Algebra II/Trig Name _____

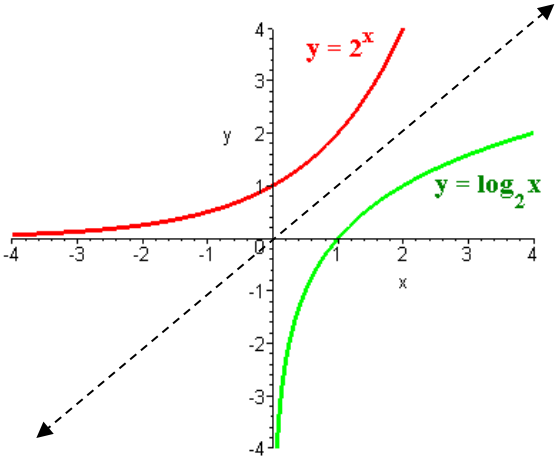
Graphs of Logarithmic Functions
Module 2, Unit 5, Lesson 10

Graphs of Logarithmic Functions

A logarithmic function is an inverse of an exponential function.

$$f(x) = 2^x \quad \text{and} \quad g(x) = \log_2 x$$

1. Logarithmic function reverse the coordinates of the exponential function.
2. The graph is a reflection about the line $y = x$.



Characteristics of Graphs of Logarithmic Functions

1. Domain: $(0, \infty)$
2. Range: $(-\infty, \infty)$
3. x-intercept: (1, 0)
4. Vertical asymptote: $x = 0$

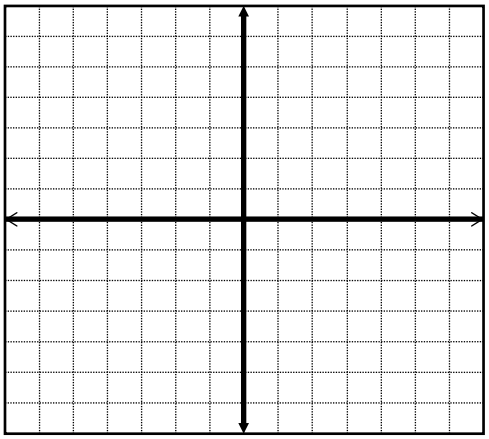
Transformations Involving Logarithmic Functions

Transformation	Graph	Effects on graph
Vertical shifts	$f(x) = \log_b x + c$ $f(x) = \log_b x - c$	Graph shifts up c units Graph shifts down c units
Horizontal shifts	$f(x) = \log_b(x + c)$ $f(x) = \log_b(x - c)$	Graph shifts to the left c units - Vertical asymptote: x = – c Graph shifts to the right c units - Vertical asymptote: $x = c$

Reflection	$f(x) = -\log_b$ $f(x) = \log_b(-x)$	Graph reflected about the *x*-axis (multiply y by – 1**)** Graph reflected about the *y*-axis (divide x by – 1)
Vertical stretching or shrinking	$f(x) = c\log_b x$	Graph stretches vertically if $c > 1$ and shrinks vertically if $0 < c < 1$. (multiply *y* by c)
Horizontal stretching or shrinking	$f(x) = \log_b(cx)$	Graph stretches horizontally if $0 < c < 1$ and shrinks horizontally if $c > 1$. (divide *x* by c)

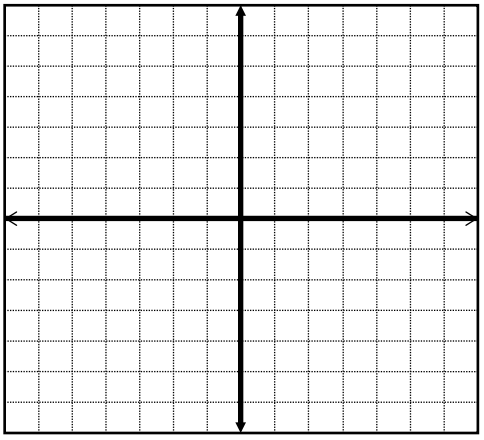
Graph the following functions.

