

## Unit 9 Review #1 – Exponentials and Logs

1. Simplify each of the following using properties of exponentials.

(Calculator Section)

a.  $\left(\frac{32x^{-8}y}{2y^{-3}z}\right)^{\frac{1}{4}}$

$$\left(\frac{16x^{-8}y^4}{z}\right)^{\frac{1}{4}} = \frac{16^{\frac{1}{4}} x^{-2} y^1}{z^{\frac{1}{4}}} = \frac{2y}{x^2 z^{\frac{1}{4}}}$$

b.  $\left(\frac{1}{x^2y}\right)^{-1} \cdot -3x^4y^6$

$$\frac{1^{-1}}{x^{-2}y^{-1}} \cdot -3x^4y^6 = x^2y^1 \cdot -3x^4y^6 = -3x^6y^7$$

c.  $\left(\frac{8x^3y^{-6}}{z^{-9}}\right)^{\frac{1}{3}} \cdot \left(\frac{4x^6}{y^4}\right)^{\frac{1}{2}}$

$$\frac{8^{\frac{1}{3}} x y^{-2}}{z^{-3}} \cdot \frac{4^{\frac{1}{2}} x^3}{y^2}$$

$$\frac{2x z^3}{y^2} \cdot \frac{2x^3}{y^2} = \frac{4x^4 z^3}{y^4}$$

d.  $\left(\frac{x^{-1}y^2z^{-3}}{x^{-2}y^0z}\right)^0$

1

2. Simplify the following with one base and no fraction:

$\frac{1000^{3x}}{100^x}$

(Calculator Section)

$$\frac{(10^3)^{3x}}{(10^2)^x} = \frac{10^{9x}}{10^{2x}} = 10^{7x}$$

3. In the year 2000, a car was purchased at \$26,000. In the year 2006, the car was worth \$17,500. Write an equation that models the amount the car was worth after  $t$  years.

(Calculator Section)

$$17,500 = 26,000(1+r)^6$$

$$.673 = (1+r)^6$$

$$.936 = 1+r$$

$$-.064 = r$$

$$A = P(1 - .064)^t$$

$$A = 26000(.936)^t$$

4. You take a 300 milligram dosage of ibuprofen. During each subsequent hour, the amount of medication in your bloodstream decreases by 27% each hour. (Calculator Section)

a. Write an exponential model giving the amount  $y$  (in milligrams) of ibuprofen in your bloodstream  $t$  hours after the initial dose.

$$A = 300(1-.27)^t$$

$$A = 300(.73)^t$$

b. How long will it take for you to have 100 milligrams of ibuprofen in your bloodstream.

$$100 = 300(.73)^t$$

$$.33 = .73^t$$

$$\log_{.73} .33 = t$$

$$t = 3.5 \text{ hours}$$

5. The number  $y$  of duckweed fronds in a pond after  $t$  days is  $y = a(1230.25)^{t/16}$ , where  $a$  is the initial number of fronds. By what percent does the duckweed increase each day? (Calculator Section)

$$y = a \left[ (1230.25)^{1/16} \right]^t$$

$$y = a(1.56)^t$$

$$y = a(1 + .56)^t$$

56%

6. Use  $A(t) = 11,000 \left( 1 + \frac{0.03}{52} \right)^{52t}$  to answer the following questions.

(Calculator Section)

a. What is the value of the account?

\$ 14,847.20

b. What is the initial deposit?

\$ 11,000

c. How many years has the account been accumulating interest?

10

d. What is the interest rate on the account?

3%

e. Circle one answer: This account was compounded \_\_\_\_\_.

Yearly

Quarterly

Monthly

Weekly

Daily

Continuously

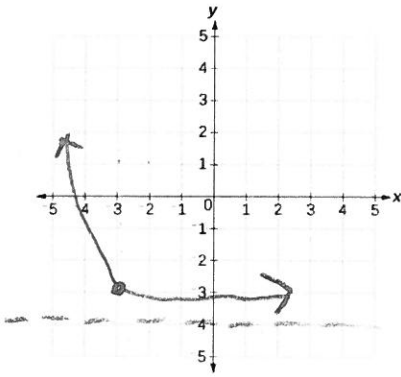
7. Calculate the initial deposit of an account that is worth \$15,500.75 after earning 7.0% interest compounded continuously for 5 years. (Calculator Section)

