NAME Key

7-8 Practice

Using Exponential and Logarithmic Functions

1. How many hours will it take a culture of bacteria to increase from 20 to 2000? Use $k = 0.614$.

$\frac{2000}{20} = \frac{20e^{.614t}}{20}$

$\ln 100 = \ln e^{.614t}$

$\frac{\ln 100}{.614} = \frac{.614t}{.614}$

$t = 7.5$ hours

2. A radioactive substance has a half-life of 32 years. Find the constant k in the decay formula for the substance.

$.5a = ae^{-32k}$

$\ln .5 = \ln e^{-32k}$

$\frac{\ln .5}{-32} = \frac{-32k}{-32}$

$k = .0217$

3. Cobalt, an element used to make alloys, has several isotopes. One of these, cobalt 60, is radioactive and has a half-life of 5.7 years. Cobalt 60 is used to trace the path of nonradioactive substances in a system. What is the value of k for cobalt 60?

$.5a = ae^{-5.7k}$

$\ln .5 = \ln e^{-5.7k}$

$\frac{\ln .5}{-5.7} = \frac{-5.7k}{-5.7}$

$k = .1216$

4. Modern whales appeared 5–10 million years ago. The vertebrae of a whale discovered by paleontologists contain roughly 0.25% as much carbon-14 as they would have contained when the whale was alive. How long ago did the whale die? Use $k = 0.00012$.

$\ln .0025 = \ln e^{-.00012t}$

$\frac{\ln .0025}{-.00012} = \frac{-.00012t}{-.00012}$

$t = 49{,}928.87$ yrs

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5. The population of rabbits in an area is modeled by the growth equation $P(t) = 8e^{0.26t}$, where P is in thousands and t is in years. How long will it take for the population to reach 25,000?

$\frac{25}{8} = \frac{8e^{.26t}}{8}$

$\ln 3.125 = \ln e^{.26t}$

$\frac{\ln 3.125}{.26} = \frac{.26t}{.26}$

$t = 4.38$ yrs

6. A radioactive element decays exponentially. The decay model is given by the formula $A = A_0e^{-0.04463t}$. A is the amount present after t days and A_0 is the amount present initially. Assume you are starting with 50g. How much of the element remains after 10 days? 30 days?

$A = 50e^{-.04463(10)}$

$A = 32$g

$A = 50e^{-.04463(30)}$

$A = 13.11$g

7. A population is growing continuously at a rate of 3%. If the population is <u>now</u> 5 million, what will it be in 17 years' time?

$y = 5e^{.03(17)}$

$y = 8.33$ Million

8. A certain bacteria is growing exponentially according to the model $y = 80e^{kt}$. Using $k = 0.071$, find how many hours it will take for the bacteria reach a population of 10,000 cells?

$\frac{10000}{80} = \frac{80e^{.071t}}{80}$

$\ln 125 = \ln e^{.071t}$

$\frac{\ln 125}{.071} = \frac{.071t}{.071}$

$t = 68$ hours