Name: _____ **Date:** _____

Lesson 7 Practice Problems

Section 7.1: Introduction to Logarithms

1. Locate the LOG button on your calculator. Use it to fill in the missing values in the input/output table. When you use your calculator, remember to close parentheses after your input value.

	x	Function	*y*	*(x,y)*
a)	5	$y = \log(x)$		
b)	3	$y = 4\log(x)$		
c)	2	$y = \log(x)^4$		
d)	6	$y = \frac{\log(x)}{\log(2)}$		

2. Complete the table filling in the missing forms

	Exponential Form	Logarithmic Form
a)	$3^2 = 9$	
b)	$16^{\frac{1}{2}} = 4$	
c)	$2^{-3} = \frac{1}{8}$	
d)		$\log_4 1024 = 5$
e)		$log_{25} 125 = \frac{3}{2}$
f)		$\log_3 1200 = 2x$

3. Compute each of the following logarithms and verify your result with an exponential "because" statement.

	Logarithmic expression		Exponential form
a)	$\log_5 1 =$	because	
b)	$\log_7 7 =$	because	
c)	$\log_3 3^2 =$	because	
d)	$\log_4 0 =$	because	

4. Compute each of the following logarithms and verify your result with an exponential "because" statement.

	Logarithmic expression		Exponential form
a)	$\log_4 16 =$	because	
b)	$\log_2 32 =$	because	
c)	$\log_5 125 =$	because	
d)	$\log 100 =$	because	

5. Compute each of the following logarithms and verify your result with an exponential "because" statement.

	Logarithmic expression		Exponential form
a)	$\log_6 1 =$	because	
b)	$\log_2 \sqrt{2} =$	because	
c)	$\log_3 \frac{1}{9} =$	because	
d)	$\log_4 2 =$	because	

Section 7.2: Computing Logarithms

6. Use the table below to determine what two integers the logarithms lie between.

x	−3	−2	−1	0	1	2	3	4	5
2^x	0.125	0.25	0.50	1	2	4	8	16	32

	Value	*Lies Between what Outputs?*	*Logarithm*	*Lies Between what inputs?*
a)	***14.23***	***8 and 16***	$\boldsymbol{log_2(14.23)}$	***3 and 4***
b)	2.7		$log_2(2.7)$	
c)	9.45		$log_2(9.45)$	
d)	0.20		$log_2(0.20)$	
e)	0.73		$log_2(0.73)$	
f)	30		$log_2(30)$	
g)	10		$log_2(10)$	
h)	12.26		$log_2(12.26)$	

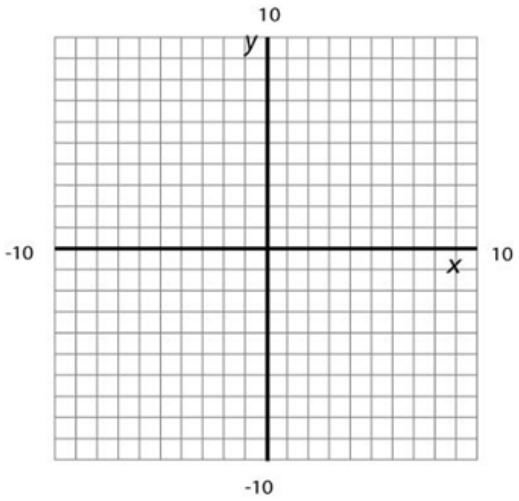
7. Use the change of base formula to rewrite the logarithm using base 10 logarithms. Then use your calculator to evaluate the logarithm. Round your result to three decimal places.

