

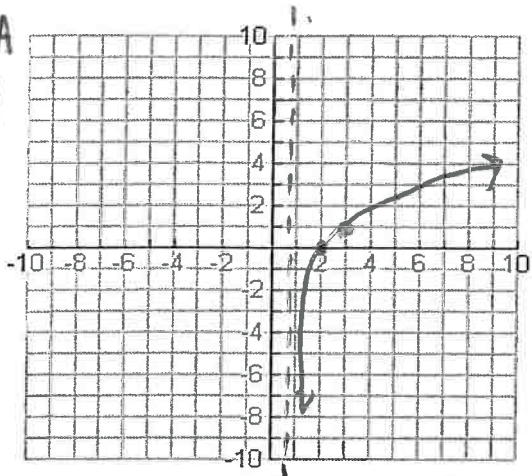
10.09 Graphing Logarithmic Functions

Graph the following functions. $x-1=0$

1. $f(x) = \log_2(x-1)$

$x=1$

x	y
1	VA
2	0
3	1



Domain: $(1, \infty)$ Range: $(-\infty, \infty)$

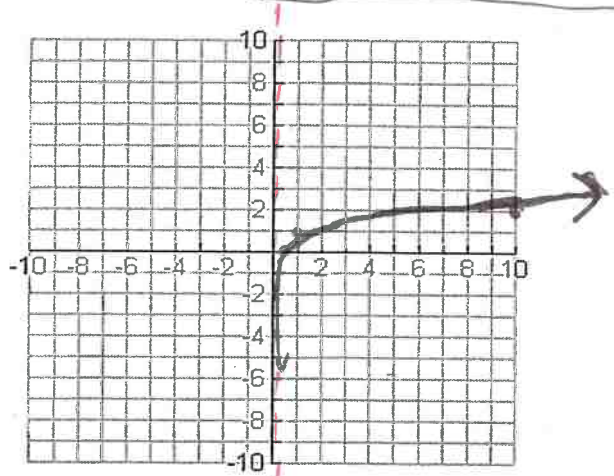
Asymptote: $x=1$ x-intercept: $(2, 0)$

Helpful Log Characteristics

- 1) $\log_b(x)$ set argument = 0 to find V.A.
- 2) $\log_b(1) = 0$
- 3) $\log_b(b) = 1$
- 4) $\log_b(\frac{1}{b}) = -1$

2. $f(x) = \log(x) + 1$

x	y
0	VA
1	1
10	2
1/10	0



Domain: $(0, \infty)$ Range: $(-\infty, \infty)$

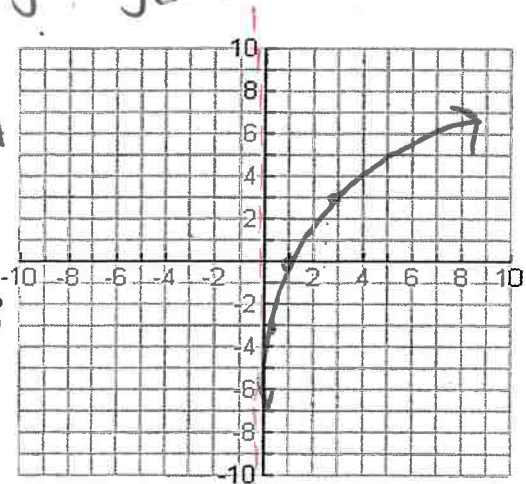
Asymptote: $x=0$ x-intercept: $(\frac{1}{10}, 0)$

3. $f(x) = 3 \ln x$

VA $x=0$

$y = 3 \log_e(x)$

x	y
0	VA
1	0
e	3
e^{-1}	-3



Domain: $(0, \infty)$ Range: $(-\infty, \infty)$

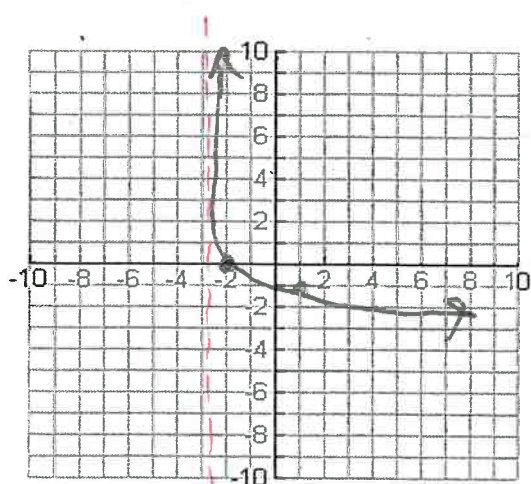
Asymptote: $x=0$ x-intercept: $(1, 0)$

4. $f(x) = -\log_4(x+3)$

$x+3=0$

$x=-3$ (VA)

