

2.3 Day3 - Other Log/Expo Apps and Modeling

Basic Exponential Growth or Decay Model:

$$A = A_0(1 \pm r)^t$$

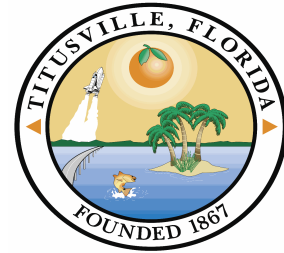
A = the amount after t time A_0 = the initial amount
 t = time gone by r = the rate of growth (+) or decay (-)

Ex.1) 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)

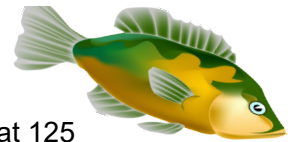
$$A = 43581(1 - .011)^{25}$$

$$A = 33053 \text{ people}$$



Ex.2) Write an exponential model for these situations and solve.

a.) A certain population of invasive foreign fish in a lake has been steadily increasing at a rate of 13% each year since 2006. Initially it is estimated that 125 of these fish were introduced to the lake. In what year will it be for this population to reach 10,000? (Round to the nearest year)



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

$$80 = (1.13)^t$$

$$\log_{1.13}(80) = t$$

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

$$t = 36 \text{ yrs.}$$

$$\frac{2006}{+36}$$

$$\boxed{\text{Yr. 2042}}$$

~~b.) Crazy Rabbits - The number of rabbits in Elkgrove has been doubling every month. There were 20 rabbits present in 2005. How long will it take for the population to become 500,000?~~

Half-Life Model:

$$A = A_0 (0.5)^{\frac{t}{k}}$$

A = the amount after t time A_0 = the initial amount
 t = time gone by k = the half-life time



Ex. 3) Write an exponential model for this situation and solve.

The half-life of a certain radioactive substance is 14 days. There are 6.6 grams present initially. How long exactly until there will be 1 gram remaining?

$k = 14$ days
 $A_0 = 6.6$ g
 $A = 1$ g
 $t = ?$

$$\frac{1}{6.6} = \frac{6.6}{6.6} (0.5)^{t/14}$$

$$\frac{1}{6.6} = (0.5)^{t/14}$$

$$\log_{0.5} \left(\frac{1}{6.6} \right) = \frac{t}{14}$$

$$\frac{\ln \left(\frac{1}{6.6} \right)}{\ln(0.5)} = \frac{t}{14} \cdot 14$$

$t = 38$ days, 2 hours, 44 min, 55 s.

Ex. 4) Write an exponential model for the situations and solve.

The half-life of a certain radioactive substance is 2.5 seconds. $k =$



~~If an initial amount of 1 kilogram is present, how long until the amount is 2 grams? (Round to the nearest...)~~

b.) Determine the initial amount if there was 1 gram left after 1 minute.

$A = 1$ g
 $t = 1$ min \rightarrow 60 s.
 $k = 2.5$ s.
 $A_0 = ?$

$$1 = A_0 (0.5)^{\frac{60}{2.5}}$$

$$\frac{1}{(0.5)^{24}} = \frac{A_0}{(0.5)^{24}}$$

$A_0 = 16,777,216$ grams

Answers to HW 2.3 Day 3

- 1.) a.) $A = 25,405$ people
b.) About the year 2036
- 2.) About the year 2034
- 3.) $A_0 = 244$ bacteria cells
- 4.) $t = 72$ days
- 5.) $t = 3$ hours, 57 minutes, 2.5 seconds
- 6.) $A_0 = 15,758.6$ grams