	Logarithm	Rewrite using Change of Base Formula	Evaluate on Calculator
a)	$\boldsymbol{log_2(12.26)}$	$\boldsymbol{\frac{log(12.26)}{log2}}$	**3.616**
b)	$log_8(19)$		
c)	$log_{12}(100)$		
d)	$log_{17}(83)$		
e)	$log_{4.3}\left(\frac{100}{89}\right)$		
f)	$log_{\frac{1}{2}}(8)$		

Section 7.3: Characteristics of Logarithmic Functions

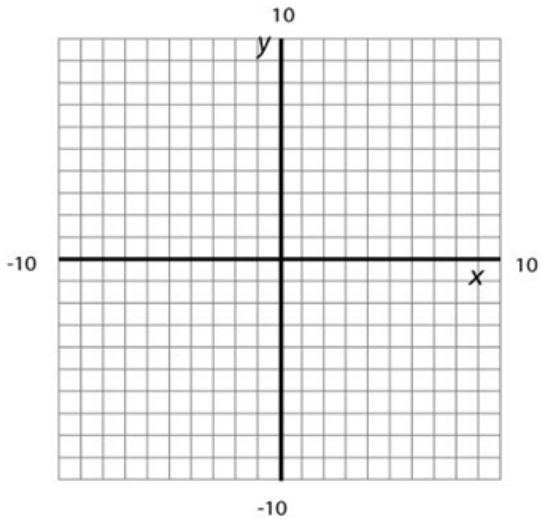
8. Graph $g(x) = log_2 x$ on your graphing calculator. Fill in the table below and plot the points on the grid. Use these points to sketch an accurate graph.

x	$g(x) = log_2 x$
0.50	
1	
2	
4	
8	



9. Graph $g(x) = log_5 x$ on your graphing calculator. Fill in the table below and plot the points on the grid. Use these points to sketch an accurate graph.

x	$g(x) = log_5 x$
0.20	
1	
5	



10. Determine the following for the function $g(x) = logx$.

Function Feature	***Answer***
a) Domain	
b) Range	
c) Horizontal Intercept	
d) Vertical Asymptote	
e) Vertical Intercept	
f) Values of x for which $g(x)$ is increasing	
g) Values of x for which $g(x) > 0$	
h) Values of x for which $g(x) < 0$	
i) Values of x for which $g(x) = 0$	
j) Values of x for which $g(x) = 1$	

11. Determine the following for the function $g(x) = log_2 x$.

Function Feature	***Answer***
a) Domain	
b) Range	
c) Horizontal Intercept	
d) Vertical Asymptote	
e) Vertical Intercept	
f) Values of x for which $g(x)$ is increasing	
g) Values of x for which $g(x) > 0$	
h) Values of x for which $g(x) < 0$	
i) Values of x for which $g(x) = 0$	
j) Values of x for which $g(x) = 1$	

12. Determine the following for the function $g(x) = log_5 x$.

Function Feature	***Answer***
a) Domain	
b) Range	
c) Horizontal Intercept	
d) Vertical Asymptote	
e) Vertical Intercept	
f) Values of x for which $g(x)$ is increasing	
g) Values of x for which $g(x) > 0$	
h) Values of x for which $g(x) < 0$	
i) Values of x for which $g(x) = 0$	
j) Values of x for which $g(x) = 1$	

Section 7.4: Solving Logarithmic Equations

13. Solve each Logarithmic equation for *x*. Show complete work. Check your answer. Write your answer in exact form and in approximate form by rounding to three decimal places.

a) $\log_5 x = 4$

b) $\log_6 x = -3$

c) $2\log_7 x = 8$

d) $4 + 2\log_7 x = 8$

14. Solve each Logarithmic equation for x. Show complete work. Check your answer. Write your answer in exact form and in approximate form by rounding to three decimal places.

a) $8 - 2\log_7 x = 10$

b) $\log_3(x + 4) = 2$

c) $8\log_3(x - 2) = 48$

d) $2 - 3\log_4(x + 10) = -13$

Section 7.5: Solving Exponential Equations

15. Solve each exponential equation for *x*. Show complete work and check your answer using a graphical process *and* a numerical one. Write your final answer in both exact form and rounded form (to three decimal places).

a) $2^x = 12$

b) $(1.23)^x = 27$

c) $5(4)^x = 25$

d) $4 + 3^x = 8$

16. Solve each exponential equation for *x*. Show complete work and check your answer using a graphical process *and* a numerical one. Write your final answer in both exact form and rounded form (to three decimal places).

a) $8 - 2(6.2)^x = -10$

b) $3^{x+2} = 18$

c) $6(2)^{x-2} = 24$

d) $5 + 4^{2x} = 68$

17. Show complete work for all parts of this problem. Write all answers in exact form and in decimal form (rounded to the nearest hundredth).

