8-1 Exploring Exponential Models

Vocabulary

Exponential Function: is a function with the general form $y = ab^x$, where x is a real number, $a \neq 0, b > 0, and\ b \neq 1.$

When $b > 1$, then b is a growth factor.

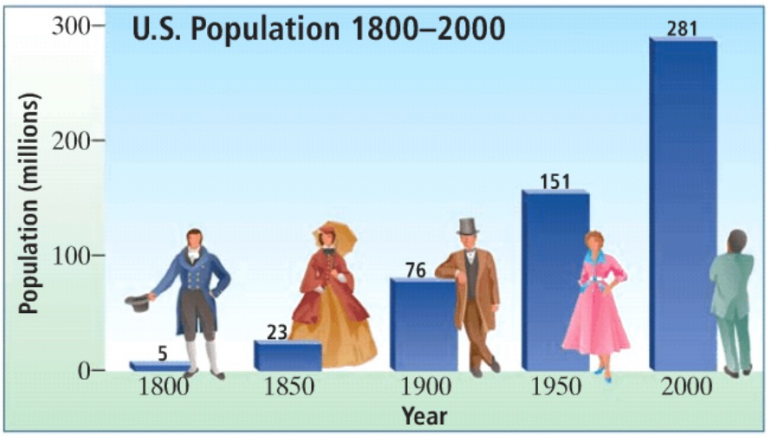
When $b < 1$, then b is a decay factor.

Asymptote: a line that a graph approaches as x or y increases in absolute value.

Finding the Growth Factor

You can use an exponential function to model population growth. If you know the rate of increase r, you can find the growth factor by using the equation $b = 1 + r$.

Refer to the graph. In 2000, the annual rate of increase in the U.S. population was about 1.24%. Suppose the rate of increase continues to be 1.24%. Which function best models U.S. population growth, in millions, after 2000?



SOURCE: U.S. Census Bureau. Go to **www.PHSchool.com** for a data update. Web Code: agg-9041

$r = 0.0124$

$b = 1 + r$

$b = 1 + 0.0124$

$b = 1.0124$

Relate The population increases exponentially, so use the general form of an exponential function, $p(x) = ab^x$.

Define Let x = number of years after 2000.

Let $p(x)$ = the population in millions.

Write $p(x) = a(1.0124)^x$

b

(2000, 281)
year millions

(0, 281)

$281 = a(1.0124)^0$

$281 = a$

$p(x) = 281(1.0124)^x$
b

$b = 1 + r$

$1.0124 = 1 + r$
$-1 \quad -1$

$0.0124 = r$

$1.24\% =$

Finding the Decay Factor

The graph shows the expected depreciation for a car over four years. Estimate the value of the car after six years.

Decay factor b equals 1 + r, where r is the annual rate of decrease. The initial value of the car is $20,000. After one year the value is $17,000.

$b = 1 + r$

$$\frac{\text{final value} - \text{initial value}}{\text{initial value}} = r$$

$$\frac{17{,}000 - 20{,}000}{20{,}000} = r$$

$$-0.15 = r$$

$b = 1 + r$ $b = 1 + (-0.15)$ $b = .85$