Algebra II
V-5
Exponential Growth and Decay

Exponential Growth and Decay

$$y = ae^{bx}$$

y- output; Final amount

a- Starting amount.

e- Euler's number = 2.7182818828....

b- Constant of Variation

x- input; usually time

*1) The half-life of carbon 14 is 5730 years. How much of an initial sample of 80 g will remain after 18000 years?

$y = 40$ $x = t = 5730$

a) What does half-life mean? a y $x = t = 18000$ Amount of time until half is left.

b) Use logical thinking to estimate your answer.

$\approx 40g$ in 6000yrs $\approx 10g$ in 18000
$\approx 20g$ in 12,000

c) Calculate the actual amount of carbon 14 remaining.

Step 1 → Find b.

$y = ae^{bx}$
$= 80e^{bx}$

$\dfrac{40}{80} = 80e^{\dfrac{5730b}{80}}$

$.5 = e^{5730b}$

$\ln .5 = \ln e^{5730b}$

$\dfrac{\ln .5}{5730} = \dfrac{5730b}{5730}$

$b = -0.00012.....$

$y = 80e^{-0.00012... x}$

$y = 80e^{-0.00012...(18000)}$

$\boxed{2nd} \ln (ANS)$

$y = 9.067$ grams

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*3) There are 500 hunnies that live at The Hive. The population of hunnies doubles every 5 days. When will The Hive host 10,000 hunnies?

$y = 1000$ $x = 5$ x $y =$

$y = ae^{bx}$

$\dfrac{1000}{500} = \dfrac{500e^{b(5)}}{500}$

$2 = e^{5b}$
$\ln 2 = \ln e^{5b}$
$\dfrac{\ln 2}{5} = \dfrac{5b}{5}$

$.1386.... = b$

$y = 500e^{.1386... x}$

$\dfrac{10000}{500} = \dfrac{500e^{.1386x}}{500}$

$20 = e^{.1386.... x}$
$\ln 20 = \ln e^{.1386.... x}$
$\ln 20 = .1386.... x$

21.61 days

TI 30xs → ln(20) / ANS =

TI 30xa $\begin{cases} .1386..... \boxed{STO} \ 1 \\ 20 \boxed{\ln} \div \boxed{RCL} \ 1 \boxed{=} \end{cases}$

Assignment:

Worksheet V-5
1-7 all