Name: KEY Period: ____

Sheet #556: Exponential Equations and Exponential Models

Possibly helpful formulas: $y = A\left(1+\frac{r}{n}\right)^{nt}$ $y = Ae^{kt}$ $y = A\left(\frac{1}{2}\right)^{t/T}$

1. Solve for x.
   $2^{x+1} = 5$

$LN(2^{X+1}) = LN(5)$

$(X+1)LN(2) = LN(5)$

$X+1 = LN(5)/LN(2)$

$X = \frac{LN(5)}{LN(2)} - 1 \approx 1.322$

2. Solve for t.
   $e^{0.1t} = 4$

$LN(e^{0.1t}) = LN(4)$

$0.1t = LN(4)$

$t = LN(4)/0.1 \approx 13.863$

3. If the continuous exponential growth rate is 8%/hour and you start with an amount of 300 units. How many units do you have after 5 hours?

$y = Ae^{kt}$ $k = 8\%$, $A = 300$ units.

$y = 300e^{0.08t}$

$t = 5$

$y = 300e^{0.08\cdot 5} = 300e^{0.4} \approx 447.547$ 447 units (or 448 units)

4. A student began taking the AP History test at 8am ($t = 0$ hours). The student had 100% brain energy (y in percent) at that time. By 12noon, the student had 40% brain energy left. Use an exponential model to find the following.
   a. Find the half life (T in hours) of brain energy.

METHOD 2

$y = Ae^{kt}$

Find k

$40 = 100e^{k\cdot 4}$

$k = LN(0.4)/4 \approx -0.22907$ per hour.

THEN FIND T

$50 = 100e^{-0.22907\cdot T}$

$LN(1/2) = -0.22907\cdot T$

$T = \frac{LN(1/2)}{-0.22907} \approx 3.026$ hours

≈ 3.0 hours

   b. Predict the brain energy left at 3pm.

$t = 7$ hours

$y = 100e^{-0.22907\cdot 7} \approx 20.119\%$

{or $y \approx 100\left(\frac{1}{2}\right)^{(7/3.0)} \approx 20\%$}

$\approx 20\%$