

The largest bundle of prints costs \$12 per print.

Looking at the price per print of each bundle, the largest bundle (6 prints) has the lowest price per print and is therefore the best buy.

Now work margin exercise 13.

In each of the examples, the larger (or largest) amount of units was the better (or best) buy. Often, larger amounts are less expensive because packaging costs less and the manufacturer wants you to buy more of the product. However, the larger amount is not always the better buy because of other considerations such as storage space or the consumer's individual needs. For example, people who do not use much pancake syrup may want to buy a smaller bottle. Even though they pay more per unit, it's more economical in the long run not to have to throw any away.

Special Comment on the Term **per**

Be aware that the term **per** can be interpreted to mean **divided by**. For example,

cents per ounce	means	cents divided by ounces
dollars per pound	means	dollars divided by pounds
miles per hour	means	miles divided by hours
miles per gallon	means	miles divided by gallons

Margin Exercise Answers

1. $\frac{6}{5}$ 2. a. $\frac{2}{7}$ b. $\frac{4}{1}$ 3. $\frac{3}{2}$ 4. a. $\frac{5}{24}$ b. $\frac{7}{40}$ 5. a. $\frac{5}{3}$ b. $\frac{3}{5}$ 6. $\frac{7}{3}$ 7. $\frac{55 \text{ students}}{2 \text{ sections}}$
 8. Rahul made 2 baskets for every 5 shots he attempted. 9. 24 laps/hr 10. 49 cupcakes/hour
 11. 42 pgs/min 12. 3 notebooks for \$12 13. 12 bags for \$36; \$5/bag (6 bags); \$3/bag (12 bags); \$4 bag (16 bags)

3.10 Exercises

Concept Check

Fill-in-the-Blank. Complete each sentence using information found in this section.

- When two quantities are compared by division, the comparison is called a/an _____.
- The ratio $\frac{3}{8}$ is read "the ratio of _____ to _____."
- Ratios can be _____ to lowest terms.
- When numbers in a ratio have different units, the ratio is said to be a/an _____.
- A unit rate is a rate with denominator _____.
- To find a unit price (or price per unit), divide the _____ by the number of units.

True/False. Determine whether each statement is true or false. If a statement is false, explain how it can be changed so the statement will be true. (**Note:** There may be more than one acceptable change.)

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7. The units in the numerator and denominator of a ratio must be the same, or need to be able to be converted to the same units.
 8. The order of the numbers in a ratio or a rate is irrelevant as long as the numbers are reduced.
 9. The ratio 8:2 can be reduced to the ratio 4.
 10. To make a unit rate, divide the numerator by the denominator.

Practice

Write each ratio as a fraction in lowest terms. See Examples 1 through 3.

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|-----------------------------------|---------------------------------------|
| 1. 18 to 28 | 6. $\frac{10}{9}$ to $\frac{5}{12}$ |
| 2. 25 to 30 | 7. \$550 to \$800 |
| 3. 32 to 24 | 8. \$1275 to \$1850 |
| 4. 21 to 35 | 9. $3\frac{1}{2}$ donuts to 12 donuts |
| 5. $\frac{2}{3}$ to $\frac{5}{6}$ | 10. 3 months to $9\frac{1}{2}$ months |

For each ratio, change to common units in the numerator and denominator and then write each ratio as a fraction in lowest terms. See Example 6.

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|------------------------------|---------------------------|
| 11. 1 dime to 4 nickels | 16. 4 hours to 30 minutes |
| 12. 5 nickels to 3 quarters | 17. 18 inches to 2 feet |
| 13. 5 dollars to 5 quarters | 18. 36 inches to 2 feet |
| 14. 6 dollars to 50 dimes | 19. 8 days to 2 weeks |
| 15. 5 minutes to 200 seconds | 20. 21 days to 4 weeks |

Write each rate as a fraction in lowest terms. See Example 7.

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|--|-------------------------------------|
| 21. \$200 in profit to \$500 invested | 26. 125 hits to 500 times at bat |
| 22. \$200 in profit to \$1000 invested | 27. 1500 children to 450 families |
| 23. 2 teachers to 24 students | 28. 900 children to 480 families |
| 24. 3 teachers to 54 students | 29. 25 scholarships to 210 students |
| 25. 100 hits to 500 times at bat | 30. 12 scholarships to 160 students |

Write each rate as a unit rate. See Examples 9 through 11.

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|--------------------------|----------------------------------|
| 31. 240 miles to 4 hours | 33. 50 miles to 2 gallons of gas |
| 32. 210 miles to 3 hours | 34. 60 miles to 5 gallons of gas |

35. 1260 words to 30 minutes
36. 840 words to 15 minutes
37. 2250 gallons of water to 25 people
38. 3600 gallons of water to 16 people
39. \$612 to 48 hours
40. \$399 to 28 hours

Find the unit price of each set of items and tell which one is the better (or best) purchase. See Examples 12 and 13.

