Name: ____ Date: __________________ # ____

Section 7-3 Logarithmic Functions as Inverses

Learning Goal: To understand how to write and evaluate logarithmic expressions; to graph logarithmic functions.

Essential Questions: How do you model quantity that changes regularly over time by the same percentage?
How are exponents and logarithms related?
How are exponential functions and logarithmic functions related?

Warm Up:

1. How does the graph of $y = 2 \bullet 2^x$ compare to the graph f the parent function?

2. How does the graph of $y = 4^{(x-6)}$ compare to the graph of the parent function?

3. A pot of water is heated to $200°F$. The table shows a typical temperature reading for the pot. The room temperature is $70°F$. How long will it take the water to cool to $150°F$?

Time (min)	**Temp ($°F$)**
0	200
5	164
10	140
15	124
20	108
25	98

4. You have $10,000. You place it in an account that pays 6.1% annual interest compounded continuously. How much will you have in 20 years? Round the answer to the nearest dollar.

5. Find the invers of $f(x)=5x^3+1$. Is the inverse a function?

Vocabulary:

<u>Logarithm-</u> base b of a positive number x satisfies the following definition.

For b > 0, $b \neq 1$, $\log_b x = y$ if and only if $b^y = x$

You can read $\log_b x$ as "log base b of x". In other words, the logarithm y is the exponent to which b must be raised to get x.

<u>How to write logarithmic functions in exponential form and vice versa:</u>

Logarithmic ↔ Exponential

$\log_b x = y$ ↔ $b^y = x$

What is the logarithmic form of each equation?

1. $100 = 10^2$

2. $81 = 3^4$

3. $36 = 6^2$

4. $\frac{8}{27} = \left(\frac{2}{3}\right)^3$

5. $8^0 = 1$

6. $4^3 = 64$

What is the value of each logarithm?

7. $\log_8 32$

8. $\log_5 125$

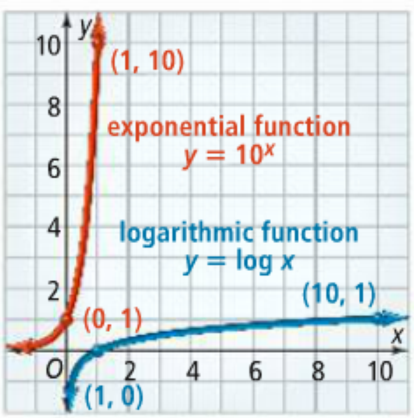
9. $\log_4 32$

10. $\log_{64} \frac{1}{32}$

Common Logarithm: is a logarithm with base 10. You can write a common logarithm $\log\ x$, without showing the 10.

Logarithmic Function: is the inverse of an exponential function.

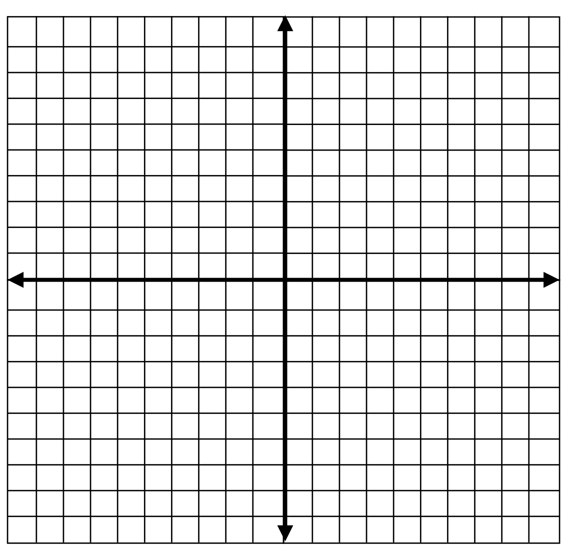
The graph of the inverse function are reflections of each other across the line y=x. You can graph $y = \log_b x$ as the inverse of $y = b^x$.



