D.5 - Day 3 - Log/Exponential Models and Applications

Ex.

1.) Get the number with the exponent by itself.

$$\frac{20000}{5000} = \frac{5000(1 + .03)^x}{5000}$$

2.) Take the log of both sides of equation.

$$\log 4 = \log 1.03^x$$

3.) The Power Prop. allows the exponent to move in front of *log*.

$$\log 4 = \log 1.03^x$$

4.) To solve for x, divide both sides by log (1.03). Use calculator!

$$\frac{\log(4)}{\log(1.03)} = \frac{x \log(1.03)}{\log(1.03)}$$

$$\mathbf{46.9 = x}$$

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Ex.1 Write an exponential model for the situation and solve.

A certain population of foreign fish in a lake has been steadily increasing at a rate of 13% each year. Initially it is estimated that 125 of these fish were introduced to the lake. In how many years will it take for this population to reach over 10,000? *(Round to the nearest tenth)*

$y = a(1 \pm r)^t$

$r = .13$

$a = 125$

$t = ?$

$y = 10,000$

$$\frac{10000}{125} = \frac{125(1+.13)^t}{125}$$

$$80 = 1.13^t$$

$$\log(80) = \log(1.13)^t$$

$$\frac{\log(80)}{\log(1.13)} = \frac{t \cdot \log(1.13)}{\log(1.13)}$$

$$\boxed{t = 35.9 \text{ yrs.}}$$

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Ex.2 Write an exponential model for the situation and solve.

In the city of Decatur, IL the population has been steadily decreasing for years at about a rate of 2.75%. In 2015 the population is 60,000 people. Find how many years it will take for Decatur's population to reach below 42,000 people. *Round to the nearest tenth.*

$a = 60{,}000$

$r = .0275$

$t = ?$

$y = 42{,}000$

$$\frac{42000}{60000} = \frac{60000}{60000}(1-.0275)^t$$

$$0.7 = 0.9725^t$$

$$\frac{\log(0.7)}{\log(0.9725)} = t$$

$$\boxed{t = 12.8 \text{ yrs.}}$$

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Ex.3 Write an exponential model for the situation and solve.

A scientist notes that the bacteria count in a petrie dish is 50. The number of bacteria double every hour. How long until 1,000,000 bacteria are present?

100% growth

$y = 1{,}000{,}000$

$r = 1$

$t = ?$

$a = 50$

$$\frac{1000000}{50} = \frac{50}{50}(1+1)^t$$

$$20000 = 2^t$$

$$\frac{\log(20000)}{\log(2)} = t$$

$$\boxed{t = 14.3 \text{ hours}}$$

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