D.5 - Exponential/Logarithmic Modeling and Applications

Exponential Model:

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

y = the amount after t time a = the initial amount

t = time gone by r = the rate of growth (+) or decay (-)

Half-Life Model:

$$y = a(0.5)^{\frac{t}{k}}$$

y = the amount after t time a = the initial amount

t = time gone by k = the half-life time

Continuous Compound Interest Model/Alternate exponential model:

$$y = P \cdot e^{rt}$$

y = the amount after t time

t = time gone by

P = the initial (principal) amount

r = interest rate

Feb 25-8:04 AM

Write an exponential model for this situation and solve.

In Titusville, FL there were 43,581 people in 2005. Since 2005, the population has been steadily decreasing at a rate of about 1.1% per year. If this trend continued, what will be the expected population in 2030? *(Round to the nearest person)*

$y = ?$

$a = 43581$

$t = 25$

$r = .011$

$y = 43581(1 - .011)^{25}$

$y = 33{,}053$ people

Feb 25-8:16 AM

Write an exponential model for this situation and solve.

Bobby has $9220.52 in his bank account after 6 years of his principal investment being compounded continuously at 3.5%. What was the value of his initial investment? *(Round your answer to the nearest cent.)*

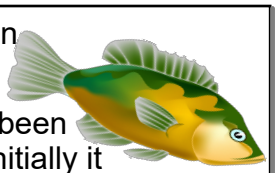
$y = 9220.52$
$P = ?$
$t = 6$
$r = .035$

$$\frac{9220.52}{e^{(.035\cdot 6)}} = \frac{P\cdot e^{(.035\cdot 6)}}{e^{(.035\cdot 6)}}$$

$$P = \$7474.01$$

Feb 25-8:20 AM

Write an exponential model for this 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)*

$y = 10{,}000$
$a = 125$
$t = ?$
$r = .13$

$y = a(1+r)^t$

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

$$80 = (1.13)^t$$

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

$$t \approx 35.9 \text{ yrs}$$

Feb 25-8:26 AM

Write an exponential model for this situation and solve.

Find at what percent rate a principal investment of $125,000 will become one million dollars if it is compounded continuously for 20 years. *(Round your answer to the nearest ten-thousandth percent)*

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

$P = 125{,}000$

$r = ?$

$t = 20$

$y = P \cdot e^{rt}$

$\frac{1000000}{125000} = \frac{125000 \cdot e^{20r}}{125000}$

$8 = e^{20r}$

$\ln(8) = \ln(e)^{20r}$

$\frac{\ln(8)}{20} = \frac{20r}{20}$

$r = 0.103972077$

$\times 100$

$10.3972\ \%$

Feb 25-8:47 AM

Write an exponential model for this situation and solve.

An official is testing a tennis ball's integrity. She drops the ball from a height of 5 feet. Its rebound was approximately 36 inches on the first bounce and 21.6 inches on the second. What exponential function would model this tennis ball's bounce?

5×12 in. $\hookrightarrow$ 60 in.

$y =$

$a = 60$

$r = 0.4$

$t =$

$y = 60(1 - 0.4)^x$

$y = 60(0.6)^x$

$r = \frac{(60 - 36)}{60} = 0.4$

Feb 25-8:33 AM

Homework (***I WILL BE CHECKING TOMORROW!!!***)

I. 7-1: p.439: 26 - 30 all, 42, 44, 46

II. 7-2: p.447: 6, 28 - 32 all, 36, 37, 44, 49

III. 7-5: p. 473: 31, 82

IV. 7-6: p. 482: 53, 66

Mar 13-12:22 PM