

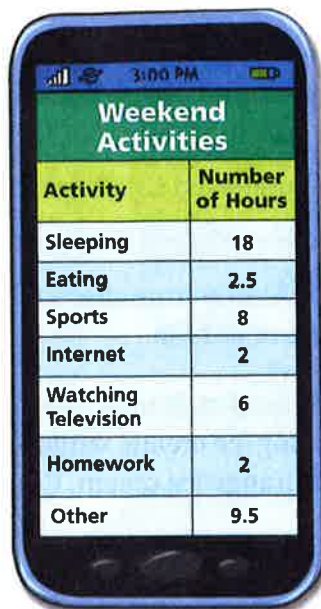


# Applications

1. In a comparison taste test of two juice drinks, 780 people preferred Cranberry Blast. Only 220 people preferred Melon Splash. Complete each statement.
  - a. There were  $\square$  more people who preferred Cranberry Blast.
  - b. In the taste test,  $\square\%$  of the people preferred Cranberry Blast.
  - c. People who preferred Cranberry Blast outnumbered those who preferred Melon Splash by a ratio of  $\square$  to  $\square$ .
  
2. In a taste test of new ice creams invented at Moo University, 750 freshmen preferred Cranberry Bog ice cream, while 1,250 freshmen preferred Coconut Orange ice cream. Complete each statement.
  - a. The fraction of freshmen who preferred Cranberry Bog is  $\frac{\square}{\square}$ .
  - b. The percent of freshmen who preferred Coconut Orange is  $\square\%$ .
  - c. The ratio of freshmen preferring Coconut Orange to those who preferred Cranberry Bog was  $\square$  to  $\square$ .
  
3. A town is debating whether to put in curbs along the streets. The ratio of town residents who support putting in curbs to those who oppose it is 2 to 5.
  - a. What fraction of the residents oppose putting in curbs?
  - b. If 210 people in the town are surveyed, how many do you expect to favor putting in curbs?
  - c. What percent of the residents oppose putting in curbs?



Students at a middle school are asked to record how they spend their time from midnight on Friday to midnight on Sunday. Carlos records his data on his phone. Use his phone screen for Exercises 4–7.



Weekend Activities	
Activity	Number of Hours
Sleeping	18
Eating	2.5
Sports	8
Internet	2
Watching Television	6
Homework	2
Other	9.5

4. How would you compare the way Carlos spent his time on various activities over the weekend?
5. Decide whether each statement is an accurate description of how Carlos spent his time that weekend. Explain your reasoning.
  - a. Carlos spent one-sixth of his time watching television.
  - b. The ratio of hours spent watching television to hours spent doing chores or homework was 3 to 1.
  - c. Sports, Internet, and watching television took about 33% of his time.
  - d. Time spent doing homework was only 20% of the time spent watching television.
  - e. Sleeping, eating, and “other” activities took up 12 hours more than all other activities combined.

6. Estimate the numbers of hours that would be in your weekend activity table. Then write a ratio statement such as the one in Exercise 5, part (b), to fit your data.
7. Use each concept below at least once. Write statements to compare the weekend time Carlos spent on his various activities.
- ratio
  - difference
  - fraction
  - percent
8. A class at Middlebury Middle School collected data on the types of movies students prefer. Complete each statement using the table.

**Types of Movies Preferred by Middlebury Students**

Type of Movie	7th Grade	8th Grade
Action	75	90
Comedy	105	150
Total	180	240

- The ratio of seventh-graders who prefer comedies to eighth-graders who prefer comedies is  $\frac{\square}{\square}$  to  $\frac{\square}{\square}$ .
  - The fraction of total students (both seventh- and eighth-graders) who prefer action movies is  $\frac{\square}{\square}$ .
  - The fraction of seventh-graders who prefer action movies is  $\frac{\square}{\square}$ .
  - The percent of total students who prefer comedies is  $\square\%$ .
  - The percent of eighth-graders who prefer action movies is  $\square\%$ .
  - Grade  $\square$  has the greater percent of students who prefer action movies.
9. In a survey, 100 students were asked whether they prefer watching television or listening to the radio. The results show that 60 students prefer watching television while 40 prefer listening to the radio. Use each concept at least once to express the student preferences.
- ratio
  - percent
  - fraction
  - difference

