

# 7-1 Reteaching

## Exploring Exponential Models

- The general form of an exponential function is  $y = ab^x$ , where  $a$  is the initial amount and  $b$  is the growth or decay factor.
- To find  $b$ , use the formula  $b = 1 + r$ , where  $r$  is the constant rate of growth or decay. If  $r$  is a rate of growth, it will be positive. If  $r$  is a rate of decay, it will be negative. Therefore, if  $b$  is greater than 1, the function models growth. If  $b$  is between zero and 1, the function models decay. When you see words like *increase* or *appreciation*, think growth. When you see words like *decrease* or *depreciation*, think decay.
- For an exponential function, the  $y$ -intercept is always equal to the value of  $a$ .

### Problem

Carl's weight at 12 yr is 82 lb. Assume that his weight increases at a rate of 16% each year. Write an exponential function to model the increase. What is his weight after 5 years?

**Step 1** Find  $a$  and  $b$ .

$$a = 82 \quad a \text{ is the original amount.}$$

$$b = 1 + 0.16 \quad b \text{ is the growth or decay factor. Since this problem models growth, } r \text{ will be positive. Make sure to rewrite the rate, } r, \text{ as a decimal.}$$

$$= 1.16$$

**Step 2** Write the exponential function.

$$y = ab^x \quad \text{Use the formula.}$$

$$y = 82(1.16)^x \quad \text{Substitute.}$$

**Step 3** Calculate.

$$y = 82(1.16)^5 \quad \text{Substitute 5 for } x.$$

$$y \approx 172.228 \quad \text{Use a calculator.}$$

Carl will weigh about 172 lb in 5 years.

### Exercises

Determine whether the function represents exponential growth or exponential decay. Then find the  $y$ -intercept.

1.  $y = 8000(1.15)^x$  **growth; 8000**

2.  $y = 20(0.75)^x$  **decay; 20**

3.  $y = 15\left(\frac{1}{2}\right)^x$  **decay; 15**

4.  $f(x) = 6\left(\frac{5}{2}\right)^x$  **growth; 6**

# 7-1 **Reteaching** (continued)

## Exploring Exponential Models

You can use the general form of an exponential function to solve word problems involving growth or decay.

### Problem

A motorcycle purchased for \$9000 today will be worth 6% less each year. How much will the motorcycle be worth at the end of 5 years?

**Step 1** Find  $a$  and  $b$ .

$$a = 9000 \quad a \text{ is the original amount.}$$

$$b = 1 + (-0.06) \quad b \text{ is the growth or decay factor. Since this problem models decay, } r \text{ will be negative. Make sure to rewrite the rate, } r, \text{ as a decimal.}$$

$$= 0.94$$

**Step 2** Write the exponential function.

$$y = ab^x \quad \text{Use the formula.}$$

$$y = 9000(0.94)^x \quad \text{Substitute.}$$

**Step 3** Calculate.

$$y = 9000(0.94)^5 \quad \text{Substitute 5 for } x.$$

$$y \approx 6605.13 \quad \text{Use a calculator.}$$

The motorcycle will be worth about \$6605.13 after 5 years.

## Exercises

**Write an exponential function to model each situation. Find each amount after the specified time.**

- A tree 3 ft tall grows 8% each year. How tall will the tree be at the end of 14 yr?  
Round the answer to the nearest hundredth.  $y = 3(1.08)^x$ ; **8.81 ft**
- The price of a new home is \$126,000. The value of the home appreciates 2% each year. How much will the home be worth in 10 yr?  
 $y = 126,000(1.02)^x$ ; **\$153,593.29**
- A butterfly population is decreasing at a rate of 0.82% per year. There are currently about 100,000 butterflies in the population. How many butterflies will there be in the population in 250 years?  
 $y = 100,000(0.9918)^{250}$ ; **12,765 butterflies**
- A car depreciates 10% each year. If you bought this car today for \$5000, how much will it be worth in 7 years?  $y = 5000(0.90)^7$ ; **\$2391.48**