

**Challenge: Skills and Applications**

For use with pages 656–662

In Lesson 11.3, you worked with functions where  $y$  varied directly or inversely with  $x$ . It is also possible to have a function where  $y$  varies directly or inversely with some power of  $x$ .

**In Exercises 1–2, use the following information.**

The weight of an object varies inversely as the square of its distance from the center of Earth. Suppose at sea level, about 4000 miles from the center of Earth, an object weighs 120 pounds.

- How much would the object weigh at the top of Mount Everest about 5.5 miles above sea level?
- How much would the object weigh at the Dead Sea, about 0.25 miles below sea level?

**In Exercises 3–4, use the following information.**

On a calm day, the air resistance that a bicyclist must overcome varies directly as the square of the speed of the bicycle. This means that if  $F$  is the air resistance and  $s$  is the speed of the bicycle, then  $\frac{F}{s^2} = k$ , where  $k$  is a constant.

- Suppose that at a speed of 18 miles/hour a bicyclist encounters a resistance of 0.81 pound. Find the force of air resistance for the same bicyclist traveling at 21 miles/hour.
- Suppose that at a speed of 15 miles/hour a bicyclist encounters a resistance of 0.9 pound. After speeding up, the same bicyclist encounters a resistance of 1.44 pounds. What is the bicyclist's new speed?

**In Exercise 5, use the following example.**

**Example:** Suppose  $y$  varies directly with  $x$  and inversely with  $v$ , and suppose  $y = 14$ , when  $x = 42$  and  $v = 12$ . Find  $y$  when  $x = 5$  and  $v = 8$ .

**Solution:** The variation can be written  $y = \frac{kx}{v}$ . Using the data, you have

$$14 = \frac{42k}{12} \Rightarrow 168 = 42k \Rightarrow k = 4.$$

$$\text{Therefore, when } x = 5 \text{ and } v = 8, y = \frac{(4)5}{8} = 2.5.$$

- Suppose  $y$  varies directly with  $x$  and inversely with the square of  $v$ , and that  $y = 5$ , when  $x = 50$  and  $v = 14$ . Find the constant of variation  $k$  and then find the value of  $y$  when  $x = 55$  and  $v = 2$ .