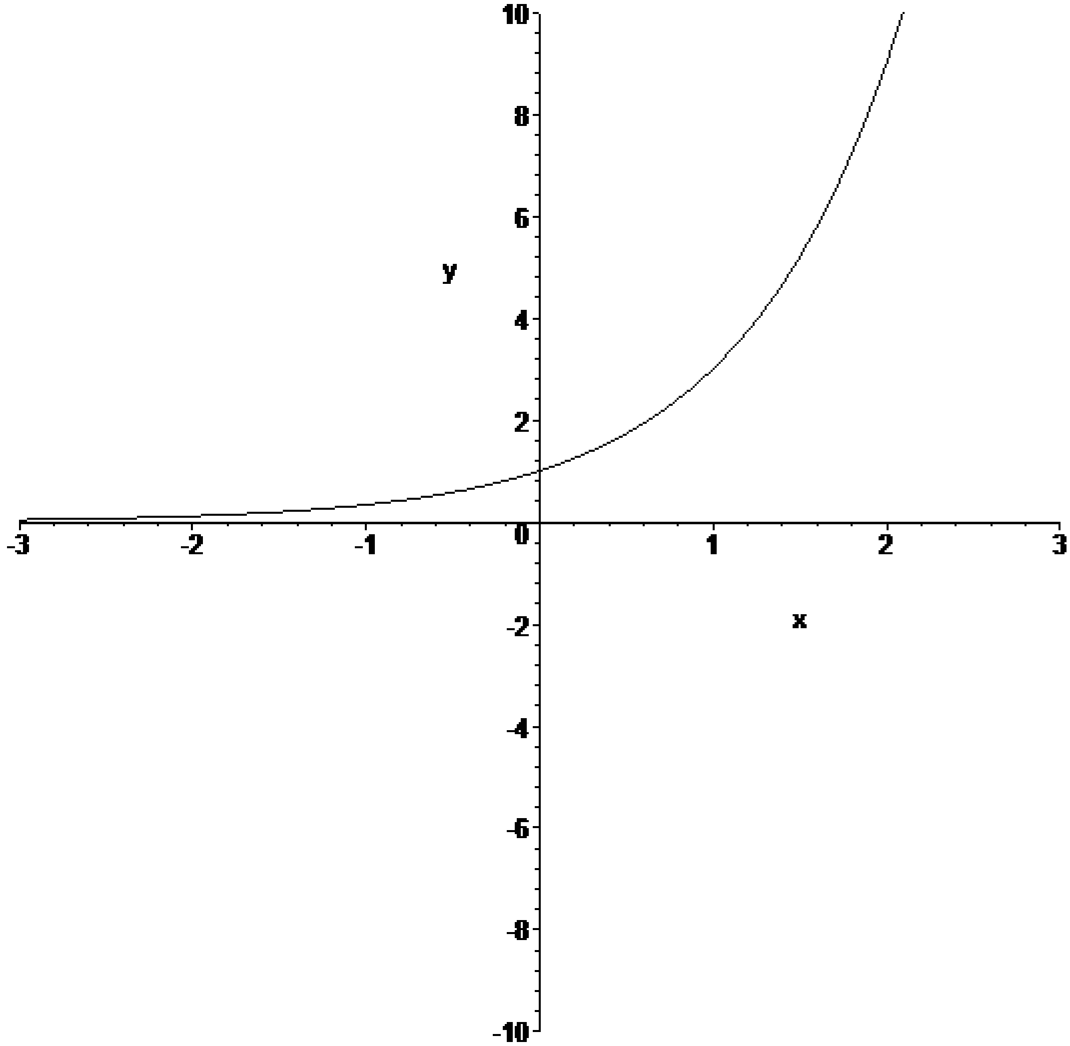
Logarithmic Functions

The graph of the function $f(x) = 3^x$ is given below:



Solve the equation $3^x = 9$

Solve the equation $3^x = \frac{1}{3}$

Solve the equation $3^x = \sqrt{3}$

Solve the equation $3^x = 7$

Solve the equation $3^x = 26$

Definition:
If b and a are positive real numbers then $log_b a$ is the number you would raise b by to get a. In other words, $log_b a$ is the unique solution to the equation $b^x = a$.

How do you interpret the following expressions:

$log_2 8$

$log_2 \sqrt{2}$

$log_2 10$

$log_5 71$

$log_2 0$

$log_3(-2)$

It is very simple, but it is new to consider the expression $log_b a$ as a number, as a thing, not as something that needs to be computed.