10. Compare these four mixes for apple juice.

<b>Mix W</b> 5 cups concentrate    8 cups cold water	<b>Mix X</b> 3 cups concentrate    6 cups cold water
<b>Mix Y</b> 6 cups concentrate    9 cups cold water	<b>Mix Z</b> 3 cups concentrate    5 cups cold water

- a. Which mix would make the most “appley” juice? Explain your reasoning.
  - b. Suppose you make a single batch of each mix. What fraction of each batch is concentrate?
  - c. Rewrite your answers to part (b) as percents.
  - d. Suppose you make only 1 cup of Mix W. How much water and how much concentrate do you need?
11. Examine these statements about the apple juice mixes in Exercise 10. Decide whether each is accurate. Give reasons for your answers.
- a. Mix Y has the most water per batch, so it will taste the least “appley.”
  - b. Mix Z is the most “appley” because the difference between the concentrate and water is 2 cups. It is 3 cups for each of the others.
  - c. Mix Y is the most “appley” because it has only  $1\frac{1}{2}$  cups of water for each cup of concentrate. The others have more water per cup.
  - d. Mix X and Mix Y taste the same because you just add 3 cups of concentrate and 3 cups of water to turn Mix X into Mix Y.
12. If possible, write each comparison of concentrate to water as a ratio. If not possible, explain why.
- a. The mix is 60% concentrate.
  - b. The fraction of the mix that is water is  $\frac{3}{5}$ .
  - c. The difference between the amount of concentrate and water is 4 cups.

A can of concentrated grapefruit juice includes the instructions “Mix one can of concentrate with 4 cans of cold water.” For Exercises 13–16, use these mixing instructions.

13. Write a ratio for each situation. Then decide whether the situation is part-to-part or part-to-whole.
- water to concentrate
  - concentrate to juice
  - water to juice
14. Determine which of the situations described in Exercise 13 can be represented by the following ratios. Explain your reasoning.
- $\frac{12}{60}$
  - $\frac{3}{12}$
  - $\frac{2}{2\frac{1}{2}}$
  - $\frac{5}{10}$
15. Orlando and Tanya are experimenting with different mix ratios. Determine whether each mix below will result in a more concentrated (more “grapefruity”) or a less concentrated (less “grapefruity”) mix than the original mix instructions.

<p><b>Mix A</b></p> <p>3 cans concentrate : 15 cans water</p>	<p><b>Mix B</b></p> <p>3 cans concentrate : 15 cans juice</p>
<p><b>Mix C</b></p> <p>10 cans cold water : 7 cans concentrate</p>	<p><b>Mix D</b></p> <p><math>\frac{1}{4}</math> can concentrate : <math>1\frac{1}{2}</math> cans water</p>

16. Jonathan and Samantha are making grapefruit juice from concentrate for a carnival. Jonathan mixes 10 cans of concentrate with 40 cans of water. Samantha mixes 8 cans of concentrate with 32 cans of water. Their teacher asks them to combine the two mixes into one large container.
- Determine whether their new mixture will be less grapefruity, more grapefruity, or the same as the recipe on the can of concentrate. Explain your reasoning.

A can of concentrated grapefruit juice includes the instructions “Mix one can of concentrate with 4 cans of cold water.” For Exercises 17 and 18, use these mixing instructions.

17. Find the missing value in each situation. State the scale factor you used.
- a. 24 cans concentrate : ■ cans water      b. 24 cans concentrate : ■ cans juice
- c. 24 cans juice : ■ cans water              d. 24 cans juice : ■ cans concentrate
18. Raina, Amelia, and Krista wanted to find the number of cans of concentrate they would need if they used 128 cans of water. They knew the problem they were trying to solve was  $\frac{1}{4} = \frac{x}{128}$ . Which of the following strategies would work? Explain.

