Precalculus
Lesson 5.4: Logarithmic Functions
Mrs. Snow, Instructor

The inverse of an exponential function is a logarithmic function.

Let a be a positive number with a not equal to 1. The logarithmic function with base a is defined by:

$$\boldsymbol{log_a x = y}$$

if and only if

$$\boldsymbol{a^y = x}$$

Domain: $(0, \infty)$

translation: whatever you are taking the log of has to be greater than zero

Range: $(-\infty, \infty)$

start with the base and move in a counterclockwise fashion.

Write as an exponential $log_a 4 = 5$	$log_e b = -3$	$log_3 5 = c$
Write as a logarithm $1.2^3 = m$	$e^b = 9$	$a^4 = 24$
Find the exact value: $log_2 16$	$log_3 \frac{1}{27}$	
Find the domain of each logarithmic function: $f(x) = log_2(x + 3)$	$g(x) = log_5 \left(\frac{1+x}{1-x}\right)$	

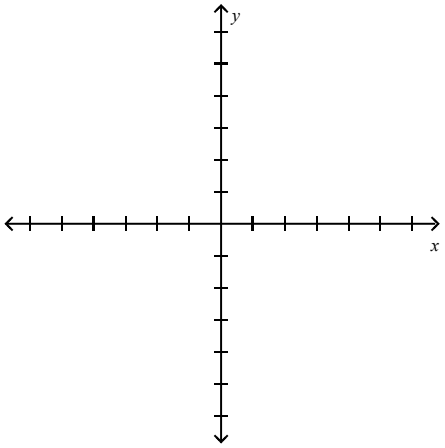
Graphing Logarithmic Functions

Knowing the general form of the graph of the log function is a short cut for graphing.

1. Write in its equivalent exponential form
2. Find the inverse; $x \; is \; y \; and \; y \; is \; x$, solve for y
3. Graph the log function's inverse, and reflect the exponential graph across the line of symmetry $y = x$.

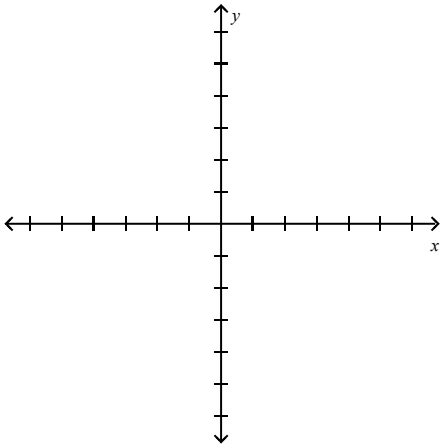
Graph, determine the domain, range and vertical asymptote.

$$y = log_2 x$$



Graph, determine the domain, range and vertical asymptote.

$$log_{1/3} x$$



The Natural and Common Logarithm

The Natural Logarithm is a logarithm with the base e. It is written with the abbreviation of ln.

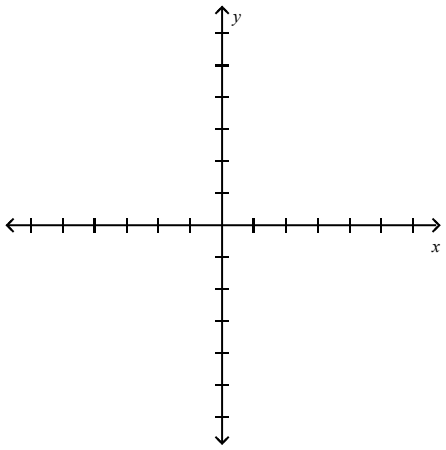
$$y = \ln x$$
if and only if $\quad x = e^y$

The logarithm with base 10 is called the **common logarithm** and is denoted by omitting the base:

$$\log x = log_{10} x$$

Graph, determine the domain, range and vertical asymptote. Identify the inverse and the domain and range of the inverse.

$$f(x) = -\ln(x - 2)$$



Solving Logarithmic Equations

$log_3(4x - 7) = 2$

$log_x 64 = 2$

Using Logarithms to Solve and Exponential Equation

$$e^{2x} = 5$$