Applications

The problems that follow will give you practice in using rates (especially unit rates) in different situations. Be careful to use measurement units that match correctly in the rates you compute.

1. Maralah can drive her car 580 miles at a steady speed using 20 gallons of gasoline. Make a rate table showing the number of miles her car can be driven at this speed. Show $1, 2, 3, \ldots$, and 10 gallons of gas.

2. Joel can drive his car 450 miles at a steady speed using 15 gallons of gasoline. Make a rate table showing the number of miles his car can be driven at this speed. Show $1, 2, 3, \ldots$, and 10 gallons of gas.

3. Franky's Trail Mix Factory gives customers the following information. Use the pattern in the table to answer the questions.

**Caloric Content of
Franky's Trail Mix**

Grams of Trail Mix	Calories
50	150
150	450
300	900
500	1,500

a. Fiona eats 75 grams of trail mix. How many Calories does she eat?

b. Rico eats trail mix containing 1,000 Calories. How many grams of trail mix does he eat?

c. Write an equation that you can use to find the number of Calories in any number of grams of trail mix.

d. Write an equation that you can use to find the number of grams of trail mix that will provide any given number of Calories.

For Exercises 4–8, you will explore relationships among time, rate, and distance.

4. When she drives to work, Louise travels 10 miles in about 15 minutes. Kareem travels 23 miles in about 30 minutes. Who has the faster average speed?

5. Rolanda and Mali ride bikes at a steady pace. Rolanda rides 8 miles in 32 minutes. Mali rides 2 miles in 10 minutes. Who rides faster?

6. Fasiz and Dale drive at the same speed along a road. Fasiz drives 8 kilometers in 24 minutes. How far does Dale drive in 6 minutes?

7. On a long dirt road leading to camp, buses travel only 6 miles in 10 minutes.

   a. At this speed, how long does it take the buses to travel 18 miles?

   b. At this speed, how far do the buses go in 15 minutes?

8. **Multiple Choice** Choose the fastest walker.

   A. Montel walks 3 miles in 1 hour.

   B. Jerry walks 6 miles in 2 hours.

   C. Phil walks 6 miles in 1.5 hours.

   D. Rosie walks 9 miles in 2 hours.

9. The dairy store says it takes 50 pounds of milk to make 5 pounds of cheddar cheese.

   a. Make a rate table showing the amount of milk needed to make 5, 10, 15, 20, . . . , and 50 pounds of cheddar cheese.

   b. Make a coordinate graph showing the relationship between pounds of milk and pounds of cheddar cheese. First, decide which variable should go on each axis.

   c. Write an equation relating pounds of milk m to pounds of cheddar cheese c.

   d. Explain one advantage of each method (the graph, the table, and the equation) to express the relationship between milk and cheddar cheese production.

10. A dairy manager says it takes 70 pounds of milk to make 10 pounds of cottage cheese.

   a. Make a rate table for the amount of milk needed to make 10, 20, . . . , and 100 pounds of cottage cheese.

   b. Make a graph showing the relationship between pounds of milk and pounds of cottage cheese. First, decide which variable should go on each axis.

   c. Write an equation relating pounds of milk m to pounds of cottage cheese c.

   d. Compare the graph in part (b) to the graph in Exercise 9. Explain how they are alike and how they are different. What is the cause of the differences between the two graphs?

11. A store sells videotapes at $3.00 for a set of two tapes. You have $20. You can split a set and buy just one tape for the same price per tape as the set.

   a. How many tapes can you buy?

   b. Suppose there is a 7% sales tax on the tapes. How many can you buy? Justify your solution.

12. Study the data in these rate situations. Then write the key relationship in three ways:

   ● in fraction form with a label for each part

   ● as two different unit rates with a label for each rate

   a. Latanya's 15-mile commute to work each day takes an average of 40 minutes.

   b. In a 5-minute test, one computer printer produced 90 pages of output.

   c. An advertisement for a Caribbean cruise trip promises 168 hours of fun for only $1,344.

   d. A long-distance telephone call lasts 20 minutes and costs $4.50.

Connections

Rewrite each equation, replacing the variable with a number that makes a true statement.

13. $\frac{4}{9} \times n = 1\frac{1}{3}$

14. $n \times 2.25 = 90$

15. $n \div 15 = 120$

16. $180 \div n = 15$

17. Write two fractions with a product between 10 and 11.

18. Write two decimals with a product between 1 and 2.

A recent world-champion milk producer was a 4-year-old cow from Marathon, Wisconsin. The cow, Muranda Oscar Lucinda, produced a record 67,914 pounds of milk in one year! Use this information for Exercises 19–22.

19. Look back at your answers to Exercise 10. How much cottage cheese could be made from the amount of milk that Muranda Oscar Lucinda produced during her record year?

20. The average weight of a dairy cow is 1,500 pounds. How many dairy cows would be needed to equal the weight of the cottage cheese you found in Exercise 19?

21. One gallon of milk weighs about 8.7 pounds. Suppose a typical milk bucket holds about 3 gallons. About how many milk buckets would Muranda Oscar Lucinda's average daily production of milk fill?