x	y
-3	VA
-2	0
1	-1



Domain: $(-3, \infty)$ Range: $(-\infty, \infty)$

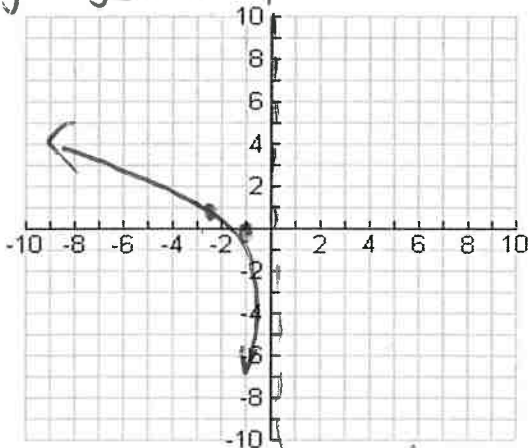
Asymptote: $x=-3$ x-intercept: $(-2, 0)$

5. $f(x) = \ln(-x)$

$y = \log_e(-x)$

VA: $x=0$

x	y
-1	0
-e	1

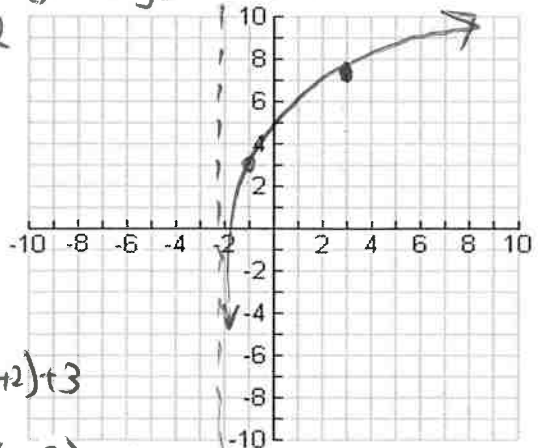


6. $f(x) = 4 \log_5(x+2) + 3$

$y = 4 \log_5(x+2) + 3$

VA: $x=-2$

x	y
-1	3
3	7



Domain: $(-\infty, 0)$ Range: $(-\infty, \infty)$

Asymptote: $x=0$ x-intercept: $(-1, 0)$

Practice:

$0 = 4 \log_5(x+2) + 3$
 $-\frac{3}{4} = \log_5(x+2)$ Domain: $(-2, \infty)$ Range: $(-\infty, \infty)$

Asymptote: $x=-2$ x-intercept: $(5^{-3/4}-2, 0)$
 $5^{-3/4} = x+2 \rightarrow x = 5^{-3/4}-2$

Sketch and analyze the graph of the function. Describe the domain, range, intercepts, asymptote, end behavior, and where the function is increasing or decreasing.

1. $f(x) = \log_{1/4} x$

$y = \log_{1/4}(x)$

VA: $x=0$

As $x \rightarrow \infty, f(x) \rightarrow -\infty$

As $x \rightarrow 0, f(x) \rightarrow +\infty$

x	y
1	0
1/4	1

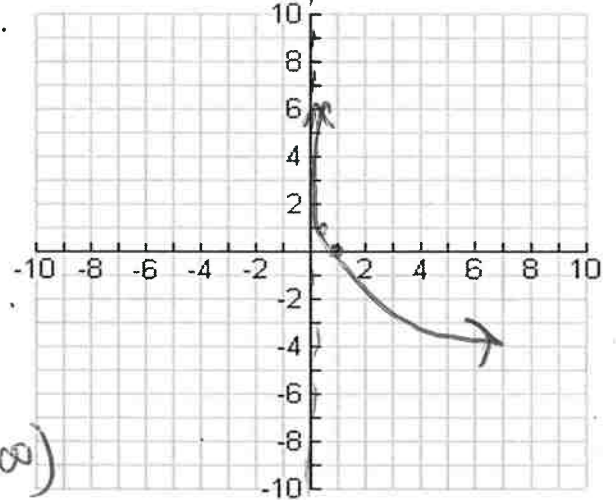
D: $(0, \infty)$

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

VA: $x=0$

x-int: $(1, 0)$

* $f(x)$ is decreasing $(0, \infty)$



Use the graph of $f(x)$ to describe the transformation that results in $g(x)$ then sketch both graphs.

parent
 2. $f(x) = \log x; g(x) = -\log(x-2)$

* Transformations:

$y = -a \log(x-b) + c$

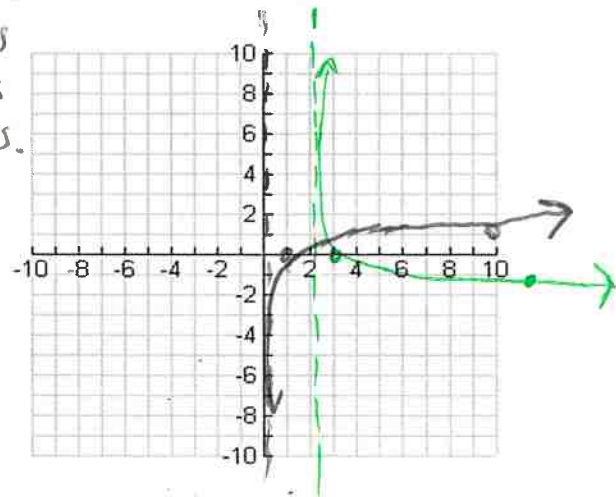
Reflection x-axis
 vertical stretch or compress

shift left (+)
 right (-)

shift up (+)
 down (-)

$g(x)$ transformations
 (i) Reflection x-axis
 (ii) shift Right 2 units.

f(x)	g(x)												
VA: $x=0$	VA: $x=2$												
<table border="1"><tr><th>x</th><th>y</th></tr><tr><td>1</td><td>0</td></tr><tr><td>10</td><td>1</td></tr></table>	x	y	1	0	10	1	<table border="1"><tr><th>x</th><th>y</th></tr><tr><td>3</td><td>0</td></tr><tr><td>12</td><td>-1</td></tr></table>	x	y	3	0	12	-1
x	y												
1	0												
10	1												
x	y												
3	0												
12	-1												



3. $f(x) = \ln x; g(x) = 3 \ln(x) + 1$

Transformations:

$g(x)$ vertical stretch by 3
 $g(x)$ vertical shift up 1

$y = \ln x$

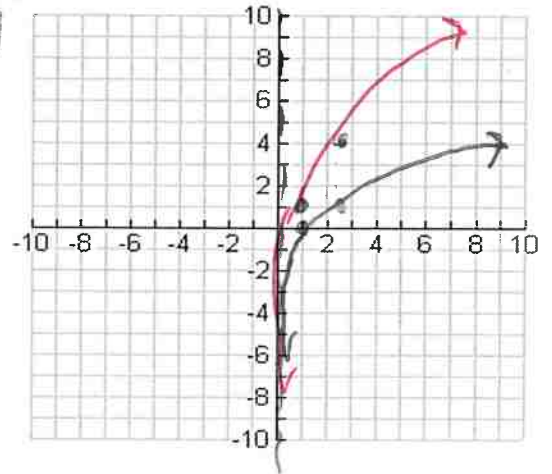
VA: $x = 0$

x	y
1	0
e	1

$y = 3 \log_e x + 1$

VA: $x = 0$

x	y
1	1
e	4

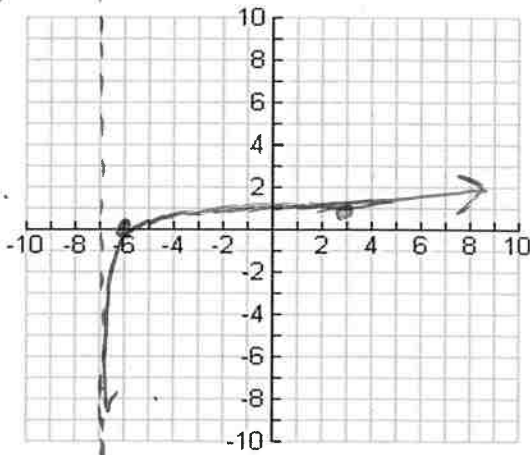


Determine the domain, range, x-intercept, and asymptote.

4. $y = \log(x + 7)$

VA: $x = -7$

x	y
-6	0
3	1



D: $(-7, \infty)$

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

x-int: $(-6, 0)$

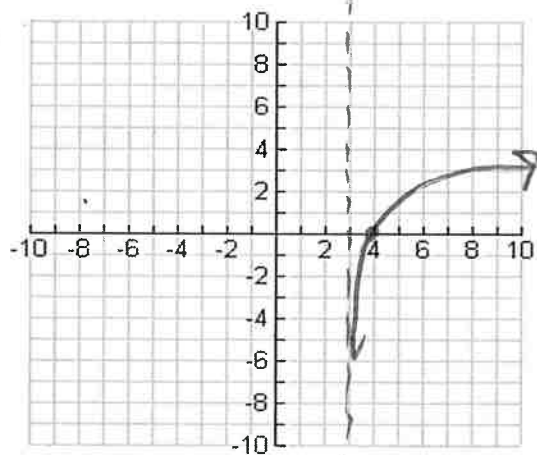
VA: $x = -7$

5. $y = \ln(x - 3)$

VA: $x = 3$

$y = \log_e(x - 3)$

x	y
4	0



D: $(3, \infty)$

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

x-int: $(4, 0)$

VA: $x = 3$