    Suppose an investment is growing at a rate of 8% per year. Determine the doubling time for this investment if the starting value is

    a) $1000

    b) $3300

    c) $5000

    d) $1,000,000

    e) Compare your answers for parts a) through d). Explain why this occurs.

18. Show complete work for all parts of this problem. Write all answers in exact form and in decimal form (rounded to the nearest hundredth).

    The body metabolizes caffeine at a rate of about 14% per hour. Determine the half-life of caffeine in the body if you consume

    a) One can of Coke Zero, which contains about 40mg of caffeine

    b) A cup of coffee, which contains about 100mg of caffeine

    c) One can of Monster Energy drink, which contains about 160mg of caffeine.

    d) Compare your answers for parts a) through c). Explain why this occurs.

19. The Richter scale was developed by Charles Richter of the California Institute of Technology in 1935. A single number, called the magnitude, is assigned to quantify the amount of seismic energy released by an earthquake. The magnitude, M, of an earthquake on the Richter scale can be approximated by the formula $\mathbf{M = log(}\boldsymbol{I}\mathbf{)}$ where I is the intensity of the earthquake, measured by a seismograph located 8 km from the epicenter (using the Lillie Empirical Formula).

Example 1: If an earthquake has an intensity of 100 then the magnitude would be $\mathbf{M = log(100)}$. Entering it into the calculator, we find that the magnitude of the earthquake is 2.

Example 2: If an earthquake has a magnitude of 4.5 (M=4.5), the Intensity would be calculated by solving $\mathbf{4.5 = log(}\boldsymbol{I}\mathbf{)}$ We can rewrite this as an exponent. The new formula would be $10^{4.5} = I$ or $I = 31{,}622.8$.

a) The intensity of an earthquake with magnitude 6 on the Richter scale is _____ times greater than an earthquake with magnitude 5.

b) The intensity of an earthquake with magnitude 7 on the Richter scale is _____ times greater than an earthquake with magnitude 5.

c) On March 27, 1964, Anchorage, Alaska was hit by an earthquake with Magnitude 8.5. Determine the intensity of this earthquake.

d) Earthquakes that measure less than 3 on the Richter scale are known as microquakes, and are not felt by humans. Determine the intensity of an earthquake with a magnitude of 3.

e) A major earthquake is the one which registers more than 7 on the Richter scale. Determine the intensity of an earthquake with a magnitude of 7.

20. In Chemistry, the pH of a substance can be determined using the formula $\boldsymbol{pH = -log[H^+]}$ where $H+$ is the hydrogen ion concentration of the substance. Solutions with a pH less than 7 are said to be acidic and solutions with a pH greater than 7 are basic or alkaline. The table below presents the pH values of some common substances.

pH Level	Substance
13	Bleach
12	Soapy Water
11	Ammonia Solution
10	Milk of Magnesia
9	Baking Soda
8	Sea Water
7	Distilled Water
6	Urine
5	Black Coffee
4	Tomato Juice
3	Orange Juice
2	Lemon Juice
1	Gastric Acid

a) Determine the hydrogen ion (H+) concentration of distilled water.

b) Determine the hydrogen ion (H+) concentration of black coffee.

c) If the water in your swimming pool has a hydrogen ion concentration of .000001 what would the pH level be? (Just for fun, should you be concerned?)

d) The hydrogen ion concentration of lemon juice is _____ times greater than the hydrogen ion concentration of orange juice.

e) **Challenge:** The hydrogen ion concentration of Gastric acid is _____ times greater than the hydrogen ion concentration of Tomato juice.