### Raina's Strategy

I was looking for  $\frac{1}{4}$  of 128. I took 128 and divided it by 4 to find the value of x.  
 $x = 32$

### Amelia's Strategy

I wrote a series of equivalent fractions by doubling the numerator and denominator.

$$\frac{1}{4} = \frac{2}{8} = \frac{4}{16} = \frac{8}{32} = \frac{16}{64} = \frac{32}{128} \quad \text{so } x = 32$$

### Krista's Strategy

I factored the denominator of the right side of the equation to determine x.

$$\frac{1}{4} = \frac{x}{128} = \frac{1 \cdot 1 \cdot 2}{4 \cdot 4 \cdot 8} \quad \text{so } x = 2$$

- 19.** Jared and Pedro walk 1 mile in about 15 minutes. They can keep up this pace for several hours.
- About how far can they walk in 90 minutes?
  - About how far can they walk in 65 minutes?
- 20.** Swimming  $\frac{1}{4}$  of a mile uses about the same number of Calories as running 1 mile.
- Gilda ran a 26-mile marathon. About how far would her sister have to swim to use the same number of Calories Gilda used during the marathon?
  - Juan swims 5 miles a day. About how many miles would he have to run to use the same number of Calories used during his swim?
- 21.** After testing many samples, an electric company determined that approximately 2 of every 1,000 light bulbs on the market are defective. Americans buy more than 1 billion light bulbs every year. Estimate how many of these bulbs are defective.
- 22.** The organizers of an environmental conference order buttons for the participants. They pay \$18 for 12 dozen buttons. Write and solve proportions to answer each question. Assume that price is proportional to the size of the order.
- How much do 4 dozen buttons cost?
  - How much do 50 dozen buttons cost?
  - How many dozens of buttons can the organizers buy for \$27?
  - How many dozens of buttons can the organizers buy for \$63?

- 23.** Denzel makes 10 of his first 15 shots in a basketball free-throw contest. His success rate stays about the same for his next 100 free throws. Write and solve a proportion for each part. Round your answer to the nearest whole number.

Free-Throw Contest		
Player	Attempts	Baskets
Denzel	15	10
Mitchell	10	5
Rachael	15	7
Zoe	15	6

- About how many baskets do you expect Denzel to make in his next 60 attempts?
- About how many free throws do you expect him to make in his next 80 attempts?
- About how many attempts do you expect Denzel to take to make 30 free throws?
- About how many attempts do you expect him to take to make 45 free throws?

For Exercises 24–31, solve each equation.

