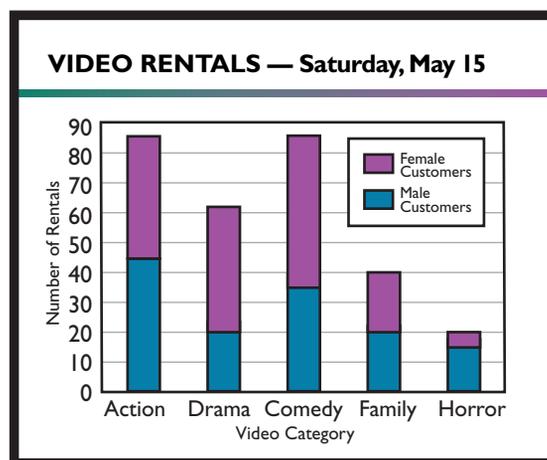
- (1) Food Booths
- (2) Auction
- (3) Rides
- (4) Games
- (5) None of the above



Answer: (2) Auction. The auction raised more than \$6000 in Year 1, but only about \$4500 in Year 2. The proceeds for every other event increased in Year 2.

The bars in a **stacked-bar graph** are divided into more than one part. The portions of the bar are different patterns or colors. Read the key to find out what each portion of each bar represents.

This graph was made by a video rental store. It shows the number of rentals on a certain day, organized by category. The bars are divided into two parts, representing male and female customers.



▶ See how a stacked-bar graph is used to make comparisons.

Example: Video World gathers information about its customers’ preferences in order to make purchasing decisions. Based on the graph, were more action videos rented by men or women?

The purple, upper portion of each bar represents the number of videos rented by women; the blue, lower portion represents those rented by men. You need to compare the purple and blue portions of the bar for action videos.

The easiest way to do this is to perform a simple calculation. Find the number representing the whole bar and subtract the number representing the lower bar (in this case, the portion representing male customers). The difference is the number representing the female customers.

$$\begin{array}{r r r r r} \text{Whole Bar} & - & \text{Lower Portion} & = & \text{Upper Portion} \\ 85 & - & 45 & = & 40 \end{array}$$

Answer: Since the lower, shaded portion of the bar represents male customers, the graph shows that **more action videos were rented by men than women.**

SKILL PRACTICE

Answer the questions using the graphs on pages 200 and 201.

Use the graph titled *AC Electronics*.

- About how many customers came from the 19136 and 19149 zip code areas combined?
- Which zip code area had about twice the number of customers as the 19124 zip code?

Use the graph titled *Police Expo Proceeds*.

- About how much more did the food booths earn than the rides in Year 2?
- Which event showed the greatest increase in proceeds from Year 1 to Year 2?

Use the graph titled *Video Rentals*.

- Which category of video was chosen equally by male and female customers?
- Which of these statements is true?
 - Women rented about 40 family videos.
 - More than twice as many comedy videos were rented as drama videos.
 - Women accounted for most of the horror video rentals.
 - The ratio of drama to family videos was about 3:2.
 - Men rented nearly 90 comedy videos.

Answers and explanations start on page 324.



FAMILY LINK: Annika recently inherited some shares of stock from her grandmother. To decide whether to keep or sell the shares, she used the Internet to gather information. A line graph showed that the price per share had risen slowly but steadily for the past year. After studying the graph, Annika felt confident that the stock was a good investment.

Reading Line Graphs

Line graphs also use axis lines to display information. Both axis lines can be marked with a scale. Because line graphs are usually used to show changes over time, one of the axis lines will often show a series of dates.

Data are plotted on a line graph by placing a point where the two scales would intersect. Once all points are plotted, they are connected by line segments.

Line graphs are often used to display financial information. This graph shows the net income from Ken's home-based gardening business.

▶▶ Read the line graph to find necessary information.

