Name:_____ Date:_____

Notes: Introduction to Logarithms

Do Now: ***Completely simplify the following expressions.***

1) $\left(\frac{4}{5}\right)^{-2}$ 2) 2^{-4} 3) $4^{1/2}$

Algebraically solve the following.

4) Find the *x* value for the equation $64 = (4)^x$.

5) Find the *x* value for the equation $2{,}560 = 5(8)^x$.

6) Find or estimate the *x* value for the equation $80 = 2(3)^x$.

What Should I Be Able to Do?

- I can explain how to perform logarithmic expression.

- I can to calculate or estimate logarithms without using a calculator.

- I can convert equations between logarithmic and exponential form.

- I can find the inverse of an exponential equation

- I can graph a logarithmic equation.

- I can show and explain how a logarithmic function is the inverse of an exponential function.

"How many of one number do we multiply to get another number?"

How many times do I multiply 8 to get 64?

How many times do I multiply 3 to get 81?

How many times do I multiply 2 to get 256?

How many times do I multiply 4 to get 1048576?

How many times do I multiple $\frac{1}{3}$ to get $\frac{1}{27}$?

How many times do I multiply 7 to get 45?

Logarithm with Base b

Suppose $b > 0$ and $b \neq 1$. For $x > 0$, there is a number y such that

$$\log_b x = y \text{ if and only if } b^y = x$$

Convert each of the six questions above into an exponential equation and a logarithmic equation.

Use your calculator to evaluate the logarithms to check your solutions.

Checkpoint:

Convert each exponential equation into its equivalent logarithmic equation.

1) $3^4 = x$ 2) $a^7 = 539$ 3) $e^y = 12$

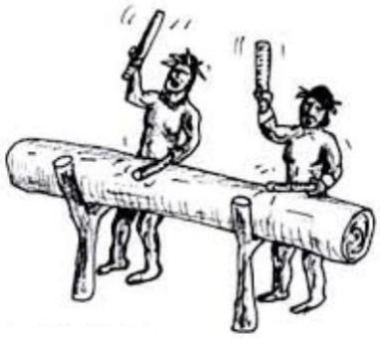
Convert each logarithmic equation into its equivalent exponential equation.

4) $\log_2 8 = y$ 5) $\log_e 28 = x$ 6) $\log_{\frac{1}{4}} \frac{1}{16} = a$ 7) $\log_b 36 = y$

Evaluate or estimate each logarithm without a calculator.

8) $\log_7 49$ 9) $\log_{\frac{1}{5}} \frac{1}{125}$ 10) $\log_2 64$ 11) $\log_6 \frac{1}{36}$

12) $\log_{49} 7$ 13) $\log_5 60$ 14) $\log_{64} 4$ 15) $\log_{11} \sqrt[6]{11}$



Why do we use logarithms?

Do Now: Find the inverse of the following function.

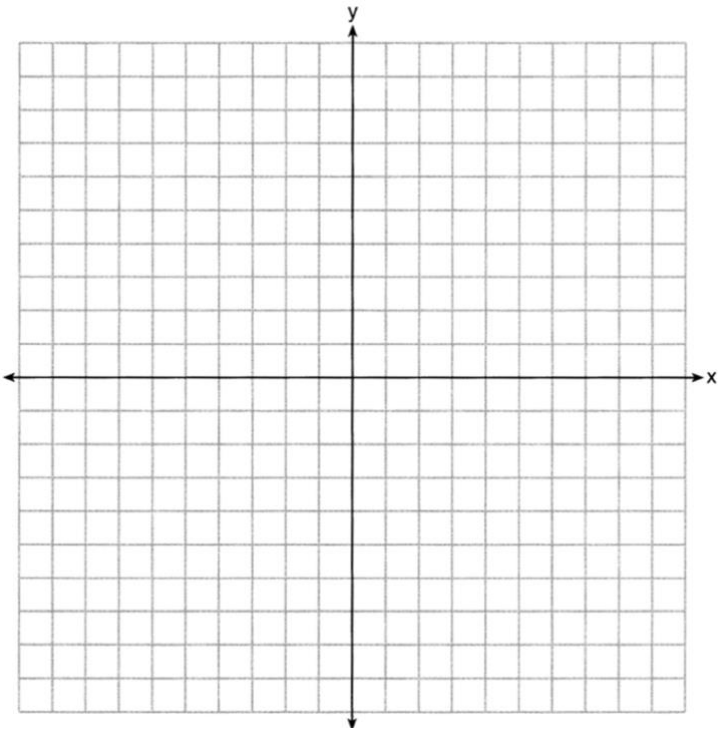
1) $y = 7^x$

What is the inverse of $y = 2^x$?