**24.**  $12.5 = 0.8x$

**26.**  $\frac{x}{18} = 4.5$

**28.**  $245 = 0.25x$

**30.**  $\frac{0.1}{48} = \frac{x}{960}$

**25.**  $\frac{x}{15} = \frac{20}{30}$

**27.**  $\frac{15.8}{x} = 0.7$

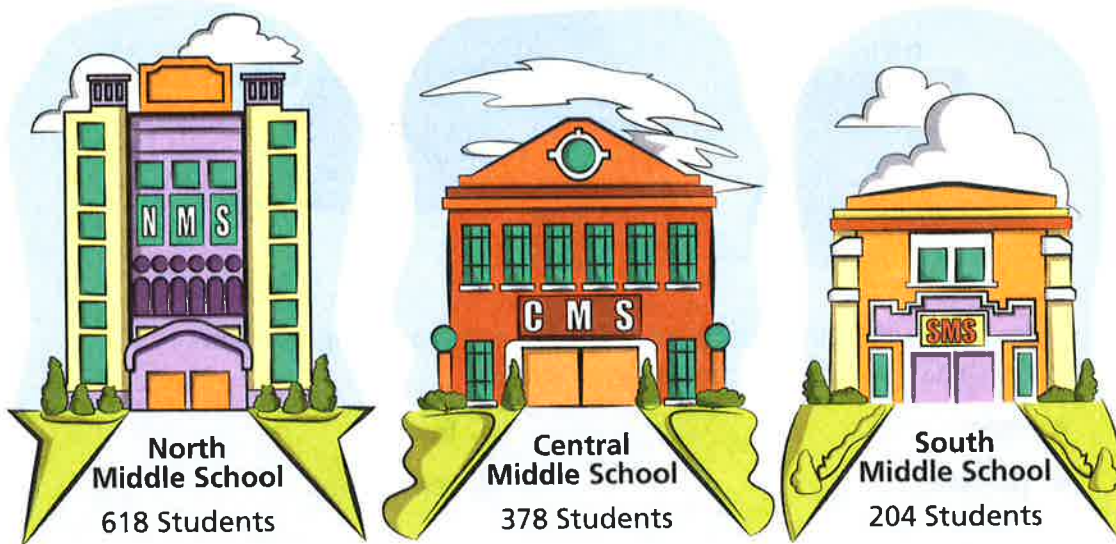
**29.**  $\frac{18}{x} = \frac{4.5}{1}$

**31.**  $\frac{x}{900} = \frac{3.5}{15}$



- 32. Multiple Choice** Middletown sponsors a two-day conference for selected middle-school students to study government. There are three middle schools in Middletown.

Suppose 20 student delegates will attend the conference. Each school should be represented fairly in relation to its population. How many should be selected from each school?

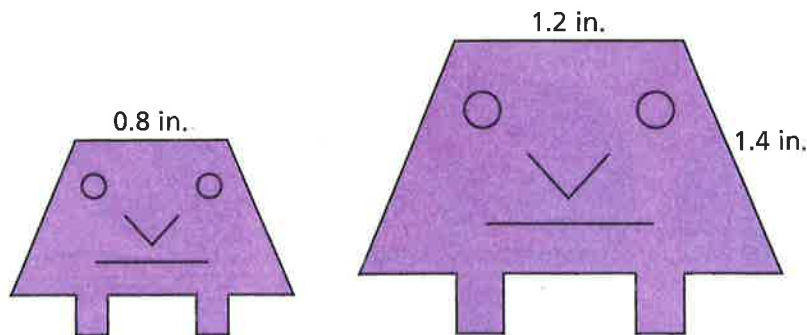


- A.** North: 10 delegates, Central: 8 delegates, South: 2 delegates  
**B.** North: 11 delegates, Central: 7 delegates, South: 2 delegates  
**C.** North: 6 delegates, Central: 3 delegates, South: 2 delegates  
**D.** North: 10 delegates, Central: 6 delegates, South: 4 delegates



## Connections

The sketches below show two members of the Grump family. The Grumps are geometrically similar. Use the figures for Exercises 33–36.



33. Write statements comparing the lengths of corresponding segments in the Grumps. Use each concept at least once.
- |            |                 |
|------------|-----------------|
| a. ratio   | b. fraction     |
| c. percent | d. scale factor |
34. Write statements comparing the areas of the Grumps. Use each concept at least once.
- |            |                 |
|------------|-----------------|
| a. ratio   | b. fraction     |
| c. percent | d. scale factor |
35. How long is the segment in the smaller Grump that corresponds to the 1.4-inch segment in the larger Grump?
36. **Multiple Choice** The mouth of the smaller Grump is 0.6 inches wide. How wide is the mouth of the larger Grump?
- |            |            |
|------------|------------|
| A. 0.4 in. | B. 0.9 in. |
| C. 1 in.   | D. 1.2 in. |


37. Suppose a news story reports "A survey found that  $\frac{4}{7}$  of all Americans watched the Super Bowl on television." Bishnu thinks this means the survey reached seven people and four of them watched the Super Bowl on television. Do you agree with him? If not, what does the statement mean?
38. A fruit bar is 5 inches long. The bar will be split into two pieces. For each situation, find the lengths of the two pieces.
- One piece is  $\frac{3}{10}$  of the whole bar.
  - One piece is 60% of the bar.
  - One piece is 1 inch longer than the other.
39. Exercise 38 includes several numbers or quantities: 5 inches, 3, 10, 60%, and 1 inch. Determine whether each number or quantity refers to the whole, a part, or the difference between two parts.
40. If possible, change each comparison of red paint to white paint to a percent comparison. If it is not possible, explain why.
- The fraction of a mix that is red paint is  $\frac{1}{4}$ .
  - The ratio of red to white paint in a different mix is 2 to 5.
41. If possible, change each comparison to a fraction comparison. If it is not possible, explain why.
- A nut mix is 30% peanuts.
  - The ratio of almonds to other nuts in a mix is 1 to 7.
42. Find a value that makes each sentence correct.
- |   |  |
|---|--|
| a. $\frac{3}{10} = \frac{\blacksquare}{30}$   | b. $\frac{1}{2} < \frac{\blacksquare}{20}$     |
| c. $\frac{\blacksquare}{20} > \frac{3}{5}$    | d. $\frac{9}{30} \leq \frac{\blacksquare}{15}$ |
| e. $\frac{\blacksquare}{12} \geq \frac{3}{4}$ | f. $\frac{9}{21} = \frac{12}{\blacksquare}$    |

