Alg 2H Exponential Growth and Decay - Applications

1. Suppose that you memorized a list of 200 Spanish vocabulary words. Unfortunately, each week you forgot one-fifth of the words that you knew the previous week. $f(x) = 200(4/5)^x$
How many words do you remember after 1 weeks? 2 weeks? 3 weeks?
Write a function which expresses the number of words you remember after x weeks.

2. Population changes between 1970 and 1990 for Missouri are modeled by the equation
$P = 4{,}903{,}000\,(1.0047)^t$ where t=0 corresponds to 1980
Population changes between 1970 and 1990 for Buffalo are modeled by the equation
$P = 1{,}025{,}000\,(0.9918)^t$ where t=0 corresponds to 1980

A) Which represents an increasing population. and how do you know this?
B) Find the population for each for the years 1970, 1980, and 1990
C) Identify the rate of increase or decrease for each. .47%, -.82%

3. Swiss banks have the reputation of being safe and confidential. Because of the secrecy given to depositors, some accounts *charge* an interest fee instead of *paying* interest. Suppose you deposit \$500,000 in a Swiss bank account that charges 2% per year. Write a function that expresses the balance in your account after x years. $f(x) = 500{,}000(.98)^x$

4. A population of 800 individuals triples each year. Write a function to express the total population after x years $f(x) = 800(3^x)$

5. A population of 5200 is decreasing at the rate of 4% per year. Write a funcion to express the total population after x years. $f(x) = 5200(.96)^x$

6. Suppose that 10 grams of the plutonium isotope Pu-239 were released in the Chernobyl nuclear accident. (The half-life of Pu-239 is about 25,000 years)
How much of the 10 grams will remain after 1 half-life period? 2 periods 100,000 years? 40,000 years? Write a function which will represent this situation. $f(x) = 10\left(\frac{1}{2}\right)^{x/25000}$
5, 2 1/2, .625, 3.297

7. Sunlight produces radioactive carbon (carbon-14), which is absorbed by living plants and animals. Once the plant or animal dies, it stops absorbing carbon-14. Its half life is 5730 years. How much of a 10 gram sample will remain after 4500 years? (~~compare method with [illegible]~~
Write a function which will represent the situation. $f(x) = 10\left(1/2\right)^{4500/5730}$

8. In 1985, you bought a sculpture for \$380. Each year, t, the value of the sculpture increases by 8%. Write an exponential model to represent this. $f(x) = 380(1.08)^t$ =

9. If a population doubles every 5 years, and it was 3000 in 1985, what will it be in the year 2000? Write a function which would enable you to solve this. Then use the function to find the population in the year 1998. $f(x) = 3000(2)^{13/5}$

Name: Key

Period: ______

Date: ______

Algebra II

Chapter 8 Review

1. Evaluate the following expressions without a calculator.

a. $\log_3 81$ 4

b. $\ln e^{14}$ 14

c. $\log_x 16 = 4$ ± 2

d. $\log_4 4^{-5}$ -5

e. $\ln 0$ $\emptyset$

f. $\log_3 6$ (*need a calculator!*) 1.63

g. $\ln(-4)$ $\emptyset$

h. $\ln \frac{1}{e^7}$ -7

i. $\log_2 8$ 3

j. $\log_9 27$ $3/2$

k. $\log_5 \frac{1}{125}$ -3

l. $\log_5 1$ 0

m. $\log_x x^{5.6}$ 5.6

n. $\ln e^{-6.1}$ -6.1

2. Expand the following expressions.

a. $\log_{10} \frac{5x^3}{9y^2}$ $\log 5 + 3\log x - \log 9 - 2\log y$

b. $\log_{10} \frac{\sqrt{xy^3}}{w}$ $\frac{1}{2}\log x + \frac{3}{2}\log y - \log w$

c. $\log_{10} \frac{3x\sqrt[3]{y}}{2z^4}$ $\log 3 + \log x + \frac{1}{3}\log y - \log 2 - 4\log z$

3. Condense the following expressions.

a. $10\log_{10} x + \frac{2}{3}\log_{10} 64$ $\log 16x^{10}$

$\log x^{10} + \log 16$

b. $2(\log_4 18 - \log_4 6) + \frac{1}{2}\log_4 \frac{1}{25}$ $\log_4 \frac{9}{5}$

$2\log_4 3 + \log_4 \frac{1}{5}$

c. $\frac{1}{3}\log_{10} 27 - 2\log_{10} 6 + \frac{1}{2}\log_{10} 81$ $\log \frac{3}{4}$

$\log 3 - \log 36 + \log 9$

d. $2\ln x - 3\ln y - 4\ln 2 - 5\ln z$ $\ln \frac{x^2}{16y^3z^5}$

$\ln x^2 - \ln y^3 - \ln 16 - \ln z^5$

4. Simplify the following.

a. $6e^4 \cdot (-3e^{-2})^3$ $6e^4(-27e^{-6})$ $-\frac{162}{e^2}$

b. $e^x \cdot e^2 \cdot e^{4x-3}$ e^{5x-1}

c. $\frac{4e^{3x+1}}{2e^{x+6}}$ $2e^{3x+1-(x+6)}$

$2e^{2x-5}$

5. Solve the following equations.

a. $3e^{2x+1}+4=19$

$e^{2x-1}=5$ → $\ln 5=2x-1$

$x=\frac{\ln 5+1}{2}\approx 1.30472$

b. $3\ln(5x)+6=27$

$\ln(5x)=7$ → $e^7=5x$

$x=\frac{e^7}{5}\approx 219.327$

c. $\log_5(3x+10)=4$

$5^4=3x+10$ $x=205$

d. $\frac{1}{2}(8)^{2x}-3=17$

$8^{2x}=40$ → $\log_8 40=2x$

$x=\frac{\log_8 40}{2}\approx .886988$

6. Write the equation and solve.

a. You deposit \$1500 in an account that pays 6.5% annual interest, compounded continuously. Find the balance after 10 years.

$y=1500e^{.065t}$

$y=1500e^{.65}=\$2873.31$

b. You deposit \$2500 in an account that pays 7.25% annual interest, compounded quarterly. How long will it take for your balance to reach \$4000?

$A=\cancel{200}\left(1+\frac{.0725}{4}\right)^{4t}$

$4000=2500\left(1+\frac{.0725}{4}\right)^{4t}$ → $\frac{8}{5}=\left(1+\frac{.0725}{4}\right)^{4t}$

$\frac{\log_{1+\frac{.0725}{4}}\left(\frac{8}{5}\right)}{4}=t$

6.54138 yrs

6 ~~&~~ 3/4 years

c. You deposit \$1234 in an account that pays 5.6% interest, compounded continuously. How long before your balance doubles?

$2=e^{.056t}$ $t\approx 12.3776$

$\frac{\ln 2}{.056}=t$

d. You purchased a rare coin in 2007 for \$128. The value of the coin increases by 12.5% each year. How much will it be worth in 2038?

$y=128(1.125)^x$

$=128(1.125)^{31}\approx \$4931.04$

$\begin{array}{r}2038\\-2007\\\hline 31\end{array}$

e. You purchased a Blue Ray player in 2009. The value depreciates by 10.2% each year. How much will it be worth in 2015? Explain why this phenomenon occurs?

$y=a(.898)^x$ after 6 yrs

$\frac{y}{a}=.898^6\approx .524394$ 52.47% of original value