The exponential equation $a^x = y$ is equivalent to the logarithmic equation $log_a y = x$

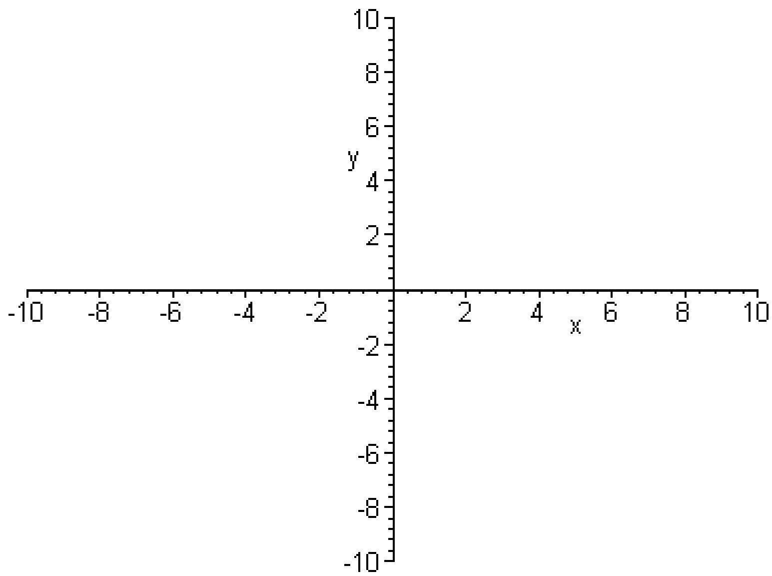
$$a^x = y \qquad \Leftrightarrow \qquad log_a y = x$$

$$2^3 = 8 \qquad \Leftrightarrow \qquad log_2 8 = 3$$

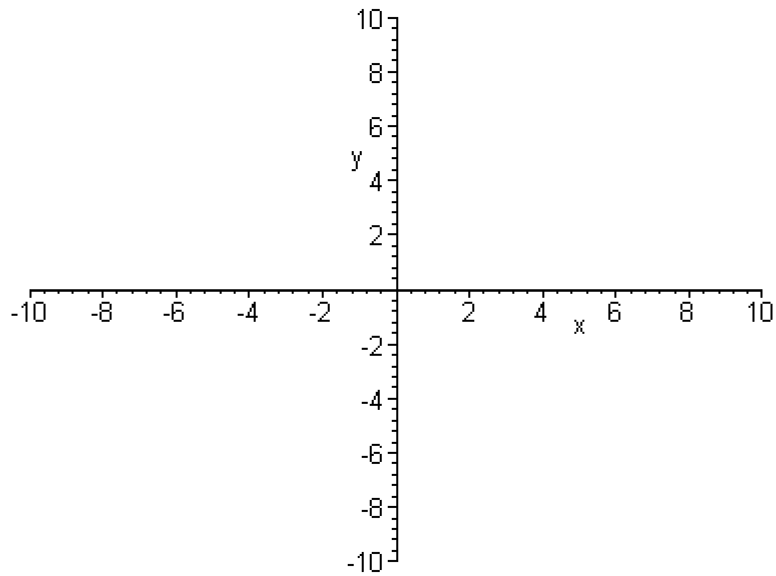
$$4^x = 64 \qquad \Leftrightarrow \qquad log_4 64 = x$$

$$7^x = 29 \qquad \Leftrightarrow \qquad log_7 29 = x$$

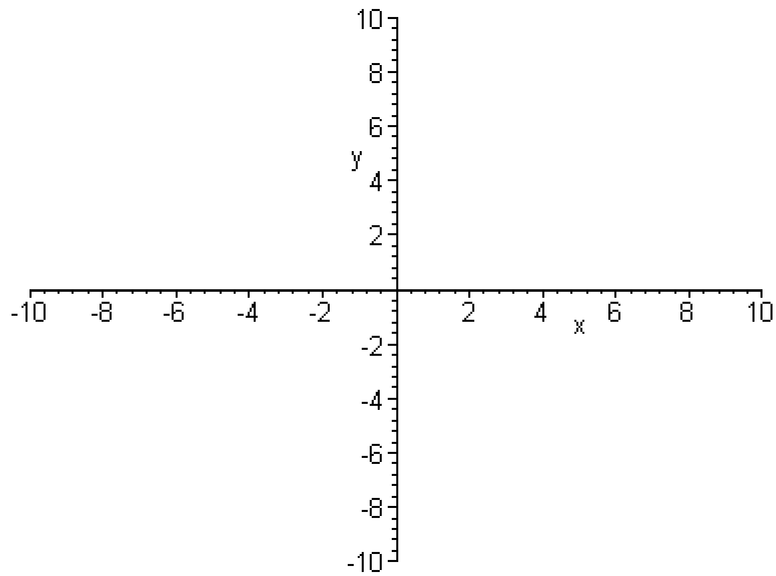
Graph the functions $f(x) = log_2 x$:



Graph the function $g(x) = log_4 x$:



Graph the function $g(x) = -log_2(x+1)+2$:



Basic Logarithm Properties :

- $log_b 1 = 0$ (because $b^0 = 1$)
- $lob_b b = 1$ (because $b^1 = b$)
- $log_b(b^x) = x$
- $b^{log_b x} = x$

Simplify the following expressions:

$log_2 \frac{1}{16}$

$log_5 \left(5\sqrt{5}\right)$

$log_{16} 2$

The common logarithm and the natural logarithm:

$log_e x$ is called the natural log and is always written $ln\, x$.

$log_{10} x$ is called the common logarithm and is usually written as $log\, x$

Simplify the following if possible or give a 2 decimal approximation using a calculator if necessary:

$ln\, 1$

$ln\,(e^3)$

$ln\, \frac{1}{e^2}$

$ln\, 40$

$ln\,(-3)$

$log\, 100$

$log\, 0.0001$

$log\, 80$

$log\, 0$