43. Use the table for parts (a)–(e).

Participation in Walking for Exercise

	Age 12–17	Age 55–64
People Who Walk	5,520,000	12,595,000
Total in Group	25,056,000	31,556,000

SOURCE: U.S. Census Bureau

- What percent of the 55–64 age group walk for exercise?
  - What percent of the 12–17 age group walk for exercise?
  - Write a ratio statement to compare the number of 12- to 17-year-olds who walk to the number of 55- to 64-year-olds who walk. Use approximate numbers to simplify the ratio.
  - Write a ratio statement to compare the percent of 12- to 17-year-olds who walk for exercise to the percent of 55- to 64-year-olds who walk for exercise.
  - Which form of data—numbers of walkers or percents—would you use to compare the popularity of walking for exercise among various groups? Explain.
44. Copy the number line below. Add labels for  $0.25$ ,  $\frac{6}{8}$ ,  $1\frac{3}{4}$ , and  $1.3$ .
- 
45. Write two unequal fractions with different denominators. Which fraction is greater? Explain.
46. Write a fraction and a decimal such that the fraction is greater than the decimal. Explain.



Copy each pair of numbers in Exercises 47–55. Insert  $<$ ,  $>$ , or  $=$  to make a true statement.

47.  $\frac{4}{5} \blacksquare \frac{11}{12}$

48.  $\frac{14}{21} \blacksquare \frac{10}{15}$

49.  $\frac{7}{9} \blacksquare \frac{3}{4}$

50.  $2.5 \blacksquare 0.259$

51.  $30.17 \blacksquare 30.018$

52.  $0.006 \blacksquare 0.0060$

53.  $0.45 \blacksquare \frac{9}{20}$

54.  $1\frac{3}{4} \blacksquare 1.5$

55.  $\frac{1}{4} \blacksquare 1.3$

56. Suppose a news story reports “90% of the people in the Super Bowl stadium were between the ages of 25 and 55.” Alicia thinks this means only 100 people were in the stadium, and 90 of them were between 25 and 55 years of age. Do you agree with her? If not, what does the statement mean?

57. **Multiple Choice** Choose the value that makes  $\frac{18}{32} = \frac{\blacksquare}{16}$  correct.

F. 7

G. 8

H. 9

J. 10

58. **Multiple Choice** Choose the value that makes  $\frac{\blacksquare}{30} \leq \frac{6}{20}$  correct.

A. 9

B. 10

C. 11

D. 12

59. Find a value that makes each sentence correct. Explain your reasoning in each case.

a.  $\frac{3}{4} = \frac{\blacksquare}{12}$

b.  $\frac{3}{4} < \frac{\blacksquare}{12}$

c.  $\frac{3}{4} > \frac{\blacksquare}{12}$

d.  $\frac{9}{12} = \frac{12}{\blacksquare}$

60. Find values that make each sentence correct.

a.  $\frac{6}{8} = \frac{\blacksquare}{12} = \frac{\blacksquare}{16}$

b.  $\frac{\blacksquare}{9} = \frac{8}{12} = \frac{\blacksquare}{21}$

c.  $\frac{\blacksquare}{60} = \frac{\blacksquare}{75} = \frac{6}{90}$

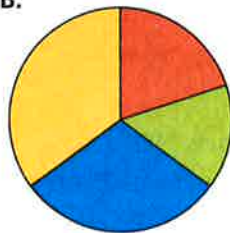
d.  $\frac{\blacksquare}{4} = \frac{15}{\blacksquare} = \frac{24}{16}$

- 61. Multiple Choice** Ayanna is making a circular spinner to be used at the school carnival. She wants the spinner to be divided so that 30% of the area is blue, 20% is red, 15% is green, and 35% is yellow. Choose the spinner that fits the description.

A.



