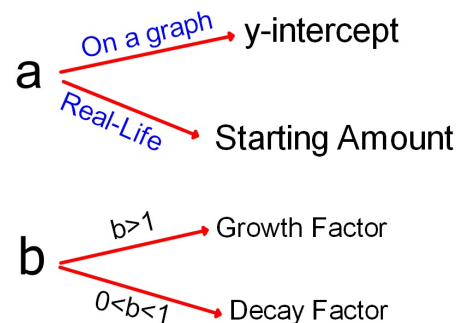


Sec 8-8: Exponential Growth and Decay: Real-Life Models

$$y = a \cdot b^x \longrightarrow a(b)^x$$



Take a small white board, pen, and rag

Does each equation represent exponential growth or decay?

- $y = 12\left(\frac{7}{6}\right)^x$ G
- $y = 0.05(1.013)^x$ G
- $y = 3\left(\frac{12}{13}\right)^x$ D
- $y = 5(16)^{-x}$ D
- $y = 1250(0.95)^x$ D
- $y = 67\left(\frac{5}{9}\right)^{-x}$ G

A TV costs \$500 but the price is decreased 20%. Find the new price.

$$\begin{array}{l|l} .20(500) = 100 & 100\% - 20\% = 80\% \\ 500 - 100 = \$400 & 80(500) = 400 \end{array}$$

You bought a house for \$125,000. The value of the house increased 6%. Find the new value of the house.

$$\begin{array}{l|l} (.06)(125,000) = 7500 & 100\% + 6\% = 106\% \\ 125,000 + 7500 = \$132,500 & (1.06)(125,000) = \$132,500 \end{array}$$

If the price of a car this year is 100% of last year's price what does this mean about this year's price compared to last year's price?

This year's price is the SAME as last year's price.

If this year's price is an increase of 9% over last year's price then this year's price is what percent of last year's price?

This year's price is 109% of last year's price

If this year's price is a decrease of 30% compared to last year's price then this year's price is what percent of last year's price?

This year's price is 70% of last year's price

Find the growth/decay factor (b).

1. This year's population increased 4% over last year's population.

a) What is this year's population as a percentage of last year's population? 104%

b) $b = 1.04$

This is a growth factor

Find the growth/decay factor (b).

2. The value of my house decreased 8% since last year.

a) What is the value of my house this year as a percentage of last year's value? $100 - 8 = 92\%$

b) $b = .92$

This is a decay factor

Take each percent change and find the growth or decay factor.

1. 83% decrease. $b = 0.17$ $100 - 83 = 17\%$
2. 3.9% increase. $b = 1.039$ $100 + 3.9 = 103.9\%$
3. 0.875% decrease. $b = 0.99125$ $100 - 0.875 = 99.125\%$
4. 135% increase. $b = 2.35$ $100 + 135 = 235\%$
5. 24.01% decrease. $b = 0.7599$ $100 - 24.01 = 75.99\%$
6. 0.35% increase. $b = 1.0035$ $100 + 0.35 = 100.35\%$

Given this exponential equation: $y = 250(1.7)^x$

Does this equation represent growth or decay?

Growth

What percent change does this equation represent?

$$b = 1.7 \rightarrow 170\% \\ \frac{-100}{70\% \text{ inc}}$$

Use the small white board

For each exponential equation find the percent change and tell if it's an increase or decrease.

1. $y = 8(1.402)^x$ $\rightarrow 140.2\% \rightarrow 40.2\% \text{ inc}$
2. $y = 80(0.72)^x$ $\rightarrow 72\% \rightarrow 28\% \text{ dec}$
3. $y = 244(1.068)^x$ $106.8\% \rightarrow 6.8\% \text{ inc}$
4. $y = 1500(0.985)^x$ $98.5\% \rightarrow 1.5\% \text{ dec}$

The population of a city in 2002 was 41,000 and has been increasing 3% each year.

Write an exponential equation to model this situation:

$$y = a(b)^x \rightarrow y = 41,000(1.03)^x \quad b = 1.03 \quad 100 + 3 = 103\%$$

What will the population be in 2013?

$$x \rightarrow \# \text{ yrs Since } 2002 = 11 \\ 41,000(1.03)^{11} = 56,754$$

What was the population in 1995?

$$41,000(1.03)^{-7} = 33,337$$

The value of a house has been decreasing 7.5% each year. The house was worth \$120,000 in 2001.

$$100 - 7.5 = 92.5\%$$

$$b = .925$$

1. Model this situation with an exponential equation.

$$y = a(b)^x \longrightarrow y = 120,000(.925)^x$$

2. Find the value of the house in 2010

$$120,000(.925)^9 = \$59,491.76$$

3. Find the value of the house in 1997

$$120,000(.925)^{-4} = 163,913.35$$