# 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
7. See slide for work

Feb 9-2:06 PM

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

$$\frac{5(3)^x}{5} = \frac{19}{5}$$
$$x\log 3 = \log\left(\tfrac{19}{5}\right)$$
$$x = \frac{\log(19/5)}{\log 3} = 1.2152$$
$$3^x = \frac{19}{5}$$
$$x = \log_3\left(\tfrac{19}{5}\right)$$

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

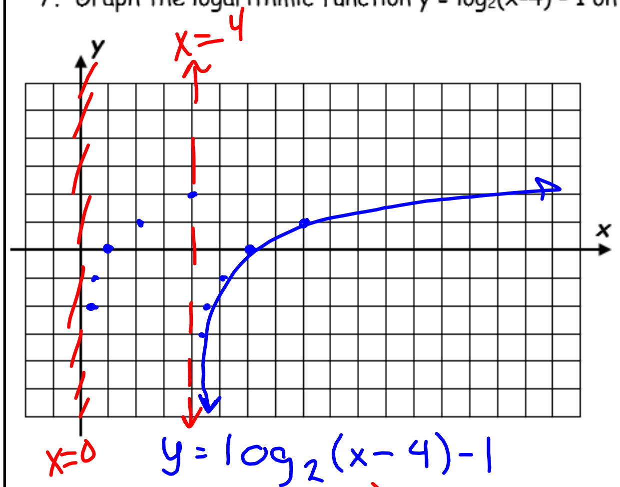
$$4(4)^x = 24$$
$$(4)^x = 6$$
$$x\log 4 = \log 6$$
$$x = \frac{\log 6}{\log 4}$$
$$x = 1.2925$$
$$x = \log_4 6$$

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

$$2\left(\tfrac{1}{3}\right)^{2x} = 18$$
$$\left(\tfrac{1}{3}\right)^{2x} = 9$$
$$\frac{2x\log(1/3)}{(2\log(1/3))} = \frac{\log 9}{(2\log(1/3))}$$
$$x = -0.8155$$
$$2x = \log_{(1/3)} 9$$
$$x = \frac{\log_{(1/3)} 9}{2}$$

Jan 26-10:32 AM

7. Graph the logarithmic function $y = \log_2(x-4) - 1$ on the graph below.




$y = \log_2(x-4) - 1$

Domain $(4, \infty)$

Range $(-\infty, \infty)$

End behavior $x \to 4$, $y \to -\infty$

$y = 2^x$

| x | -2 | -1 | 0 | 1 | 2 |
|---|---|---|---|---|---|
| y | 1/4 | 1/2 | 1 | 2 | 4 |

$y = \log_2 x$

| x | 1/4 | 1/2 | 1 | 2 | 4 |
|---|---|---|---|---|---|
| y | -2 | -1 | 0 | 1 | 2 |

Asymptote of $y = \log_2 x$? $x = 0$

$y = \log_2(x-4) - 1$

Transformations? Right 4, down 1

Asymptote of $y = \log_2(x-4) - 1$? $x = 4$

# 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

Compound Interest Formula; rate as decimal; t is time (usually years)

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

End; Initial; # compounds per ___ (year)

decrease

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.

   $a = 35$
   $r = .125$
   $t =$ hours

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

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

   $t = 3$ hours
   $A(3) = 35(.875)^3 \approx 23.45$ mg

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

   $t?$

   ISOLATE

   $\frac{15}{35} = \frac{35(.875)^t}{35}$

   $\frac{3}{7} = .875^t$ → or $t = \log_{.875}(3/7)$

   $t = 6.35$ hrs.

   $\log 3/7 = t \log .875$

   $t = \frac{\log 3/7}{\log .875} =$

   6.35 hours



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.

   $a$

   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.

   function

   $B(t) = 104(1 + .03)^t$
   $B(t) = 104(1.03)^t$

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

   $t$

   ending amt

   Isolate

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

   $\frac{200}{104} = (1.03)^t$ → $t = \log_{1.03}(200/104) = 22.1229$

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

   $t = \frac{\log\left(\frac{200}{104}\right)}{\log 1.03} = 22.1229$

   22.1 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 [redacted]

Nearest tenth of a week

$=a$ $t$ end amt

① $A(t) = 22.50(1-.05)^t$

② $10 = 22.50(.95)^t$ Isolate

$\frac{10}{22.50} = (.95)^t$ or → $t = \log_{.95}\left(\frac{10}{22.50}\right)$

$\log\left(\frac{10}{22.50}\right) = t \log .95$

$t = \frac{\log(10/22.50)}{\log(.95)}$

15.8 weeks

Feb 9-1:55 PM

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.

$n = 4$ $r = .046$

$A(t) = a\left(1+\frac{r}{n}\right)^{nt}$ Isolate

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

$2 = \left(1+\frac{.046}{4}\right)^{4t}$

$\log 2 = 4t \log\left(1+\frac{.046}{4}\right)$

$t = \frac{\log 2}{\left(4\log\left(1+\frac{.046}{4}\right)\right)}$

$t \approx 15.2$ years

$4t = \log_{\left(1+\frac{.046}{4}\right)}(2)$

$t = \frac{\log_{\left(1+\frac{.046}{4}\right)}(2)}{4} = 15.2$ years

15.2 years

Feb 9-1:56 PM

Feb 9-2:18 PM