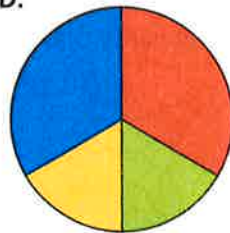
B.



C.



D.

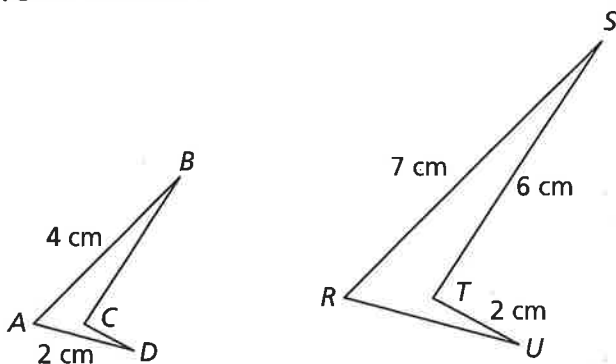


- 62.** Hannah is making her own circular spinner. She makes the ratio of green to yellow 2 : 1, the ratio of red to yellow 3 : 1, and the ratio of blue to green 2 : 1. Make a sketch of her spinner.

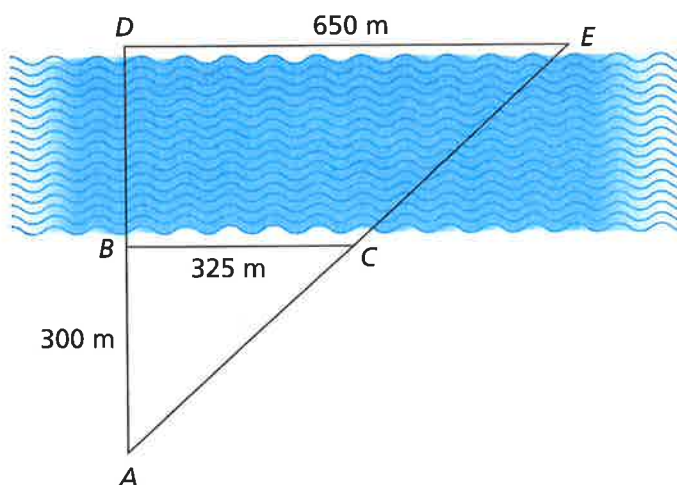
- 63.**
- Plot the points  $(8, 6)$ ,  $(8, 22)$ , and  $(24, 14)$  on a coordinate plane. Connect them to form a triangle.
  - Draw the triangle you get when you apply the rule  $(0.5x, 0.5y)$  to the three points from part (a).
  - How are lengths of corresponding sides in the triangles from parts (a) and (b) related?
  - The area of the smaller triangle is what percent of the area of the larger triangle?
  - The area of the larger triangle is what percent of the area of the smaller triangle?



64. The polygons below are similar.



- What is the length of side  $BC$ ? Explain your reasoning.
  - What is the length of side  $RU$ ? Explain your reasoning.
  - What is the length of side  $CD$ ? Explain your reasoning.
65. Yoshi and Kai are trying to earn a certificate in their Outdoor Education Class. They have the task of measuring the width of a river. Their report includes a diagram that shows their work.

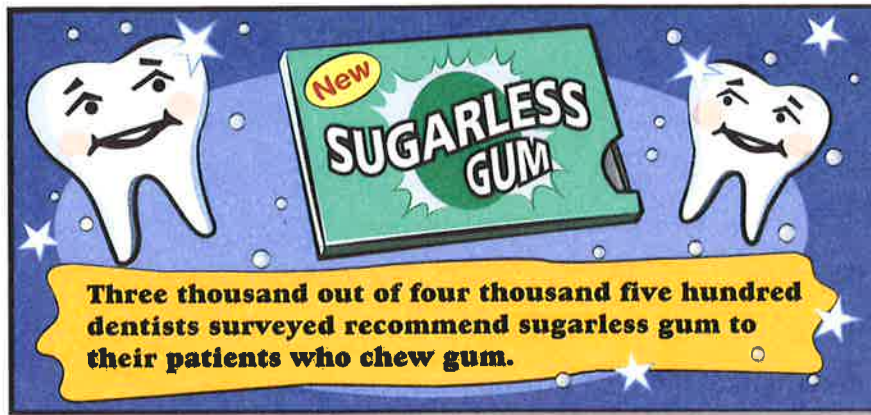


- How do you think they came up with the lengths of the segments  $AB$ ,  $BC$ , and  $DE$ ?
- How can they use segments  $AB$ ,  $BC$ , and  $DE$  to find the width of the river?