41. **Shoes:** 3 pairs for \$75, 5 pairs for \$120
42. **Candy:** 4 ounces for 64 cents; 6 ounces for 84 cents
43. **Socks:** 6 pairs for \$18, 3 pairs for \$12
44. **Lawn chairs:** 2 chairs for \$112; 5 chairs for \$240
45. **Paint:** 4 quarts for \$36; 8 quarts for \$80
46. **Curtain panels:** 6 panels for \$192; 8 panels for \$224
47. **Rose bushes:** 13 for \$364; 9 bushes for \$234; 7 bushes for \$175, 4 bushes for \$96
48. **Books:** 20 books for \$320; 16 books for \$240; 12 books for \$192; 9 books for \$162

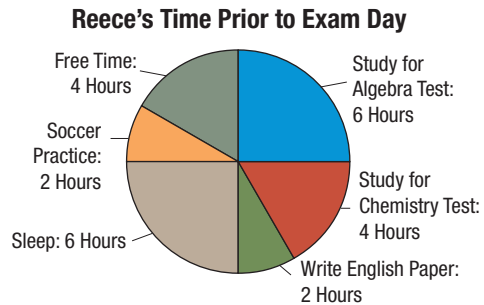
Applications

Solve.

49. A serving of three home-baked chocolate chip cookies weighs 40 grams and contains 12 grams of fat. What is the rate, in lowest terms, of fat grams to total grams?
50. In recent years, 18 out of every 100 students taking the SAT (Scholastic Aptitude Test) at a local school have scored 600 or above on the mathematics portion of the test. Write the ratio, in lowest terms, of the number of scores 600 or above to the number of scores below 600.
51. In a recent year, Albany, NY, reported a total of 60 clear days, the rest being cloudy or partly cloudy. For a 365-day year, write the rate, in lowest terms, of clear days to cloudy or partly cloudy days.
52. Different sellers for an online book broker sell the same book title for a wide variety of prices. For a certain title, the highest selling price (mint condition) is \$35, while the lowest selling price is \$10. What is the ratio of the highest price to the lowest?
53. One truck can carry 9 tons of cargo, while a second truck can haul 12 tons. What is the ratio of their capacities?
54. If the CEO of a major corporation makes \$4,000,000 a year, and the average annual salary of the workers is \$30,000 a year, what is the ratio of the CEO's salary to that of the regular workers?
55. John has collected 7 quarters, while Walt has collected 25 dimes. How much money does Walt have compared with John's accumulation? (**Hint:** When converting the coin collections to monetary values, express them in cents.)
56. A recipe calls for 6 cups of milk and 4 cups of bread crumbs. What is the ratio of milk to bread crumbs?

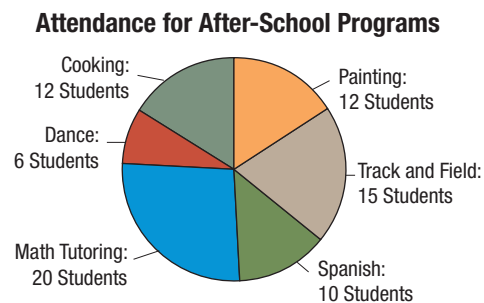
57. A farmer has a long narrow rectangular piece of land. If the length is 9504 feet and the width is 1320 feet, what is the ratio of the length to the width?
58. Lemonade can be made by mixing lemon juice, sugar, and water in the ratio 1:1:6. Find the amount of each ingredient in 16 quarts of lemonade.

The circle graph shown here illustrates how Reece spent his time the day before his final exams. Use the information from the graph to answer the following questions.



59. What is the ratio of time Reece spent studying for his algebra exam to time spent studying for his chemistry exam?
60. What is the ratio of time Reece spent at soccer practice to time spent sleeping?
61. What is the ratio of time Reece spent writing his English paper to the total number of hours in the day?
62. What is the ratio of time Reece spent in free time to the total number of hours in the day?

Iliana is organizing an after school program for kids in her school. The circle graph shown here illustrates the number of kids that have signed up for each session. Use the information from the graph to answer the following questions.

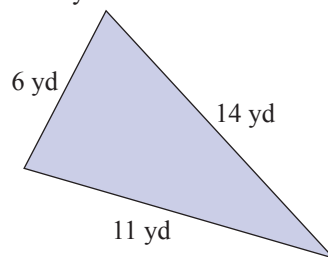


63. What is the ratio of children in Cooking to children in Track and Field?
64. What is the ratio of children in Dance to children in Spanish?
65. What is the ratio of children in Math Tutoring to total children in the program?
66. What is the ratio of children in Painting to total children in the program?

