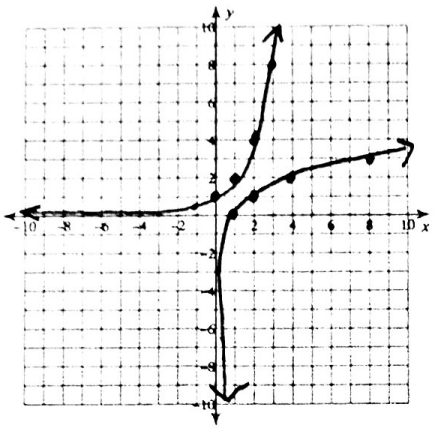
8.3 Intro to Logarithms

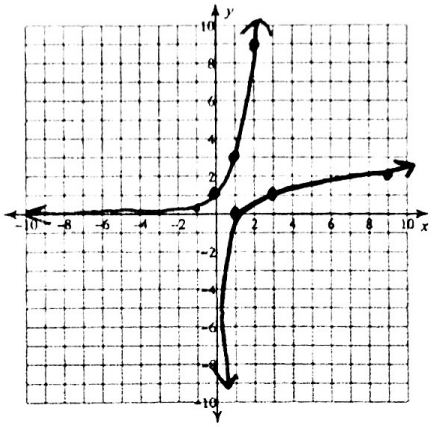
1) Graph each function and its inverse.

a. $y = 2^x$



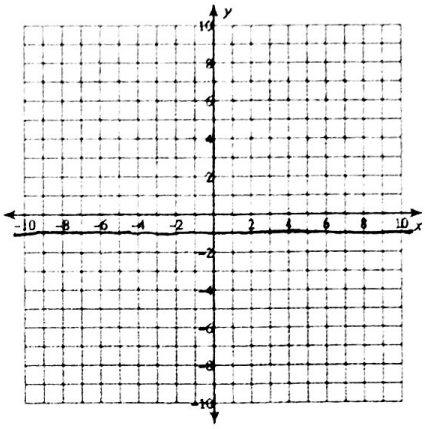
Inverse: $y = \log_2 x$

b. $y = 3^x$



Inverse: $y = \log_3 x$

c. $y = 2^{x-1}$



Inverse:

The inverse of an exponential function is called a **logarithm**. The purpose of a logarithm is to solve for exponents. Basically, a logarithm will cancel out a base.

Exponential Function	Logarithmic Function
$y = b^x$	$\log_b y = x$

2) Write each equation in logarithmic form.

a) $100 = 10^2$

$\log_{10} 100 = 2$

b) $81 = 3^4$

$\log_3 81 = 4$

c) $3^{-2} = \frac{1}{9}$

$\log_3 \frac{1}{9} = -2$

d) $10^{-2} = .01$

$\log_{10} .01 = -2$

3) Write each equation in exponential form.

a) ~~$\log_8 32$~~

$\log_8 64 = \boxed{2}$

since $8^2 = 64$

b) $\log_5 125 = \boxed{3}$

since $5^3 = 125$

c) $\log_{49} 7 = \boxed{\frac{1}{2}}$

$\sqrt{49} = 7$

$49^{\frac{1}{2}} = 7$

d) $\log_4 32$

Logs: What exponent does (base) need to become (inside)?

Special Logarithms

A log with a base of 10 is called a common logarithm. A log with base e is called a natural logarithm.

Common Logarithm	Natural Logarithm
log means $\log_{10}$	ln means $\log_e$
So if you don't see a base, it is assumed that it is $\log_{10}$	(I use a cursive L so it doesn't look like a 1)

4) Switch from logarithmic to exponential form or vice versa.

a. $\log 100 = 2$

$10^2 = 100$

b. $e^x = 12$

$\log_e 12 = x$, so $\ln 12 = x$

c. $\ln 8 = x$

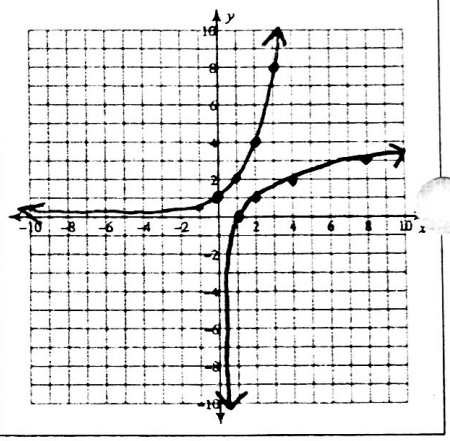
$e^x = 8$

d. $10^3 = 1000$

$\log_{10} 1000 = 3$, so $\log 1000 = 3$

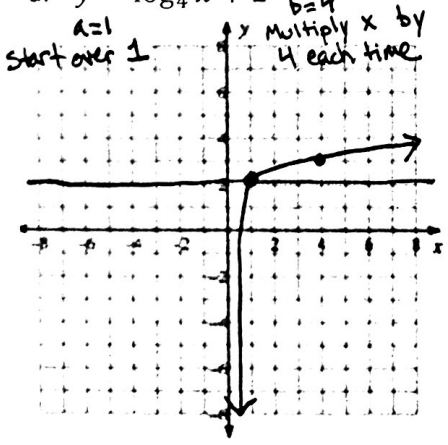
Graphing

We have already discussed how a logarithm is the inverse of an exponential. That being said, let's compare the parent graphs of an exponential and a logarithm.

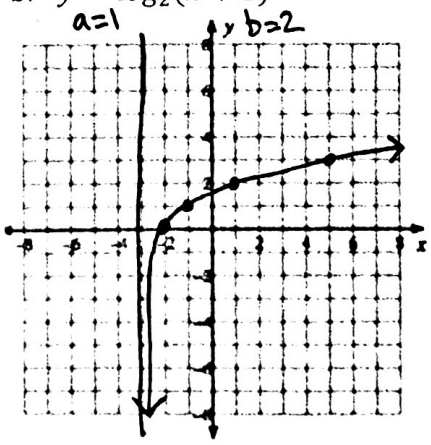
$y = 2^x$	$y = \log_2 x$	
Starts at (0,1)	Starts at (1,0)	
Horizontal asymptote at y=0	Vertical asymptote at x=0	
$y = a \cdot b^x$ (initial (y); base, multiplier (y))	$y = a \log_b x$ (initial (x); base, multiplier (x))	

5) Graph the following functions.

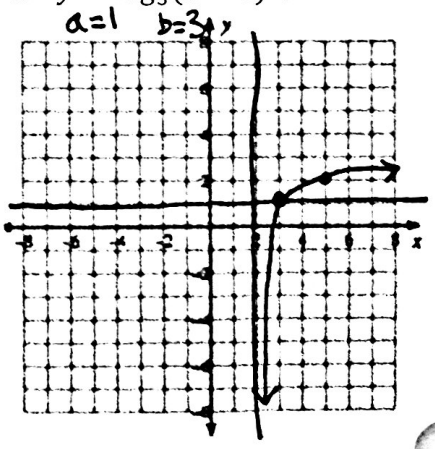
a. $y = \log_4 x + 2$



b. $y = \log_2(x + 3)$



c. $y = \log_3(x - 2) + 1$



y moves up 1 every time, while the x-value multiplies by the base of the log