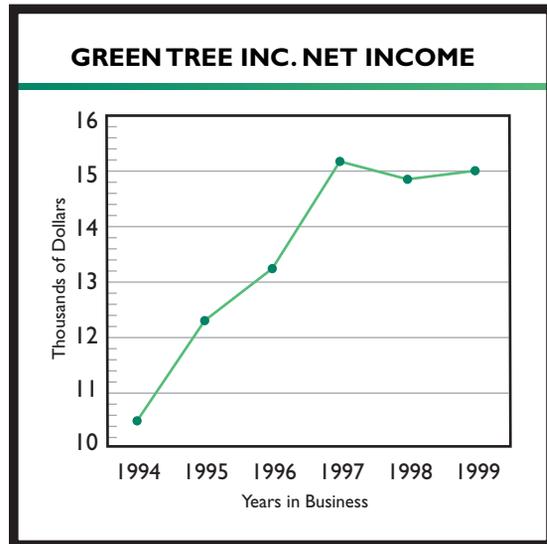
Example: Ken is analyzing the performance of his company over the last six years. In what year did Ken's business earn the greatest amount of net income? What was the approximate net income for that year?

Always read the labels on the graph carefully to understand how the scales are constructed. The horizontal scale at the bottom shows years. The vertical scale on the left shows thousands of dollars. For instance, the number 10 on the scale represents \$10,000.

Find the highest point on the graph. Follow the point down to the scale at the bottom. The highest point is above the year 1997.

Now move from the highest point to the scale on the left. The point is at the first tick mark on the scale between 15 and 16. The point represents 15.2 thousand or \$15,200.

Answer: Ken's best year was in **1997**, when his net income was **\$15,200**.



Making Predictions

A **trend**, or pattern of change, can help you make a projection. A **projection** is a prediction of how the data will change in the future based on the patterns of change in the past and the present.

▶ See how a projection is made using the data from GreenTree Inc.

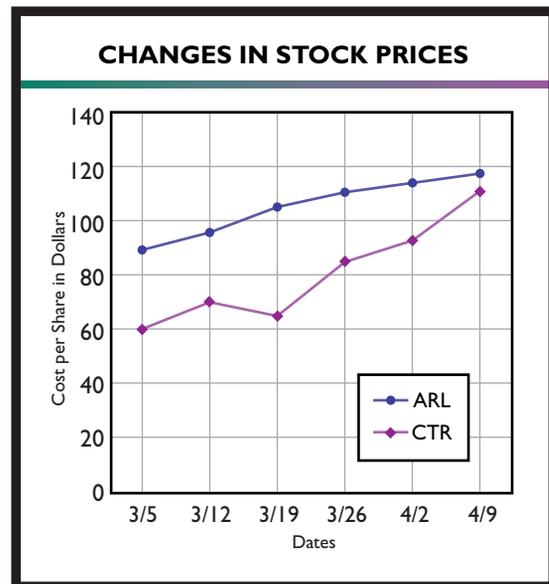
Example: When Ken started his business in 1994, he had only a few customers. In 1997, his business had grown so much that he hired an assistant. Now he wants to know whether he should consider hiring another employee in the next couple of years.

Answer: Probably not. The graph shows two trends—a sharp increase in business from 1994 to 1997 and a leveling off from 1997 to 1999. Ken’s business will probably hold steady over the next couple of years. It is unlikely to match the amount of increase seen in the earlier years.

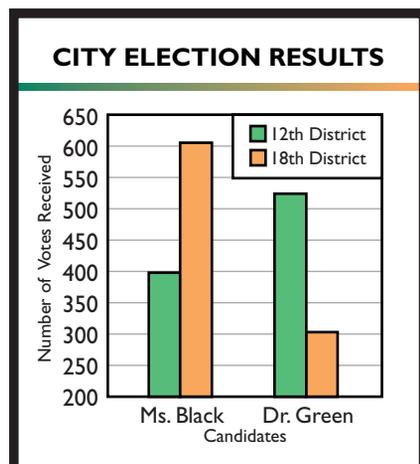
SKILL PRACTICE

The graph below shows the performance of two stocks, ARL and CTR, over a 5-week period. Use the line graph below to answer items 1 to 5.

1. On March 26, what was the approximate cost of one share of CTR stock?
2. Which stock has shown the greatest increase in price over the 5-week period?
3. Guido bought 5 shares of ARL stock on March 5. Approximately how much did he pay for the shares?
4. Based on the current trends, which stock will be worth more per share by the end of April?
5. By about how much money did the price of a share of CTR stock increase from March 19 to March 26?



SOCIAL STUDIES Connection



Political opinion polls often use graphics to represent election results. This double-bar graph shows how many votes were received by two candidates in two districts.