1. $y = \log_3 x$



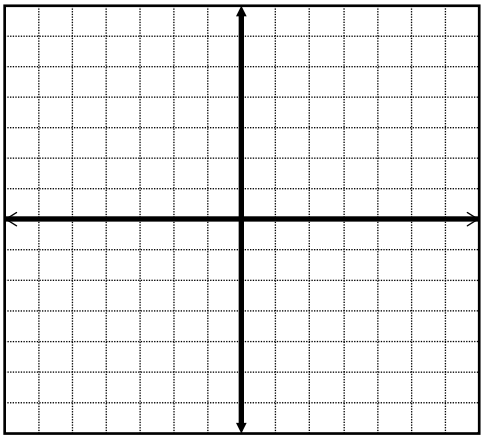
Domain: _____
Range: _____
Asymptote: _____

2. $y = \ln x$



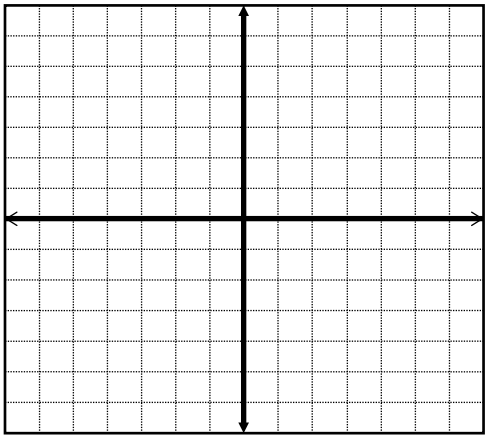
Domain: _____
Range: _____
Asymptote: _____

3. $y = -\frac{1}{2}\ln(x-1)$



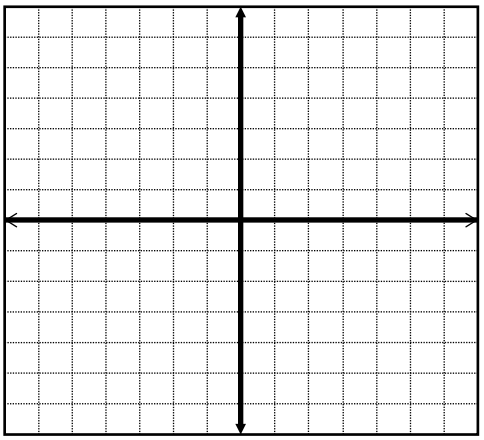
Domain: _____
Range: _____
Asymptote: _____

4. $y = 2\log_3 x + 1$



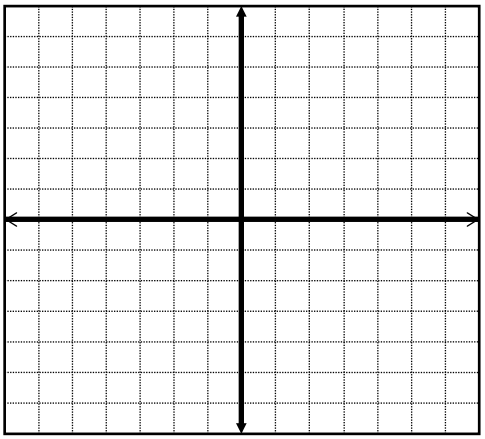
Domain: _____
Range: _____
Asymptote: _____

5. $y = \frac{1}{2}\log_2(x+1)$



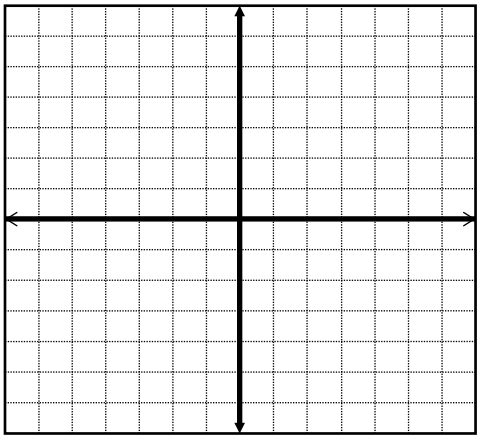
Domain: _____
Range: _____
Asymptote: _____

6. $y = -\ln x - 3$



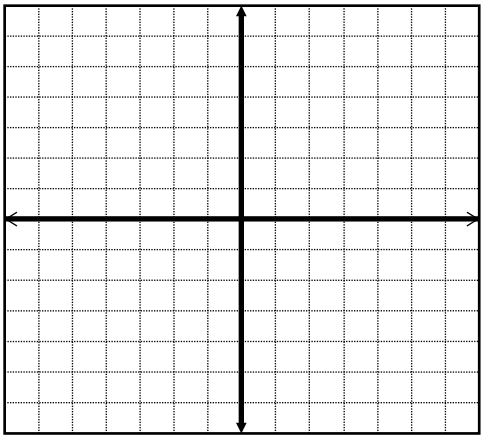
Domain: _____
Range: _____
Asymptote: _____

7. $y = 2\ln\left(\frac{1}{2}x\right)$



Domain: _____
Range: _____
Asymptote: _____

8. $y = \log_2(x-2) + 3$



Domain: _____
Range: _____
Asymptote: _____