

7.3 Notes Day 2 – Graphing Logarithmic Functions

Warm -Up Remember: $b^x = a \leftrightarrow \log_b(a) = x$

a. Rewrite each exponential equation in logarithmic form:

$$3^4 = 81 \rightarrow \log_3(81) = 4$$

$$\left(\frac{1}{5}\right)^3 = \frac{1}{125} \rightarrow \log_{\left(\frac{1}{5}\right)}\left(\frac{1}{125}\right) = 3$$

b. Rewrite each logarithmic equation in exponential form:

$$\log_4(256) = 4 \rightarrow 4^4 = 256$$

$$\log_6\left(\frac{1}{216}\right) = -3 \rightarrow 6^{-3} = \frac{1}{216}$$

c. Evaluate each expression. (Remember: log means "what exponent goes on...")

$$\log_4\left(\frac{1}{64}\right) = -3$$

$$\log_8(512) = 3$$

$$\log_4(1) = 0$$

WEGO 4 to get $\frac{1}{64}$

$$\log_8(8) = 1$$

$$\log_{32}(2) = \frac{1}{5}$$

$$\log_{\frac{1}{2}}(64) = -6$$

$$\begin{aligned} 32^x &= 2 \\ (2^5)^x &= 2 \rightarrow 5x = 1 \\ &\rightarrow x = \frac{1}{5} \end{aligned}$$

$$\begin{aligned} \frac{1}{2}^x &= 64 \\ &\rightarrow (2^{-1})^x = 2^6 \\ -x &= 6 \\ x &= -6 \end{aligned}$$

Common logarithm – When no base is indicated, the base is 10.

Evaluate: $\log 1000 = 3$

$$\log 0.01 = -2$$

$$\frac{1}{100}$$

$$\log 1 = 0$$

Graphing Logarithmic Functions:

Parent function: $f(x) = \log_b x$, where $b \neq 1$

Domain: $x > 0$

Vertical asymptote: $x = 0$

Graphing exponentials:

Range: \mathbb{R}

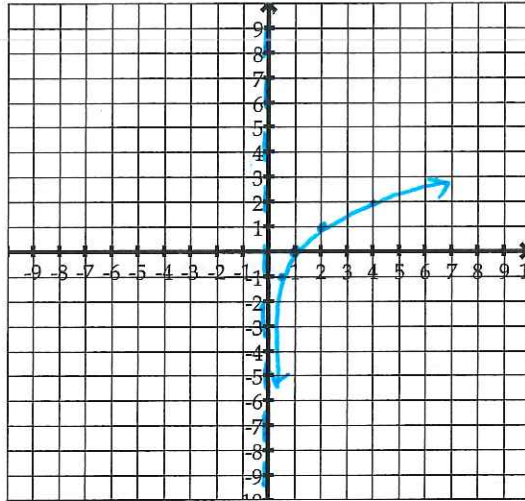
x-intercept (1, 0)

Critical points: $(\frac{1}{b}, -1); (1, 0); (b, 1)$

Graph: $f(x) = \log_2 x$

	x	f(x)
$2^{-1} \rightarrow$	$\frac{1}{2}$	-1
$2^0 \rightarrow$	1	0
$2^1 \rightarrow$	2	1

↑
use these
for y values
in all log parents



Asymptote: $x=0$

Domain: $x > 0$ Range: \mathbb{R}

The graphs of logarithmic functions can be transformed by changing the value of the constants a , h , and k in the equation $f(x) = a \log_b (x - h) + k$. The vertical asymptote is always $x = h$

1. Graph: $f(x) = \log_2 x - 5$

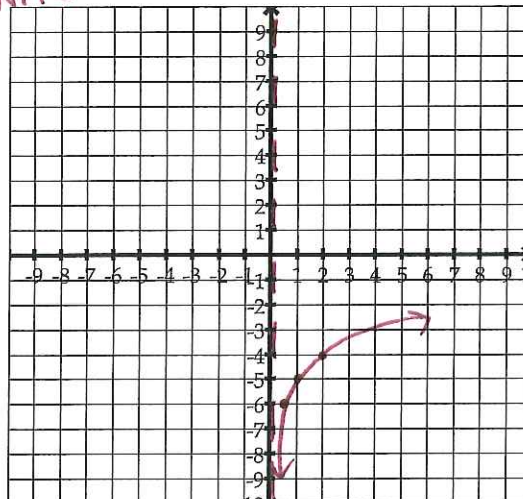
Parent:

$y = \log_2 x$

x	y
$\frac{1}{2}$	-1
1	0
2	1

Transformations: *down 5*

x	y-5
$\frac{1}{2}$	-6
1	-5
2	-4



Asymptote: $x=0$

Domain: $x > 0$

Range: \mathbb{R}

2. Graph: $f(x) = \log_5(x + 3)$

Parent:

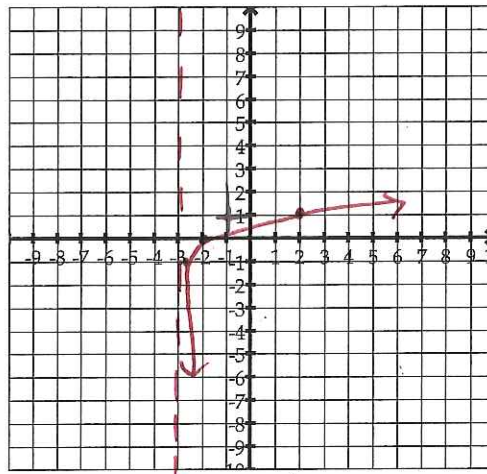
$y = \log_5 x$

x	y
1/5	-1
1	0
5	1

Transformations:

left + 3

$x-3$	y
-2.8	-1
-2	0
2	1



Asymptote:

$x = -3$

Domain:

$x > -3$

Range:

\mathbb{R}

3. Graph: $f(x) = -\log(x - 2)$

Parent:

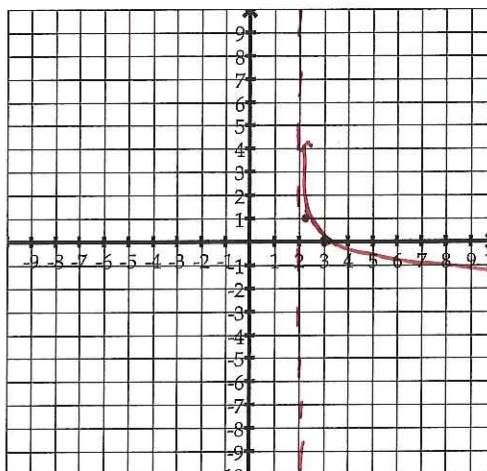
$y = \log x$

x	y
1/10	-1
1	0
10	1

Transformations:

reflect over x axis, right 2

$x+2$	$-y$
2.1	1
3	0
12	-1



Asymptote:

$x = 2$

Domain:

$x > 2$

Range:

\mathbb{R}

4. Graph: $f(x) = 3 \log_{1/2}(x) + 1$

Parent:

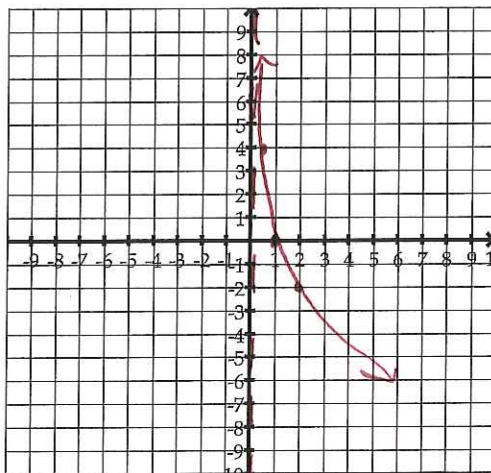
$y = \log_{1/2} x$

x	y
2	-1
1	0
1/2	1

Transformations:

vertical stretch by 3
up 1

x	$3y+1$
2	-2
1	1
1/2	4



Asymptote:

$x = 0$

Domain:

$x > 0$

Range:

\mathbb{R}

