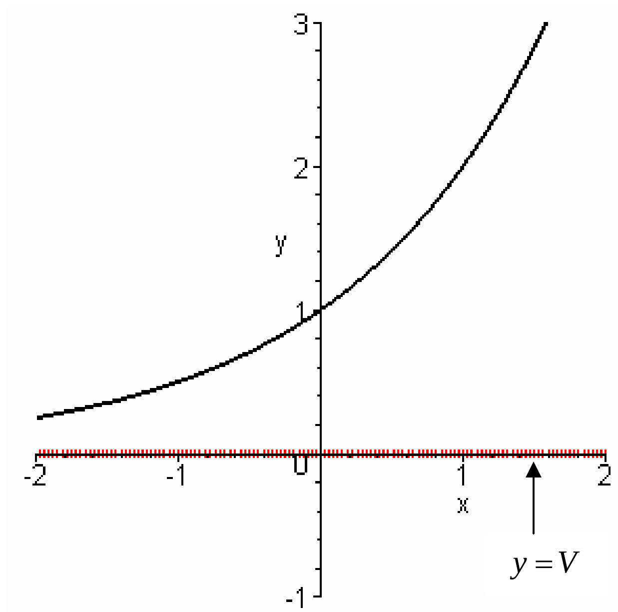
Section 4.1 and 4.2

The graph of General Exponential function with base *b* is defined for all real numbers *x* by

$$y = (a)b^{(x-H)} + V$$



This graph has a Horizontal Asymptote: $y = V$
This value is also a Vertical Shift.

a is the stretching factor

H is Horizontal Shift

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

Range: if $a > 0$, (V, ∞); if $a < 0$, $(-\infty, V)$

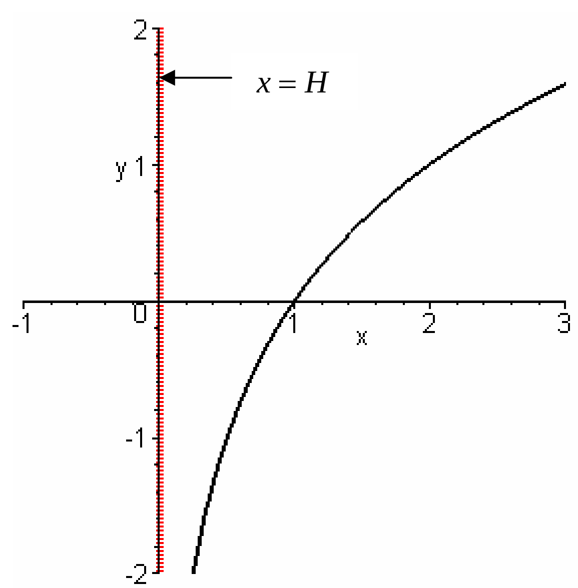
This is also true if the base $b = e$ which is a natural base covered in section 4.2 and it will look like:

$$y = (a)e^{(x-H)} + V$$

Section 4.3

The graph of General Logarithmic function with base *b*:

$$y = (a)\log_b(x - H) + V$$



This graph has a Vertical Asymptote:
solve $x - H = 0$ for *x*.

a is the stretching factor

V is Vertical Shift

Domain: solve $x - H > 0$ for *x*.

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

This is also true if the base $b = e$ which is a natural base and it will look like:

$$y = (a)\ln(x - H) + V$$

Conversion formula:
$b^p = N \quad \Leftrightarrow \quad p = \log_b N$
$(10)^p = N \quad \Leftrightarrow \quad p = \log N$
$e^p = N \quad \Leftrightarrow \quad p = \ln N$

Properties of Logarithms:	
$\log_b 1 = 0$	$\ln 1 = 0$
$\log_b(b) = 1$	$\ln(e) = 1$
$\log_b(b^x) = x$	$\ln(e^x) = x$
$b^{\log_b x} = x$	$e^{\ln x} = x$

Section 4.4

Laws of Logarithms

$\log_b(AB) = \log_b A + \log_b B$	$\ln(AB) = \ln A + \ln B$
$\log_b\left(\frac{A}{B}\right) = \log_b A - \log_b B$	$\ln\left(\frac{A}{B}\right) = \ln A - \ln B$
$\log_b(A^p) = p \log_b A$	$\ln(A^p) = p \ln A$

Change of Base Formula

$$\log_b A = \frac{\ln A}{\ln b} = \frac{\log A}{\log b}$$

Section 4.6

Exponential Growth (Doubling Time)
If the initial size of a population is n_0 and the doubling time is a, then the size of the population at time t is

$$n(t) = n_0 2^{t/a}$$

Where a and t are measured in the same time units (minutes, hours, days, years, and so on).

Exponential Growth (Relative Growth Rate)
A population that experiences exponential growth increases according to the model

$$n(t) = n_0 e^{rt} \qquad \text{or} \qquad P(t) = P_0 e^{rt}$$

where: $n(t) = P(t) =$ population at time t
$n_0 = P_0 =$ initial size of the population
$r =$ relative rate of growth (expressed as a proportion of the population)
$t =$ time