Example: Is the following statement true? In the 18th District, Ms. Black received about four times as many votes as Dr. Green.

Answer: The statement is **false**. Read the left-hand scale carefully to see that Ms. Black received **twice** as many votes.

Note: A graph can appear misleading if the scale doesn’t start at 0.

Do you agree with this statement? Why or why not?

Ms. Black received twice as many votes from the 18th District as she did from the 12th District.

Understanding Circle Graphs



COMMUNITY LINK: Sharon is a member of a school's Booster Club, which raises funds to help buy books and computers for the school. She wants to help parents understand the importance of the Booster Club to the school, so she prepares a circle graph showing that the Booster Club is providing nearly one-half of the school's funds for these items.

How Circle Graphs Are Organized

A **circle graph** is used to show how a whole amount is divided into parts. Circle graphs are often used to show how money is spent. The circle in a circle graph represents the whole. In the circle graph below, the circle represents the entire amount of money to be budgeted. The pie-shaped sections represent the percentages budgeted for individual items.

This graph shows how the Miller family budgeted its income. Each section is labeled with the name of an expense and a percent of the family's income.

Compare the sections for savings and taxes. Since 15% is three times more than 5%, the size of the taxes section is three times larger than the section for savings. The sizes of the sections can help you understand the relationship of the sections to each as well as to the total budget.

Now add the percents in the sections.

$$29\% + 14\% + 15\% + 5\% + 7\% + 9\% + 5\% + 16\% = 100\%$$

The sections add up to 100%, the entire family income.

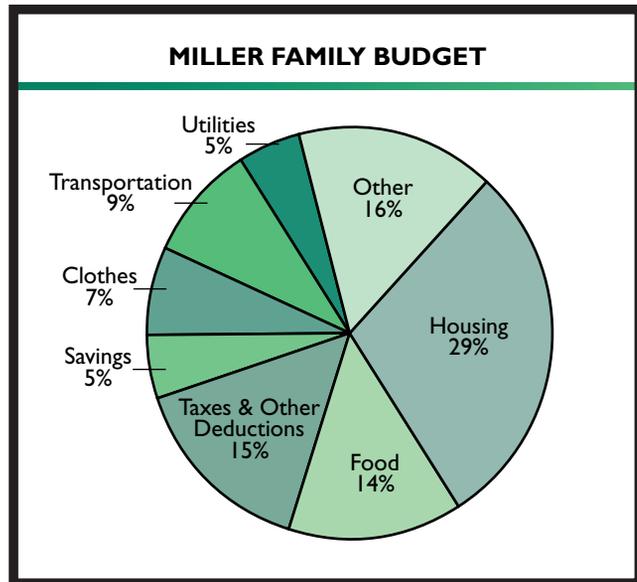
▶▶ Read the graph to answer this question about the family's budget.

Example: What percent of their income did the Millers budget for food and clothing?

Find the sections for food and clothing on the graph and add:

$$\text{Food } 14\% + \text{Clothes } 7\% = 21\%$$

Answer: The Millers budgeted **21%** of their income on food and clothing.



20. **(3) right** The sum of the interior angles of a triangle is 180° . You can find the missing angle by adding the known angles and subtracting from 180° : $33^\circ + 57^\circ = 90^\circ$, and $180^\circ - 90^\circ = 90^\circ$. The missing angle is a right angle; therefore, the triangle must be a right triangle.
21. **(1) 8** Sketch a picture of lines G and H and the perpendicular intersecting line A. Remember that line A will cross *both* lines G and H, by definition of a line. Eight angles are formed, all of which will be right angles, or 90-degree angles.
22. **(5) Neither $\angle Y$ nor $\angle Z$ equals 36° .** In a scalene triangle, there are no equal angles (or equal sides). Since $\angle X$ equals 36° , the other angles must have different measures.
23. **(4) 500** Use the formula for volume of a cylinder: $V = \pi r^2 h$. Since you need an approximate answer, round pi to 3. Substitute and solve: $V = 3 \times 4^2 \times 10 = 3 \times 16 \times 10 = 480$. You know the answer will be a bit more than 480, so your best choice is (4).