22. One pound of milk fills about two glasses. About how many glasses of milk could you fill with Muranda Oscar Lucinda's average daily production of milk?

23. Some campers bike 10 miles for a nature study. Use this setting to write questions that can be answered by solving each equation. Find the answers, and explain what they tell about the bike ride.

   **a.** $10 \div 8 = \blacksquare$ **b.** $1.2 \times \blacksquare = 10$ **c.** $\blacksquare \div 2 = 5$

The table shows the mean times that students in one seventh-grade class spend on several activities during a weekend. The data are also displayed in the stacked bar graph below the table. Use both the table and the graph for Exercises 24 and 25.

Weekend Activities (hours)

Category	Boys	Girls	All Students
Sleeping	18.8	18.2	18.4
Eating	4.0	2.7	3.1
Recreation	7.8	6.9	7.2
Talking on the Phone	0.5	0.7	0.6
Watching TV	4.2	3.0	3.4
Doing Chores and Homework	3.6	5.8	5.1
Other	9.1	10.7	10.2

Weekend Activities
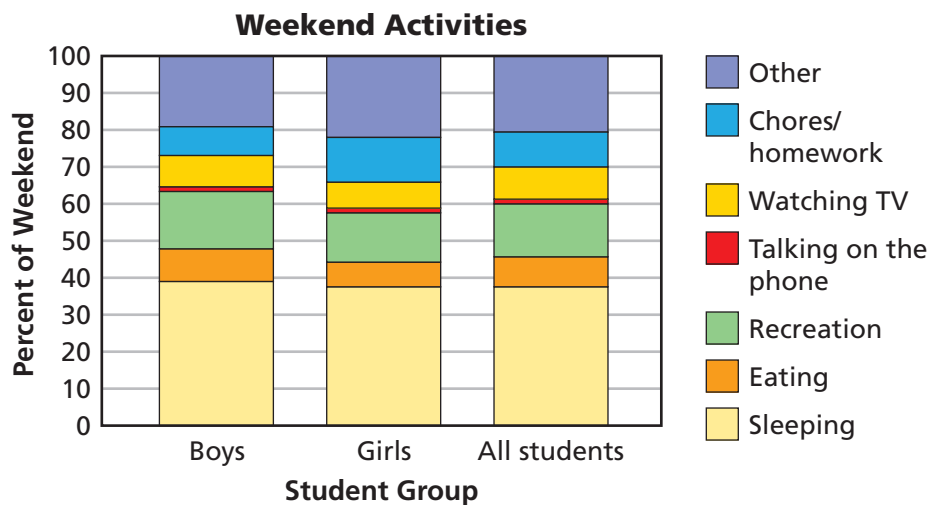
24. The stacked bar graph was made using the data from the table. Explain how it was constructed.

25. Suppose you are writing a report summarizing the class's data. You have space for either the table or the graph, but not both. What is one advantage of including the table? What is one advantage of including the stacked bar graph?

26. This table shows how to convert liters to quarts.

Liters	Quarts
1	1.06
4	4.24
5	5.30
9	9.54

    a. About how many liters are in 5.5 quarts?

    b. About how many quarts are in 5.5 liters?

    c. Write an equation for a rule that relates liters L to quarts Q.

Express each of the relationships in Exercises 27–31 as a unit rate. Label each unit rate with measurement units.

27. 12 cents for 20 beads

28. 8 cents for 10 nails

29. 405 miles on 15 gallons of gasoline

30. 3 cups of water for 2 cups of orange concentrate

31. $4 for 5 cans of soup

32. The two clocks shown below are geometrically similar. One is a reduction of the other. Each outside edge of the larger clock is 2 centimeters long. Each outside edge of the smaller clock is 1.6 centimeters long.

    a. Write an equation relating the length L of any part of the large clock to the length S of the corresponding part of the small clock.

    b. Write an equation relating the area R of any part of the large clock to the area M of the corresponding part of the small clock.

    c. Write a decimal scale factor relating lengths in the large clock to lengths in the small clock. Explain how that scale factor is like a unit rate.

Extensions

33. Chemistry students analyzed the contents of rust. They found that it is made up of iron and oxygen. Tests on samples of rust gave these data.

Contents of Rust

Amount of Rust (g)	Amount of Iron (g)	Amount of Oxygen (g)
50	35.0	15.0
100	70.0	30.0
135	94.5	40.5
150	105.0	45.0

  a. Suppose the students analyze 400 grams of rust. How much iron and how much oxygen should they find?

  b. Is the ratio of iron to oxygen the same in each sample? If so, what is it? If not, explain.

  c. Is the ratio of iron to total rust the same in each sample? If so, what is it? If not, explain.

34. A cider mill owner has pressed 240 liters of apple juice. He has many sizes of containers in which to pack the juice.

  a. The owner wants to package all the juice in containers of the same size. Copy and complete this table to show the number of containers of each size needed to hold the juice.

Containers Needed by Volume

Volume of Container (liters)	10	4	2	1	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{1}{10}$
Number of Containers Needed	■	■	■	■	■	■	■

  b. Write an equation that relates the volume v of a container and the number n of containers needed to hold 240 liters of juice.