## Extensions

66. Rewrite this ad so that it will be more effective.



67. Use the table below.

**Money Spent on Food**

Where Food Is Eaten	2002	2010
Home	\$471,533,000,000	\$617,475,000,000
Away from Home	\$295,341,000,000	\$446,442,000,000

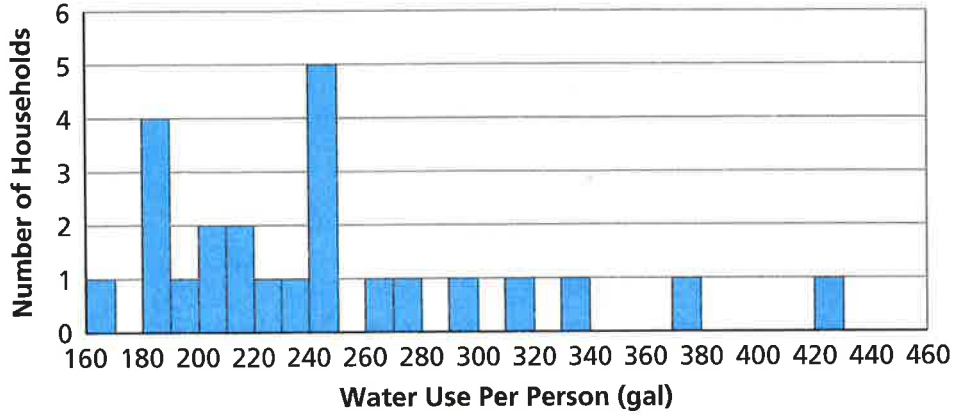
SOURCE: U.S. Census Bureau

- Compare money spent on food eaten at home and food eaten away from home to the total amount spent on food each year. Write statements for each year.
- Explain how the statements you wrote in part (a) show the money spent on food away from home increasing or decreasing in relation to the total spent on food.

