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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. $y = 8000(1.15)^x$

2. $y = 20(0.75)^x$

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

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

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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 .

$$a = 9000$$

a is the original amount.

$$b = 1 + (-0.06)$$

b is the growth or decay factor. Since this problem models decay, r will be negative. Make sure to rewrite the rate, r , as a decimal.

$$= 0.94$$

Step 2 Write the exponential function.

$$y = ab^x$$

Use the formula.

$$y = 9000(0.94)^x$$

Substitute.

Step 3 Calculate.

$$y = 9000(0.94)^5$$

Substitute 5 for x .

$$y \approx 6605.13$$

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.
- 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?
- 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?
- A car depreciates 10% each year. If you bought this car today for \$5000, how much will it be worth in 7 years?