Alternate Math Formats, pages 189–190

24. **2.6** Divide 2600 by 1000, since $1000 \text{ m} = 1 \text{ km}$.
25. **7** $18 \text{ in} \times 6 = 108 \text{ in}$, but you need the amount in feet. Since $12 \text{ in} = 1 \text{ ft}$, $108 \text{ in} = 9 \text{ ft}$. Subtract to find the remaining amount: $16 \text{ ft} - 9 \text{ ft} = 7 \text{ ft}$.
26. **144** Find the missing distances. The total length of the diagram is 44 ft ($28 + 16$), so the missing length at the bottom of the diagram must be $44 - 24 = 20 \text{ ft}$. The total width is 28 ft ($20 + 8$), so the missing width at the top of the diagram must be $28 - 20 = 8 \text{ ft}$. Add all measurements:
 $20 + 28 + 8 + 16 + 20 + 24 + 8 + 20 = 144 \text{ ft}$.
27. **816** Break the space into three rectangles. The measurements are 20 by 16 ft, 20 by 20 ft, and 12 by 8 ft. You will need to use the other measurements on the diagram to calculate the length and width of the smallest rectangle. Find the area of each rectangle using the formula $A = lw$:
 $20 \times 16 = 320$
 $20 \times 20 = 400$
 $12 \times 8 = 96$
 Then add the areas: $320 + 400 + 96 = 816 \text{ sq ft}$.
28. **156** Use the formula for finding simple interest: $i = prt = 650 \times 0.08 \times 3 = \156
29. **50.2** Use the formula for finding the area of a circle: $A = \pi r^2$. The radius is 4 cm, which is half the diameter. $A = 3.14 \times 4^2 = 3.14 \times 16 = 50.24$. Round to the nearest tenth.
30. **12** Use the Pythagorean relationship:
 $c^2 = a^2 + b^2$. $13^2 = 5^2 + b^2$
 $169 = 25 + b^2$
 $144 = b^2$
 $12 = b$
31. **23** The sum of the interior angles of a triangle is always 180° . You know that one angle is a right angle measuring 90° . The measure of another angle is given as 67° . Solve for the missing angle:
 $180 = 90 + 67 + x$
 $180 = 157 + x$
 $23 = x$
32. **42.3** Use the formula for finding the area of a square: $A = s^2 = 6\frac{1}{2} \times 6\frac{1}{2} = 42.25$. Round to the nearest tenth.
33. **1296** Use the formula for finding the volume of a rectangular container:
 $V = lwh = 18 \times 6 \times 12 = 1296$ cubic feet.
34. **95** The sum of supplementary angles is 180° . Subtract to find the unknown angle measurement: $180^\circ - 85^\circ = 95^\circ$.
35. **1140** Divide 3.42 by 3, then multiply by 1000 to convert your answer to milliliters.

PROGRAM 36: DATA ANALYSIS, PART ONE

Skill Practice, page 197

- True
 - False
 - False
 - True
- New York** You can quickly see that only New York and Los Angeles increased by more than 3,000,000 from 1900 to 1990. Subtract to find the exact difference for each city.
- (5) $4\frac{1}{2}$** Use a calculator to divide New York's population by Houston's. You can also round to the hundred thousands place and estimate an answer. Houston's population rounds to 1,600,000, and New York's rounds to 7,300,000. Compare the numbers 16 and 73. The number 73 is about $4\frac{1}{2}$ times greater than 16.
- Memphis** This city's population dropped by 6%. The next smallest change was Nashville's, with an increase of 7%.
- No** The chart does not give you any information about the actual size of the population of the cities.

Skill Practice, page 199

- \$1,125,000** Multiply $4\frac{1}{2}$ by \$250,000.
- (4) \$1,875,000** The row for basketball players contains $7\frac{1}{2}$ symbols more than the row for football players. Multiply $7\frac{1}{2}$ by \$250,000.
- False
 - False
 - True
 - True
 Each symbol represents \$250,000, so compare the number of symbols and see if the difference is less than 1:
 $5\frac{1}{4} - 4\frac{1}{2} = 5\frac{1}{4} - 4\frac{2}{4} = \frac{3}{4} = 0.75$.

Problem Solver Connection, page 199

There are two item sets on page 197. Items 1 through 3 are based on the first table. Items 4 and 5 are based on the chart.

