Graphs of Logarithm Functions

A logarithmic function has the form:

$f(x) = \log_b(x)$

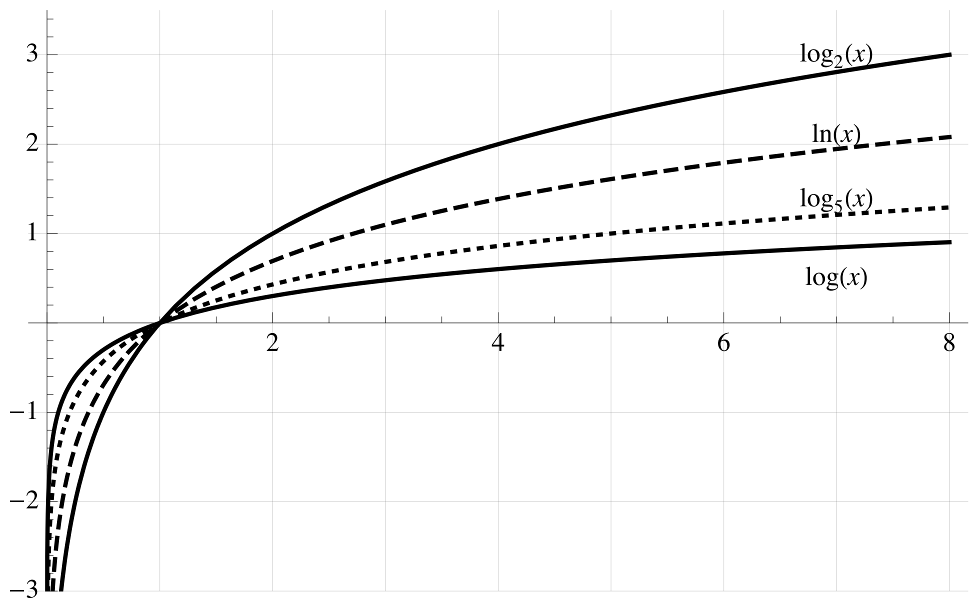
Of course, for common logarithms (base 10), we would simply write:

$f(x) = \log(x)$

For natural logarithms (base e), we would write:

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

The following graph plots a few logarithmic functions:



$\log_b(1)$

All of the plots in the above graph intersect at (1, 0). Why? To answer that question, let's go back to our original "power" notation for logs:

$\text{power}_b(1) \;=\; ?$

In words: what power of b gives us 1?

$b^? = 1$

The answer, of course, is 0:

$b^0 = 1$

We can write this as:

$\log_b(1) = 0$

Domain and Range of $\log_b(x)$

From the graphs, it should be clear that the domain of $\log_b(x)$ is

$D = \{x : x > 0\} \;=\; (0, \infty)$

Note how the domain of the $\log_b(x)$ function must be restricted to be greater than zero: there is no real-numbered exponent that will yield a negative number:

$$b^{?} = -1$$

In other words,

$$\text{power}_b(x) = \log_b(x) = \text{undefined}, \text{ if } x < 0$$

The range is

$$R = \{y : -\infty < y < \infty\} = (-\infty, \infty)$$