$$15,500.75 = Pe^{(0.07)(5)}$$

$$P = \$10,923.20$$

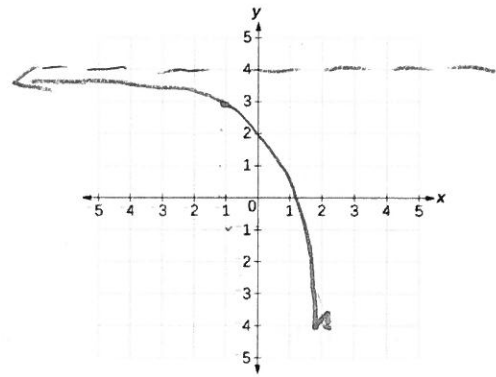
8. Graph each of the following including one accurately plotted and labeled point. (Non-Calculator Section)

a.  $f(x) = \left(\frac{1}{2}\right)^{x+3} - 4$



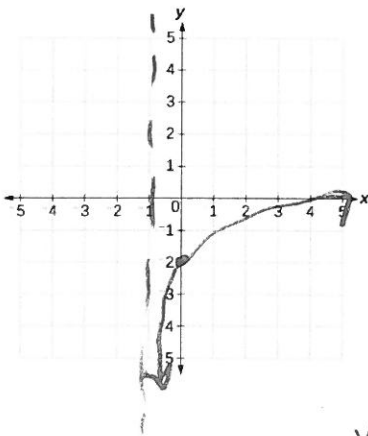
Equation of Asymptote:  $y = -4$   
 Domain:  $\mathbb{R}$   
 Range:  $y > -4$

b.  $g(x) = -2^{x+1} + 4$



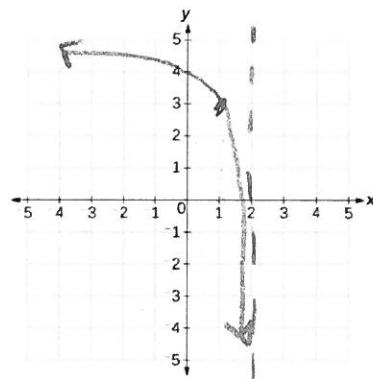
Equation of Asymptote:  $y = 4$   
 Domain:  $\mathbb{R}$   
 Range:  $y < 4$

c.  $h(x) = \ln(x+1) - 2$



Equation of Asymptote:  $x = -1$   
 Domain:  $x > -1$   
 Range:  $\mathbb{R}$

d.  $f(x) = \log_2(-x-2) + 3$



Equation of Asymptote:  $x = 2$   
 Domain:  $x < 2$   
 Range:  $\mathbb{R}$

9. Evaluate each of the following logarithms.

(Non-Calculator Section)

a.  $\log_4 2$

$$\frac{1}{2}$$

b.  $\log_2 16^2 + \log_3 27$

$$8 + 3 = 11$$

c.  $\ln e$

$$1$$

d.  $\log_5 \left( \frac{1}{125} \right)$

$$-3$$

10. Use properties of logarithms to expand the following:

$$\ln \left( \sqrt[3]{\frac{xy^6}{z^3}} \right)$$

(Non-Calculator Section)

$$\frac{1}{3} (\ln x + 6 \ln y - 3 \ln z)$$

$$\frac{1}{3} \ln x + 2 \ln y - \ln z$$

11. Use properties of logarithms to condense the following:

$$\frac{1}{2} \log 25 + 3 \log x - \log 10$$

(Non-Calculator Section)

$$\log \frac{25^{\frac{1}{2}} \cdot x^3}{10} = \log \frac{5x^3}{10} = \log \frac{x^3}{2}$$

12. Solve each of the following equations.

(Non-Calculator Section)

You may leave logarithms in your answer since you will not have a calculator. Be sure to check your answers for extraneous solutions.

a.  $\log_6(3x) + \log_6(x-1) = 3$

$$\log_6 3x(x-1) = 3$$

$$3x^2 - 3x = 216$$

$$3x^2 - 3x - 216 = 0$$

$$3(x^2 - x - 72) = 0$$

$$3(x-9)(x+8) = 0$$

9 or ~~-8~~

c.  $\ln(2x+5) = \ln(x-1)$

$$2x+5 = x-1$$

$$x = 6$$

b.  $6\ln(x+1) - 10 = 26$

$$6\ln(x+1) = 36$$

$$\ln(x+1) = 6$$

$$e^6 = x+1$$

$$e^6 - 1 = x$$

d.  $36^{2x} = \left(\frac{1}{6}\right)^{-x-2}$

$$(6^2)^{2x} = (6^{-1})^{-x-2}$$

$$4x = x+2$$

$$3x = 2$$

$$x = \frac{2}{3}$$

e.  $2e^{4x} + 5 = 13$

$$2e^{4x} = 8$$

$$e^{4x} = 4$$

$$\log_e 4 = 4x$$

$$\frac{\ln 4}{4} = x$$

f.  $11^{6x} = 38$

$$\log_{11} 38 = 6x$$

$$\frac{\log_{11} 38}{6} = x$$

