Graphing Logarithms

basic shape

Logarithms are inverse functions of exponentials

So, everything is just the reverse of the exponential graphs.

Domain: restricted
Range: $\mathbb{R}$

Definition of a logarithm

$$\boxed{\log_b a = y} \iff \boxed{b^y = a}$$

$\log_2 4 = \boxed{2}$ what power do you put on 2 to get 4? answer 2

$\log_4 64 = \boxed{3}$ what power do you put on 4 to get 64? answer 3

$\log_2 4 = x$ $2^x = 4$ so $x = 2$
$\log_4 64 = x$ $4^x = 64$ so $x = 3$

also $\log_2 4 = \dfrac{\log 4}{\log 2} = 2$

called **change of bases formula.**

log graphs

$y = a\log_b(x-h) + k$

have vertical asymptotes

"starting vertices" (1,0) R

(−1,0) L

Example sketch a graph of $f(x) = \log_2 x$

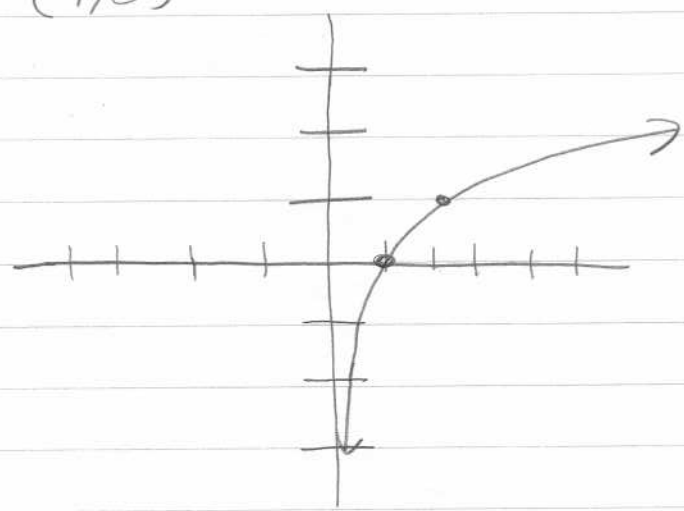
"starting vertex" = (1,0)

shift = (0,0)

(1,0)

vertical asymptote

$x = 0$



Domain: $x > 0$

Range: $\mathbb{R}$

x	y
0	DNE ($\log_2 0$)
1	0
2	$\log_2 2 = 1$

Example 2

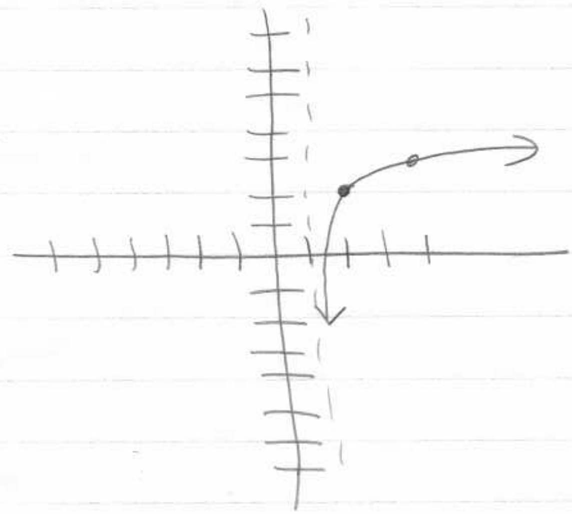
graph $f(x) = \log_3(x-1) + 2$

"Starting vertex": $(1,0)$

shift $(1,2)$

$2,2$

VA: $x=1$



D: $x>1$

R: $\mathbb{R}$

x	y
2	$\log_3 1 + 2 = 2$
3	$\log_3 2 + 2 = ?$
4	$\log_3 3 + 2 = 1 + 2 = 3$

Example 3

graph $f(x) = -\log_2(x+3)$

"starting vertex" $(1,0)$

shift $-3,0$

$(-2,0)$

VA: $x=-3$

D: $x > -3$

R: $\mathbb{R}$

x	y
-3	DNE
-2	0
-1	$-\log_2(2) = -1$
1	$-\log_2(4) = -2$