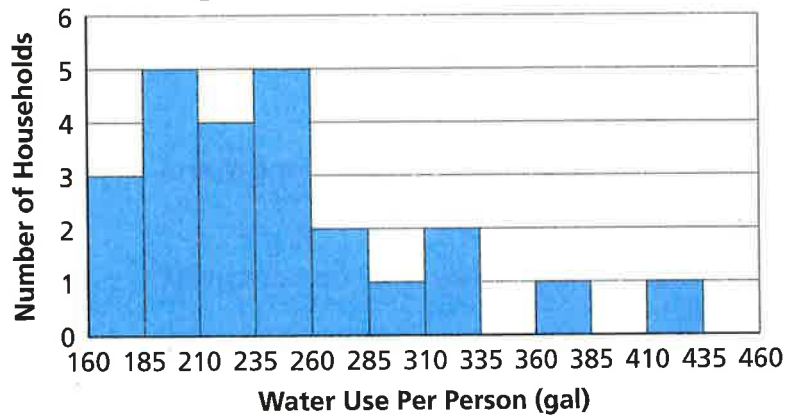


68. The two histograms below display information about gallons of water used per person in 24 households in a week.

**Histogram A: Water Use in 24 Households**



**Histogram B: Water Use in 24 Households**



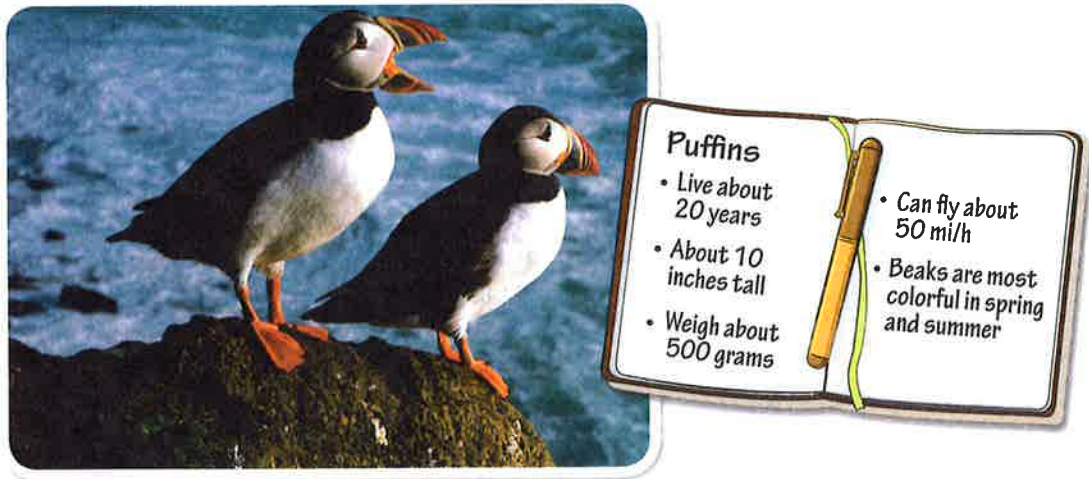
- Compare the two histograms and explain how they differ.
- Where do the data seem to clump in Histograms A and B?

The table below shows advertising spending for a small media company. Use the table for Exercises 69–74.

Advertising Spending		
Placement	2000	2010
Newspapers	\$32,415	\$18,203
Magazines	\$4,973	\$7,728
Television	\$19,318	\$35,718
Radio	\$5,126	\$11,318
Yellow Pages	\$4,984	\$1,327
Internet	\$1,934	\$7,548
Direct Mail	\$13,497	\$8,458
Other	\$13,194	\$19,345
Total	\$95,441	\$109,645

69. Which placement has the greatest difference in advertising dollars between 2000 and 2010?
70. Find the percent of advertising dollars spent for one type of placement in 2000.
71. Find the percent of advertising dollars spent for one type of placement in 2010.
72. Use your results from Exercises 70 and 71. Write several sentences describing how advertising spending changed from 2000 to 2010.
73. Suppose you were thinking about investing in Internet advertising or radio station advertising. Which method of comparing advertising costs (differences or percents) makes the Internet seem the better investment? Which makes the radio station seem the better investment?
74. Suppose you are a reporter writing an article about trends in advertising over time. Which method of comparison would you choose? Explain.

75. Angela, a biologist, spends summers on an island in Alaska. For several summers she studied puffins. Two summers ago, Angela captured, tagged, and released 20 puffins. This past summer, she captured 50 puffins and found that 2 of them were tagged. Using Angela's findings, estimate the number of puffins on the island. Explain your reasoning.



76. Rita wants to estimate the number of beans in a large jar. She takes out 100 beans and marks them. Then she returns them to the jar and mixes them with the unmarked beans. She then gathers some data by taking a sample of beans from the jar. Use her data to predict the number of beans in the jar.

### Sample

Number of marked beans: 2

Beans in sample: 30

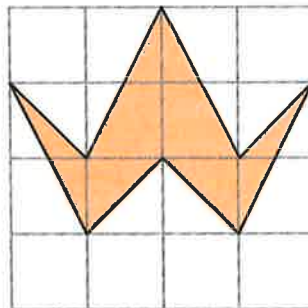


**77.** The picture below is drawn on a centimeter grid.

**a.** On a grid made of larger squares than those shown here, draw a figure similar to this figure. What is the scale factor from the original figure to your drawing?

**b.** Draw another similar figure, but use a grid of smaller squares than those shown here. What is the scale factor from the original figure to your drawing?

**c.** Compare the perimeters and areas of the original figure and its copy in each case (enlargement and reduction). Explain how these values are related to the scale factor in each case.



**78.** The people of the United States are represented in Congress, which is made up of the House of Representatives and the Senate.

**a.** In the House of Representatives, the number of representatives from each state varies. From what you know about Congress, how is the number of representatives from each state determined?

**b.** How is the number of senators from each state determined?

**c.** Compare the two methods of determining representation in Congress. What are the advantages and disadvantages of these two forms of representation for states with large populations? How about for states with small populations?