Skill Practice, page 201

- About 140 customers** Both bars fall between 60 and 80. The 19149 bar falls short of the halfway mark and probably represents 65. The 19136 bar represents about 75. Add: $65 + 75 = 140$.
- 19136** The 19124 bar represents about 40 customers. Look for the bar that is closest to 80 customers.
- About \$1600** The food booths earned about \$4400, and the rides earned about \$2800. Subtract: $\$4400 - \$2800 = \$1600$. Consider your answer correct if it is between \$1400 and \$1800.
- Rides
- Family videos
- (4) The ratio of drama to family videos was about 3:2.** Evaluate the truthfulness of each statement. There were about 60 drama rentals, compared with 40 family rentals. The ratio 60:40 reduces to 3:2.

Skill Practice, page 203

- About \$82
- CTR stock** You are looking for the greatest change in price, not the highest price.
- \$450** Multiply \$90 by 5.
- CTR stock** The line representing CTR is climbing faster than the line for ARL. The CTR line is likely to cross the ARL line in the very near future.
- About \$20

Social Studies Connection, page 203

The statement is false. Look at the two bars labeled Ms. Black. Although the bar for the 18th District is about twice the length of the bar for the 12th District, the bar for the 18th District represents about 600 votes, while the bar for the 12th District represents about 400 votes. The number 600 is not two times 400.

Skill Practice, page 205

- 6 times** The 29% for housing is close to 30%. That is about 6 times greater than 5% for savings.
- Yes** You can set up a proportion: The ratio of 29% to \$826.50 is equal to the ratio of 14% to what number? You can also use your knowledge of percent. Since 29% is equal to \$826.50, what was the Miller's monthly income? Use your calculator to divide \$826.50 by 0.29, or write a proportion. The Miller's monthly income was \$2850. Now you can use this amount, the value of the whole circle, to find the value of any of the sections.

- Transportation** The fraction $\frac{1}{10}$ is equal to 10%, which is closest to the percent for transportation.
- \$12.50** One-fourth of each dollar (25 cents, or 25%) is spent on the library, and $\frac{1}{4}$ of \$50 is \$12.50.
- $\frac{2}{3}$ Subtract $\frac{1}{3}$, the fraction sold to adults, from 1, the whole (total ticket sales).

Skill Practice, page 207

- $\frac{3}{10}$ $30\% = \frac{30}{100} = \frac{3}{10}$
- 160** Find 25% of 640, the total books donated.
- 352** Add the other sections: $20\% + 25\% + 10\% = 55\%$. Find 55% of the total donated: $640 \times 0.55 = 352$ books.
- 20%** The 15% section on the present graph represents 96 books: $640 \times 0.15 = 96$. On the new graph, the science section will represent 136 books: $96 + 40 = 136$. The total of all books will increase from 640 to 680. Find what percent 136 is of 680: $136 \div 680 = 0.2 = 20\%$.

Technology Connection, page 207

Answers will vary. Each graph has a different emphasis. The graph with multiple bars makes it easy to compare the data from the three stores. You can easily see which store had the greatest sales in each quarter. The three-dimensional graph emphasizes how much better the store in the east did during the third quarter. The line graph is useful for seeing trends in how the stores are doing over time.

GED Practice, pages 208–210

- (4) Central States and New England States** Use addition to evaluate each of the options. Only the Central States maps (about 2,300 units sold) and the New England States maps (about 2,800 units sold) total about 5,000.
- (3) 2.5** The company sold twice as many this year as last year, so you need to find half of this year's sales of the map. Mentally draw a line from the end of the bar to the scale to see that 5 thousand units were sold this year. Divide by 2: $\frac{5}{2} = 2.5$.
- (2) \$0.01** Read the key to learn that Murphy's Gas is represented by the dashed line. Find March 4 ($\frac{3}{4}$) on the bottom scale and move your finger up to where the dashed line crosses, at \$1.08. The solid line represents Gas & Go, which crosses March 4 at \$1.07. The difference is $\$1.08 - \$1.07 = \$0.01$.
- (5) 15(\$1.09)** Multiply the number of gallons (15) by the price of gas at Gas & Go on March 5 (\$1.09).
- (5) Not enough information is given.** You do not know how many gallons of gasoline were sold by each station or to each customer.