On the set of axes, graph $y = 2^x$ and its inverse.

x	y
0	
1	
2	
3	
4	

x	y



For $y = 2^x$, domain: _____ range: _____ asymptote: _____

For $y = \log_2 x$, domain: _____ range: _____ asymptote: _____

Explain how the x-y tables prove that the functions are inverses.

_____

_____

Explain how the graph of each function prove that the functions are inverses.

_____

_____

Success Criteria

- I can explain how to simplify a logarithmic expression.

- I can to calculate or estimate logarithms without using a calculator.

1) $\log_{81} 9$ 2) $\log_2 16$ 3) $\log_{24} 1$ 4) $\log_4 90$

- I can convert equations between logarithmic and exponential form.

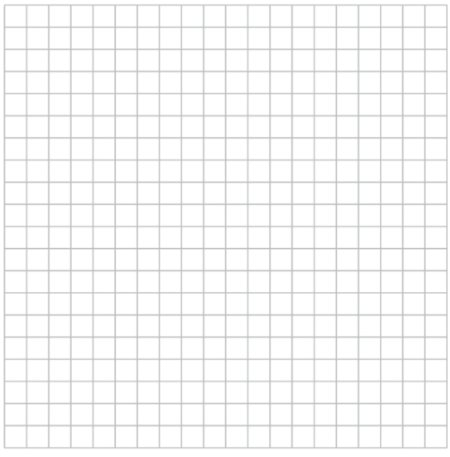
1) $\log_b 81 = 2.5$ 2) $\log_{10} 1000 = y$ 3) $y = e^9$ 4) $256 = 2^x$

- I can find the inverse of an exponential equation

1) $y = 4^x$ 2) $y = \frac{1}{2}^x$

- I can graph a logarithmic equation.

$y = \log_3 x$



- I can show and explain how a logarithmic function is the inverse of an exponential function.

Name:_____ Date:_____

Classwork: Introduction to Logarithms

Write each equation in logarithmic form.

1) $3^4 = 81$

2) $4^2 = 16$

3) $b^3 = 729$

4) $64^{\frac{1}{3}} = 4$

5) $12^{-1} = \frac{1}{12}$

6) $e^{2/3} = y$

Write each equation in exponential form.

7) $\log_9 81 = 2$

8) $\log_e 2 = y$

9) $\log_5 1 = 0$

10) $\log_{25} 125 = \frac{3}{2}$

Evaluate or estimate each expression.

11) $\log_3 27$

12) $\log_6 \frac{1}{216}$

13) $\log_4 1{,}024$

14) $\log_{\frac{1}{3}} \frac{1}{9}$

15) $\log_5 130$

16) $\log_{100} 10$

17) $\log_{64} 2$

18) $\log_9 \sqrt[4]{9}$

19) Between which to consecutive integers must $\log_3 50$ lie?

(1) 1 and 2
(2) 2 and 3
(3) 3 and 4
(4) 4 and 5

20) Which of the following is equivalent to $y = \log_8 x$?

(1) $y = x^8$
(2) $x = y^8$
(3) $x = 8^y$
(4) $y = x^{1/8}$

21) A local pizza parlor is trying to spend money on advertising in order to increase their revenue. The revenue of the pizza parlor, in thousands of dollars, can be modeled by the equation $R(m) = 5 + 8\log_5(m + 2)$, where *m* is the amount of money spent on advertising in thousands, when $m \geq 0$.

a) Find the value of:

i) $R(0)$

ii) $R(6)$

22) Elisa and Matthew are evaluating $\log_2 \frac{1}{32}$. Is either of them correct? Explain your reasoning WITHOUT USING A CALCULATOR.

Elisa	Matthew	
$\log_2 \frac{1}{32} = y$	$\log_2 \frac{1}{32} = y$	
$(2)^y = \frac{1}{32}$	$\frac{1}{32}^y = 2$	
$(2)^y = 32^{-1}$	$(32^{-1})^y = 2$	
$2^y = (2^5)^{-1}$	$32^{-y} = 2$	
$2^y = 2^{-5}$	$-y = 2$	
$y = -5$	$y = -2$	

23)

a) What is the inverse of $y = 4^x$?

b) On the set of axes, graph $y = 4^x$ and its inverse.

c) For $y = 4^x$, find each of the following:

domain: _____ range: _____ asymptote: _____ y-intercept: _____

d)For the inverse of $y = 4^x$, find each of the following:

domain: _____ range: _____ asymptote: _____ x-intercept: _____