When an exponential models a "real life" situation:

$$y = a \cdot b^x$$

The initial amount

Growth Factor $b>1$ or Decay Factor $0<b<1$

Number of time periods
Future: $t > 0$
Past: $t < 0$
Present: $t=0$

Use the given information to find the base (b) of an exponential equation that could model the situation.

1. Each year there is 20% more. $b = 1.2$
   100% + 20% = 120%
2. Each day there is 5% less. $b = 0.95$
   100% − 5% = 95%
3. Each month there is 31.6% more. $b = 1.316$
   100% + 31.6% = 131.6%
4. Each week there is 17.3% less. $b = 0.827$
   100% − 17.3%
   = 82.7%

Each given situation is exponential: $y = a(b)^x$

What would the exponent, x, represent in each situation?

1. Each year there is 14% less. x is # of years
2. Each day there is 35% more. x is # of days
3. Every 6 months there is 5.7% more. x is # of 6 month periods

For each function find the percent increase or decrease that the function models.

1. $800(0.816)^x$

   x100
   81.6%
   − 100
   − 18.4% dec

2. $1.667(1.204)^x$

   x100
   120.4%
   − 100
   20.4% inc

The population of a city in 2012 was 24,400. The population has been increasing 3.5% each year.

$100\% + 3.5\% \rightarrow b = 103.5$

1. Model this situation with an exponential equation.

$y = 24{,}400(1.035)^x$

2. Find the population in the following year.

a. 2020

$x = 2020 - 2012 = 8 \rightarrow 24{,}400(1.035)^8 = 32{,}130$

b. 2007

$x = 2007 - 2012 = -5 \rightarrow 24{,}400(1.035)^{-5} = 20{,}544$

The value of a business as been decreasing 2.9% each year. The value in 2009 was $2,500,000.

$100\% - 2.9\% = 97.1\% \longrightarrow b = .971$

1. Find the value of the business in 2016.

$2{,}500{,}000(.971)^7 = \$2{,}034{,}579.28$

2. Find the value of the business in 2000.

$2{,}500{,}000(.971)^{-9} = \$3{,}258{,}118.98$

The number of cases of flu is increasing 22% every 4 days. On February 1 there were 176 cases of flu.

$100\% + 22\% = 122\%$ $\quad y = 176(1.22)^x$

$b = 1.22$

a. Find the number of cases 12 days later.

$x = \frac{12 \text{ days}}{4 \text{ days}} = 3 \quad 176(1.22)^3 \approx 320$

b. Find the nmber of cases of flu 3 weeks later.

$x = 3 \text{ wks} = \frac{21 \text{ days}}{4 \text{ days}} \quad 176(1.22)^{21/4} \approx 500$

The number of deer in the county has been decreasing 5.6% every 5 years. The number of deer in 2009 was 9,500.

$100 - 5.6 = 94.4\% \rightarrow 0.944 \quad y = 9500(.944)^x$

a. Find the number of deer in 2014.

$x = \frac{5 \text{ yrs}}{5 \text{ yr}} = 1 \quad 9500(.944)^1 = \boxed{8968 \text{ deer}}$

b. Find the number of deer in 2020.

$x = \frac{11 \text{ yrs}}{5 \text{ yr}} = 2.2 \quad 9500(.944)^{2.2} = \boxed{8469 \text{ deer}}$

When a couple's first child is born they invest $10,000 in an account that pays 8% interest annually. How much will be in the account when the child turns 18 years old?

$100\% + 8\% = 108\%$

$b = 1.08$

$y = 10{,}000(1.08)^{18} = \boxed{\$39{,}960.19}$

You can now finish Hwk #33

Sec 8-1

Due tomorrow

Pages 434 - 436

Problems 9, 20-23, 35-38, 45-48

The value of an investment is increasing 8% each year. If the investment's value today is $125,000 find the number of years it will take to reach $1,000,000.

$$\frac{1{,}000{,}000}{125{,}000} = \frac{125{,}000(1.08)^x}{125{,}000}$$

$8 = 1.08^x$

$\boxed{x \approx 27}$

Students don't know how to solve this yet so they can use trial and error to find the "solution".

Find the value of x in each equation:
Round to the nearest hundredth when needed.

1. $\frac{12x}{12} = \frac{600}{12}$ $x = 50$

2. $\sqrt[3]{64} = \sqrt[3]{x^3}$ $x = 4$

3. $10^5 = x$ $x = 100{,}000$

4. $10^x = 200$ Students don't know how to solve this yet. A little trial and error will lead to x = 2.30

Every math operation has it's inverse.

Inverse operations "undo" each other.

We solve equations by using inverses to get the variable by itself.

What operation is the inverse of each given operation?

Given Operation	Inverse Operation
Addition	Subtraction
Division	Multiplication
Squaring	Square Root
Cube Root	Cubing

Find the equation of the inverse for this function:

$$y = \sqrt{\frac{4x^3 - 7}{8}} + 1$$

step 1: Switch x and y
Step 2: Solve for y.

$$x = \sqrt{\frac{4y^3 - 7}{8}} + 1$$

$$\sqrt[3]{\frac{8(x-1)^2 + 7}{4}} = y \text{ or } f^{-1}$$

Find the equation of the inverse.

$$y = 10^x$$

Right now students don't know how to solve exponential equations or write the inverse of exponential equations.

This will take a new function.

To solve for x in an exponential equation: $y = 4^x$
we use the inverse operation called:

Logarithm