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Algebra II

Exponential Equations Word Problems

1. A population of wolves in a county is represented by the equation $P(t) = 80(0.98)^t$, where t is the number of years since 1998. After how many years will the population of wolves be 60 rounded to the *nearest year*?

$P(t)$

$$\frac{60}{80} = \frac{80(0.98)^t}{80}$$

$$\log \frac{3}{4} = \log 0.98^t$$

$$\frac{\log \frac{3}{4}}{\log 0.98} = \frac{t \log 0.98}{\log 0.98}$$

$$= t$$

2. Juliette deposits $3000 into a bank account where the balance of the account $b(t)$ after t years can be represented by $b(t) = 3000e^{.042t}$. To the nearest tenth of a year, how long will it take for Juliette's money to double?

$b(t) = 2(3000) = 6000$

$$\frac{6000}{3000} = \frac{3000e^{.042t}}{3000}$$

$$2 = e^{.042t}$$

$$\ln 2 = \ln e^{.042t}$$

$$\frac{\ln 2}{.042} = \frac{.042t \ln e}{.042}$$

$$16.5 = t$$

3. 200 grams of a radioactive substance decays according to the formula $a(t) = 200(.094)^{2t}$ where $a(t)$ is the amount of the radioactive substance remaining after t years. To the nearest hundredth of a year, how long will it take until there are 150 grams remaining?

$a(t)$

$$\frac{150}{200} = \frac{200(.094)^{2t}}{200}$$

$$\log \frac{3}{4} = \log .094^{2t}$$

$$\frac{\log \frac{3}{4}}{2\log .094} = \frac{2t \log .094}{2\log .094}$$

$$.06 = t$$

4. After an oven is turned on, its temperature, T, is represented by the equation $T = 400 - 350(3.2)^{-0.1m}$, where m represents the number of minutes after the oven is turned on and T represents the temperature of the oven, in degrees Fahrenheit.
How many minutes does it take for the oven's temperature to reach 300°F? Round your answer to the *nearest minute.*

T

$300 = 400 - 350(3.2)^{-0.1m}$
$-400 \quad -400$

$\frac{-100}{-350} = \frac{-350(3.2)^{-0.1m}}{-350}$

$\log \frac{2}{7} = 3.2^{-0.1m}$

$\frac{\log \frac{2}{7}}{-0.1\log 3.2} = \frac{-0.1m\log 3.2}{-0.1\log 3.2}$

$11 = m$

5. Drew's parents invested \$1,500 in an account such that the value of the investment doubles every seven years. The value of the investment, V, is determined by the equation $V = 1500(2)^{\frac{t}{7}}$, where t represents the number of years since the money was deposited. How many years, to the *nearest tenth of a year*, will it take the value of the investment to triple?

$V = 3(1500) = 4500$

$\frac{4500}{1500} = \frac{1500(2)^{\frac{t}{7}}}{1500}$

$\log 3 = 2^{\frac{t}{7}}$

$7(\log 3) = 7\left(\frac{t}{7}\log 2\right)$

$\frac{7\log 3}{\log 2} = \frac{t\log 2}{\log 2}$

$11 = t$

6. The number of houses in Central Village, New York, grows every year according to the function $H(t) = 540(1.039)^{1.02t}$, where H represents the number of houses, and t represents the number of years since January 1995. A civil engineering firm has suggested that a new, larger well must be built by the village to supply its water when the number of houses exceeds 1,000. During which year will this first happen?

$H(t)$

$\frac{1100}{540} = \frac{540(1.039)^{1.02t}}{540}$

$\log \frac{55}{27} = 1.039^{1.02t}$

$\frac{\log \frac{55}{27}}{1.02\log 1.039} = \frac{1.02t\log 1.039}{1.02\log 1.039}$

$18 = t$

1995
$+18$
2013