

# Investigation 3

## Comparing and Scaling Rates

The following examples illustrate situations involving another strategy to compare numbers.

- My mom's car gets 45 miles per gallon on the expressway.
- We need two sandwiches for each person at the picnic.
- I earn \$3.50 per hour baby-sitting for my neighbor.
- The mystery meat label says 355 Calories per 6-ounce serving.
- My brother's top running rate is 8.5 kilometers per hour.

Each of these statements compares two different quantities. For example, one compares miles to gallons of gas. A comparison of two quantities measured in different units is a **rate**. You have used rates in earlier problems. For example, you used rates in finding pizza per person.

### Getting Ready for Problem 3.1

- What two quantities are being compared in the rate statements above?
- Which of the rate statements is different from the others?



## 3.1 Technology on Sale

Stores, catalogs, and Web sites often use rates in their ads. The ads sometimes give the costs for several items. You might see an offer like the one shown at the right.

### Calculators for School

Fraction: \$120 for 20  
Scientific: \$240 for 15  
Graphing: \$800 for 10



The listed prices are for orders of 10, 15, or 20 to figure the price for any number you want to purchase. One way to figure those prices is to build a *rate table*. A rate table is started below.

**Price of Calculators for Schools**

Number Purchased	1	2	3	4	5	10	15	20
Fraction	■	■	■	■	■	■	■	\$120
Scientific	■	■	■	■	■	■	\$240	■
Graphing	■	■	■	■	■	\$800	■	■

### Problem 3.1 Making and Using a Rate Table

Suppose you take orders over the phone for the calculator company. You should be quick with price quotes for orders of different sizes.

- A.** Build a rate table like the one above. Fill in prices for each type of calculator for orders of the sizes shown.

Use your rate table to answer Questions B–F.

- B.** How much does it cost to buy 53 fraction calculators? How much to buy 27 scientific calculators? How much to buy 9 graphing calculators?
- C.** How many fraction calculators can a school buy if it can spend \$390? What if the school can spend only \$84?
- D.** How many graphing calculators can a school buy if it can spend \$2,500? What if the school can spend only \$560?
- E.** What *arithmetic operation* (addition, subtraction, multiplication or division) do you use to find the cost per calculator?
- F.** Write an equation for each kind of calculator to show how to find the price for any number ordered.

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## 3.2 Time, Rate, and Distance

Sascha cycled on a route with different kinds of conditions. Sometimes he went uphill, sometimes he went mostly downhill. Sometimes he was on flat ground. He stopped three times to record his time and distance:

- Stop 1: 5 miles in 20 minutes
- Stop 2: 8 miles in 24 minutes
- Stop 3: 15 miles in 40 minutes



### Problem 3.2 Finding Rates

Show your work. Label any rate that you find with appropriate units.

- Find Sascha's rate in miles per hour for each part of the route.
- On which part was Sascha cycling fastest? On which part was he cycling slowest?
  - How do your calculations in Question A support your answers?
- Suppose you can maintain a steady rate of 13 miles per hour on a bike. How long will it take you to travel the same distance Sascha traveled in 1 hour and 24 minutes?
- Suppose you were racing Sascha. What steady rate would you have to maintain to tie him?

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### Did You Know?

The highest rate ever recorded on a pedal-powered bicycle was 166.944 miles per hour. Fred Rempelberg performed this amazing feat on October 3, 1995, at the Bonneville Salt Flats in Utah. He was able to reach this rate by following a vehicle. The vehicle acted as a windshield for him and his bicycle.



For: Information about speed records  
Web Code: ane-9031

### 3.3 Comparing CD Prices

The ads below use rates to describe sale prices. To compare prices in sales such as these, it's often useful to find a unit rate. A **unit rate** is a rate in which one of the numbers being compared is 1 unit. The comparisons "45 miles per gallon," "\$3.50 per hour," "8.5 kilometers per hour," and "two sandwiches for each person" are all unit rates. "Per gallon" means "for one gallon" and "per hour" means "for one hour."



#### Problem 3.3 Unit Rates and Equations

Use unit rates to compare the ad prices and to find the costs of various numbers of CDs at each store.

- Which store has the lower price per CD?
- For each store, write an equation (a rule) that you can use to calculate the cost  $c$  for any purchase of  $n$  compact discs.
- Use the equations you just wrote for Question B. Write new equations to include 5% sales tax on any purchase.

- D.** Suppose a Web site sells CDs for \$8.99 per disc. There is no tax, but there is a shipping charge of \$5 for any order. Write an equation to give the cost  $c$  of any order for  $n$  discs from the Web site.
- E.** Use your equations from Question C or make a rate table to answer each question.
1. How many discs do you have to order from the Web site to get a better deal than buying from Music City?
  2. How many discs do you have to order from the Web site to get a better deal than buying from CD World?

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## 3.4

### What Does Dividing Tell You?

**I**n this problem, the questions will help you decide which way to divide when you are finding a unit rate. The questions will also help you with the meaning of the quotient after you divide.

#### Getting Ready for Problem 3.4

Dario has two options for buying boxes of pasta. At CornerMarket he can buy seven boxes of pasta for \$6. At SuperFoodz he can buy six boxes of pasta for \$5.

At CornerMarket, he divided 7 by 6 and got 1.16666667. He then divided 6 by 7 and got 0.85714286. He was confused. What do these numbers tell about the price of boxes of pasta at CornerMarket?

Decide which makes more sense to you. Use that division strategy to compare the two store prices. Which store offers the better deal?

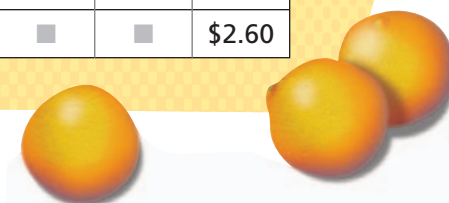
### Problem 3.4 Two Different Rates

Use division to find unit rates to solve the following questions. Label each unit rate.

- A.** SuperFoodz has oranges on sale at 10 for \$2.
1. What is the cost per orange?
  2. How many oranges can you buy for \$1?
  3. What division did you perform in each case? How did you decide what each division means?
  4. Complete this rate table to show what you know.

**Cost of Oranges at SuperFoodz**

Oranges	10	■	1	20	11	■
Cost	\$2.00	\$1.00	■	■	■	\$2.60



- B.** Noralie used 22 gallons of gas to go 682 miles.
1. What are the two unit rates that she might compute?
  2. Compute each unit rate and tell what it means.
  3. Which seems more useful to you? Why?



- C.** It takes 100 maple trees to make 25 gallons of maple syrup.
1. How many maple trees does it take for 1 gallon of syrup?
  2. How much syrup can you get from one maple tree?



- D.** A 5-minute shower requires about 18 gallons of water.
1. How much water per minute does a shower take?
  2. How long does a shower last if you use only 1 gallon of water?
- E.**
1. At the CornerMarket grocery store, you can buy eight cans of tomatoes for \$9. The cans are the same size as those at CannedStuff, which sells six cans for \$5. Are the tomatoes at CornerMarket a better buy than the tomatoes at CannedStuff?
  2. What comparison strategies did you use to choose between CornerMarket and CannedStuff tomatoes? Why?

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