Note: $y = \log_b x$
Domain: x > 0
Range: all real #
y-intercept – none
vertical asymptote: x = 0

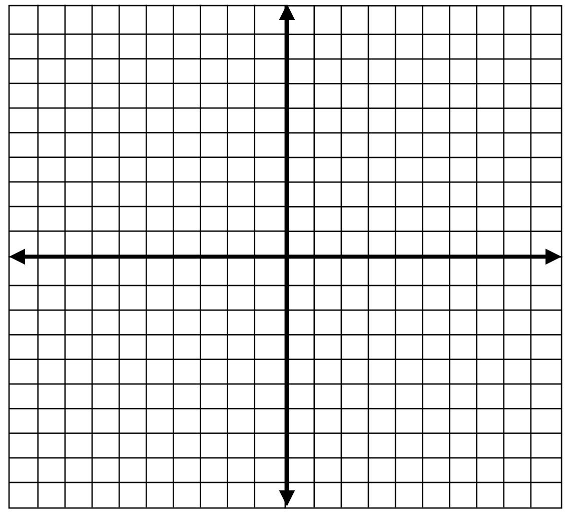
11. What is the graph of $y = \log_4 x$? Describe the domain, range, y-intercept and asymptotes ?

x	y
-2	
-1	
0	
1	
2	



12. What is the graph of $y = \log_6 x$? Describe the domain, range, y-intercept and asymptotes ?

x	y
-2	
-1	
0	
1	
2	



13. Suppose you use the following table to help you graph $y = \log_2 x$. (Recall that if $y = \log_2 x$, then $2^y = x$.) Complete the table. Explain your answers.

x	$2^y = x$	y
-1	$2^y = -1$	■
0	$2^y = 0$	■
1	$2^y = 1$	■
2	$2^y = 2$	■

Translating the graph of the parent function $y = \log_b x$ to $y = \log_b(x - h) + k$

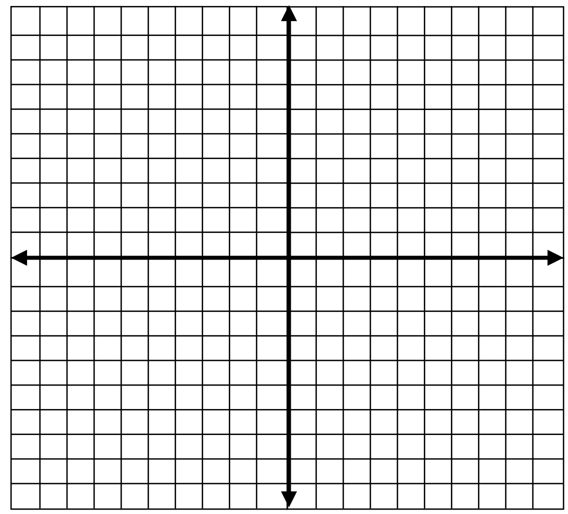
take note

Concept Summary **Families of Logarithmic Functions**

Parent functions:	$y = \log_b x, b > 0, b \neq 1$
Stretch ($\lvert a \rvert > 1$) Compression (Shrink) ($0 < \lvert a \rvert < 1$) Reflection ($a < 0$) in x-axis	$y = a \log_b x$
Translations (horizontal by h; vertical by k)	$y = \log_b (x - h) + k$
All transformations together	$y = a \log_b (x - h) + k$

14. How does the graph of $y = \log_4(x-3)+4$ compare to the graph of the parent function?

x		Y



15. Without graphing, how does the graph each function compare to the graph of the parent function?

a) $y = \log_2(x+4)-3$

b) $y = 5\log_2 x$

	Log2x	$y = \log_2(x+4)-3$	$y = 5\log_2 x$
Domain:			
Range:			
y-int:			
Asymptote:			
Reflection:			
Stretch / Compression:			
Translation:			

16. How does the graph of $y = \frac{3}{4}\log x - 2$ compare to the graph of the parent function?

Closure: How can you use the properties of exponents to evaluate the logarithm?

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How can you use the graph of an exponential function to graph its inverse?

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Assignment: section 7.3 # 12,13,17,19,20,22,25,38,40,41,42,43,61,64,65 (15 problems)