Unit 10 Day 5 HW

1. x = 2.1240
2. y = 0.9534
3. y = 3.2056
4. x = 1.2152
5. x = 1.2925
6. x = -0.8155

Name________________________________ Alg 2 CC

Date_____________________ Unit 10 Day 5 HW

Solve each equation. Round to the nearest ten-thousandths place.

1. $4^x = 19$

$\frac{x\log 4}{\log 4} = \frac{\log 19}{\log 4}$

$x = 2.1240$

$x = \log_4 19$

2. $9^{2y} = 66$

$\frac{2y\log 9}{(2\log 9)} = \frac{\log 66}{(2\log 9)}$

$y = 0.9534$

$\log_9 66 = 2y$

$\frac{\log_9 66}{2} = y$

3. $12^{y-2} = 20$

$\frac{(y-2)\log 12}{\log 12} = \frac{\log 20}{\log 12}$

$y = \frac{\log 20}{\log 12} + 2$

$y - 2 = \log_{12} 20$

$y = \log_{12} 20 + 2$

$y = 3.2056$

4. $5(3)^x + 4 = 15$

$\frac{5(3)^x}{5} = \frac{19}{5}$

$x\log 3 = \log(\frac{19}{5})$

$x = \frac{\log(19/5)}{\log 3} = 1.2152$

$3^x = \frac{19}{5}$

$x = \log_3(\frac{19}{5})$

5. $4(4)^x - 6 = 18$

$4(4)^x = 24$

$(4)^x = 6$

$x\log 4 = \log 6$

$x = \frac{\log 6}{\log 4}$

$x = 1.2925$

$x = \log_4 6$

6. $2(1/3)^{2x} + 3 = 15$

$2(\frac{1}{3})^{2x} = 18$

$(\frac{1}{3})^{2x} = 9$

$\frac{2x\log(1/3)}{(2\log(1/3))} = \frac{\log 9}{(2\log(1/3))}$

$x = -0.8155$

$2x = \log_{(1/3)} 9$

$x = \frac{\log_{(1/3)} 9}{2}$

Solving Exponential and Logarithmic Word Problems

Using Logarithms to Solve Real World Word Problems. Unit 10 Day 6

Recall that for an exponential model that is growing or decaying the formula that we used in the previous unit was

$$A(t) = P(1 \pm \frac{r}{n})^{nt} \text{ or } A(t) = P(1 \pm r)^{t}$$

1. A cup of green tea contains 35 milligrams of caffeine. The average teen can eliminate approximately 12.5% of the caffeine from their system per hour.

   a. Write a function to model this situation.

   $$A(t) = 35(1-.125)^t$$
   $$A(t) = 35(.875)^t$$

   b. Estimate the amount of caffeine in a teenager's body 3 hours after drinking a cup of green tea. To the nearest hundredth

   $$A(3) = 35(.875)^3 = 23.45 \text{ mg}$$

   c. Estimate how many hours it will take to have 15 milligrams left in their system. To the nearest hundredth of an hour

   $$\frac{15}{35} = \frac{35(.875)^t}{35}$$
   $$\frac{15}{35} = .875^t$$
   $$\frac{\log\left(\frac{15}{35}\right)}{\log .875} = \frac{t \log .875}{\log .875}$$
   $$t = 6.35 \text{ hrs.}$$

2. A biologist is modeling the population of bats on a tropical island. When he first starts observing them, there are 104 bats. The biologist believes that the bat population is growing at a rate of 3% per year.
   a. Write an equation for the number of bats, B(t), as a function of the number of years, t, since the biologist started observing them.

$$B(t) = 104(1.03)^t$$

   b. Using the equation from part (a), algebraically determine the number of years (t) it will take for the bat population to reach 200. Round your answer to the [redacted] Nearest tenth of a year

$$\frac{200}{104} = \frac{104(1.03)^t}{104}$$

$$\frac{200}{104} = 1.03^t$$

$$\frac{\log\left(\frac{200}{104}\right)}{\log 1.03} = \frac{t \log 1.03}{\log 1.03}$$

$$t = 22.1 \text{ years}$$

3. A stock has been declining in price at a steady pace of 5% per week. If the stock started at a price of \$22.50 per share, determine algebraically the number of weeks it will take for the price to reach \$10.00. Round your answer to the

Nearest tenth of a week

$$10 = 22.50\,(.95)^t$$

$$\frac{10}{22.5} = .95^t$$

$$\frac{\log\left(\frac{10}{22.5}\right)}{\log .95} = \frac{t \log .95}{\log .95}$$

$$t = 15.8 \text{ wks}$$

4. Mandy's parents gave her $5000 to invest for her sweet sixteen-birthday present. Her parents advised her to put it into an account that will pay her 4.6% compounded quarterly. Algebraically determine, to the nearest tenth of a year, how long it would take her to double her initial investment.

$$\frac{10{,}000}{500} = \frac{5000\left(1+\frac{.046}{4}\right)^{4t}}{5000}$$

$$2 = 1.0115^{4t}$$

$$\frac{\log 2}{\log 1.0115} = \frac{4t \log 1.0115}{\log 1.0115}$$

$$4t = 60.62$$

$$t = 15.2 \text{ years}$$