3.2 Logarithms - Function - Graphs

Definition of Log Function

For $x > 0$ and $0 < a \neq 1$

$y = \log_a x$ iff $a^y = x$

A logarithm is a power $\Rightarrow$ specifically it is the power a base must be raised to in order to get the argument.

Ex: $\log_2 16 = 4$

$\log_2 16 = x$

$2^x = 16$

$\log_4 4 =$

$\log_4 4 = x$

$4^x = 4^1$

$\log_3 27 = 3$

$\log_3 27 = x$

$3^x = 27$

$\log_9 3$

$\log_9 3 = x$

$9^x = 3$

$(3^2)^x = 3^1$

$3^{2x} = 3^1$

$2x = 1$

$x = \frac{1}{2}$

If you can get the bases to be the same → set the powers equal

$\log_3\left(\frac{1}{9}\right)$

$\log_3\left(\frac{1}{9}\right) = x$

$3^x = \frac{1}{9}$

$3^x = \frac{1}{3^2}$

$3^x = 3^{-2}$

$\log_4 1 = x$

$4^x = 1$

$\log_2(-4) = x$

$2^x = -4$

no solution

Properties of Logarithms

① $\log_a 1 = 0$ b/c $a^0 = 1$

② $\log_a a = 1$ b/c $a^1 = a$

③ $\log_a a^x = x$ b/c $a^{\log_a x} = x$

④ If $\log_a x = \log_a y$, then $x = y$.

$$\log_3(2x-7) = \log_3(12)$$

$$2x - 7 = 12$$

$$2x = 19$$

$$x = 19/2$$

Graphs of Logarithmic Functions

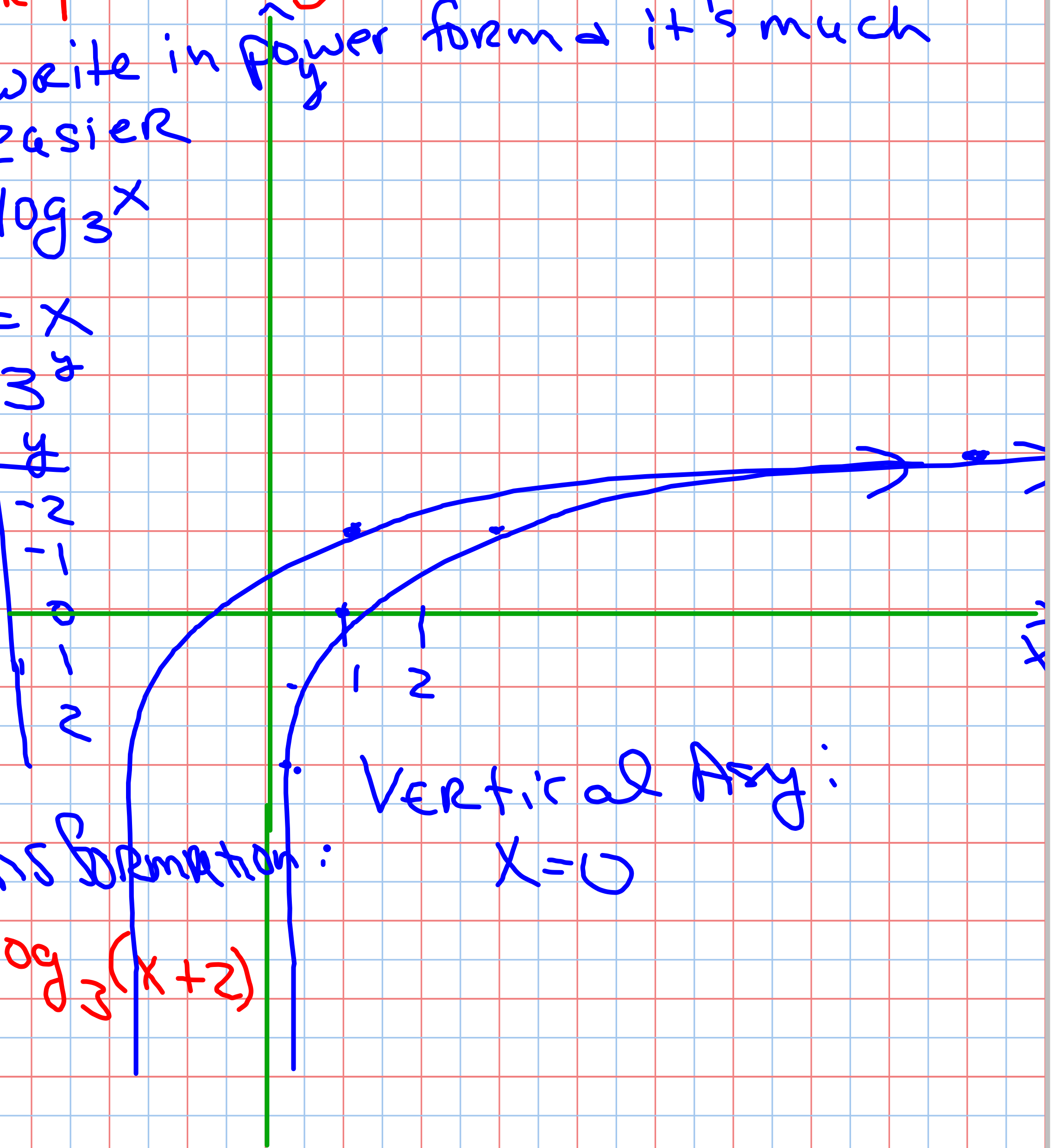
Rewrite in power form & it's much easier

$y = \log_3 x$

$3^y = x$

$x = 3^y$

x	y
1/9	-2
1/3	-1
1	0
3	1
9	2



Vertical Asy:

$x = 0$

Transformation:

$y = \log_3(x+2)$

Natural Log Function: ln

1. $e^{\ln 2}$

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

3. $e^{\ln(-23)}$

4. $\ln e^{5}$

5. $\ln e^{-10}$

6. $\ln e^{(1/2)}$

ln & e are inverses

$e^{-5} = \frac{1}{e^5}$ $\ln(-5) = x$ $e^x = -5$

no soln

Domain of log and ln is

$x > 0$