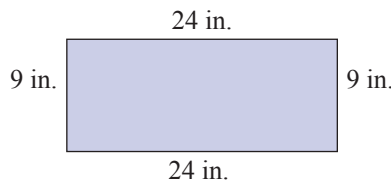
Solve.

67. The lengths of the sides of a triangle are 6 yd, 11 yd, and 14 yd.

- Find the ratio of the length of the longest side to the length of the shortest side.
- Find the ratio of the length of the shortest side to the length of the longest side.



68. The length of a rectangle is 24 in. and its width is 9 in.



- Find the ratio of the length to the width.
 - Find the ratio of the width to the length.
69. If a car consumes 9 gallons of gasoline while being driven 225 miles, what is the unit rate of the distance driven to the gasoline consumed?
70. A certain selective college has 18,400 applicants for 400 openings. What is the unit rate of applicants to openings?
71. An employer who has 6 job openings is overwhelmed with 444 applicants. What is the rate of applicants per job opening?
72. In the new office building he is designing, Steve is including 216 electrical outlets in the offices. If the building will have 36 similar sized offices, what is the unit rate of outlets to offices?
73. A benefactor donated new iPads to his local elementary school. If he gave the school 210 iPads and the school has 42 classrooms, what is the unit rate of iPads per classroom?
74. An automobile manufacturer produces 6000 cars in a week. Find their production rate of cars per day. (Assume a 5 day workweek.)
75. An office entered a local contest for best Christmas decorations and won. If the grand prize was \$1800 and the money was split evenly between all 24 employees, what were the dollar per person winnings?
76. A restaurant charges a flat fee of \$120 to rent the banquet room for an evening. If the room was used for 4 hours, what was its cost per hour?
77. Suppose a basketball player made $\frac{3}{10}$ of the baskets he shot in a basketball game. What does this indicate?

78. Suppose a basketball player made $\frac{6}{13}$ of the baskets he shot during several basketball games. What does this indicate?
79. A home improvement store sells vinyl fence posts in two different sized bundles. A 6-pack of fence posts costs \$222 and a 15-pack of fence posts costs \$510. Which option is the better deal per fence post?
80. A landscaping company needs to purchase marble chip landscaping rocks in bulk for an upcoming project. Brand A sells 9 cubic feet of rocks for \$81. Brand B sells 27 cubic feet for \$270. If the quality of the rocks is equivalent, which brand should the company go with?
81. A set of 6 swirled glass tumblers sell for \$48. What is the price per tumbler?
82. A stand at a farmer's market sells handmade Christmas ornaments. A bundle of 12 ornaments costs \$108. What is the price per ornament?
83. A home decoration store sells area rugs at a discounted price if you buy more than two. An interior designer purchased 6 area rugs for a total of \$684 after the discount. What was the price per rug?
84. A company had calendars printed as part of a promotional giveaway. It cost the company \$600 to print 75 calendars. What was the price per calendar?
85. A tutoring center purchases 85 scientific calculators for a total of \$1340 and receives a \$150 discount. What is the cost per calculator after the discount?
86. A photographer purchases thirteen 16-inch by 20-inch wooden frames for \$460 and receives a \$44 discount. What is the price per frame after the discount?
87. A car travels 434 miles and uses 14 gallons of gas. The fuel efficiency rating for the car is advertised to be 33 miles per gallon.
- Find the rate of miles per gallon for the car.
 - Does the car's mileage per gallon match the advertised mileage per gallon? If not, is it higher or lower?
88. A receptionist at a luxury spa sold 35 memberships during her 5-day work week. She is required to sell an average of 6 memberships per work day.
- Find the rate of memberships per day that the receptionist sold.
 - Does the average number of membership sales by the receptionist match her daily quota? If not, is it higher or lower?
89. A motorist drives along an interstate highway for 3 hours and travels a total of 189 miles. The posted speed limit is 65 miles per hour. Does the motorist's average speed (in miles per hour) match the posted speed limit? If not, is it higher or lower?
90. A nurse sets up a 750 milliliter bag of intravenous solution. The bag empties in 5 hours. The patient's doctor prescribed the solution to be administered at a rate of 150 milliliters per hour. Does the rate that the nurse set the bag at match the prescribed rate? If not, is it higher or lower?

Writing & Thinking

91. Demonstrate three different ways the ratio comparing 5 apples to 3 apples can be written. Choose one form and explain why it is the preferred form when using ratios in a math course.
92. Give an example of when the use of ratios or rates might be relevant in a real life situation.
93. In your own words, define each of the following terms.
 - a. Rate
 - b. Unit rate
 - c. Price per unit
94. When finding price per unit, will monetary units be located in the numerator or the denominator of the rate?