Logarithmic Functions and Their Graphs

Name _____

Date _____ Period _____

A logarithmic function is a function with the form

$$f(x) = \log_a x$$

where $a > 0$ and $a \neq 1$.

$f(x) = \log_2 x$ $f(x) = \log_{0.3} x$ $f(x) = \log x$

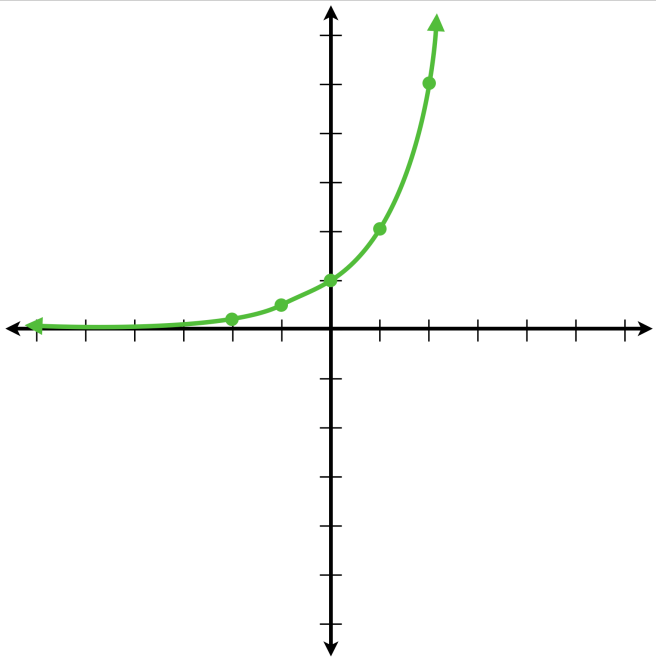
Logarithmic Functions are Inverses of Exponential Functions

$f(x) = 2^x$

x	$f(x)$
-2	$\frac{1}{4}$
-1	$\frac{1}{2}$
0	1
1	2
2	4

$f(x) = \log_2 x$

x	$f(x)$
$\frac{1}{4}$	-2
$\frac{1}{2}$	-1
1	0
2	1
4	2



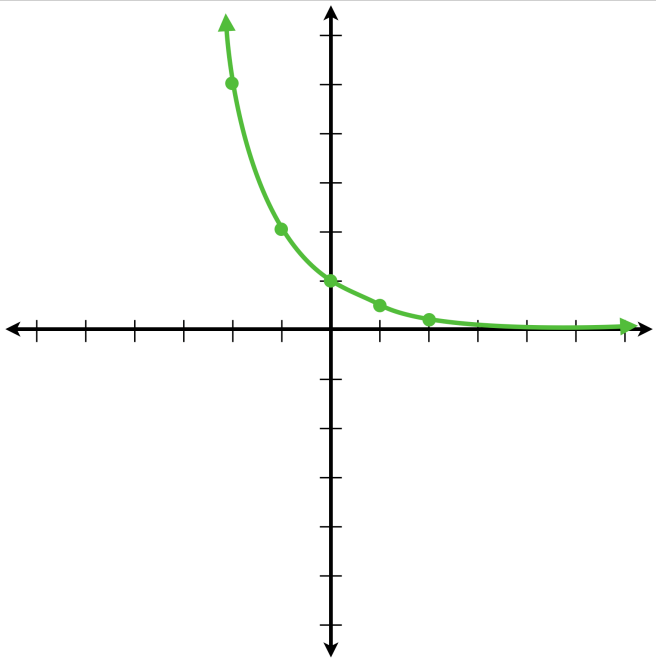
Logarithmic Functions are Inverses of Exponential Functions

$f(x) = (\frac{1}{2})^x$

x	$f(x)$
-2	4
-1	2
0	1
1	$\frac{1}{2}$
2	$\frac{1}{4}$

$f(x) = \log_{\frac{1}{2}} x$

x	$f(x)$
4	-2
2	-1
1	0
$\frac{1}{2}$	1
$\frac{1}{4}$	2



$f(x) = \log_2 x$ $f(x) = \log_{\frac{1}{2}} x$

Properties of Logarithmic Functions

Domain: $\{x \mid x > 0\}$

Range: $\{y \mid -\infty < y < \infty\}$

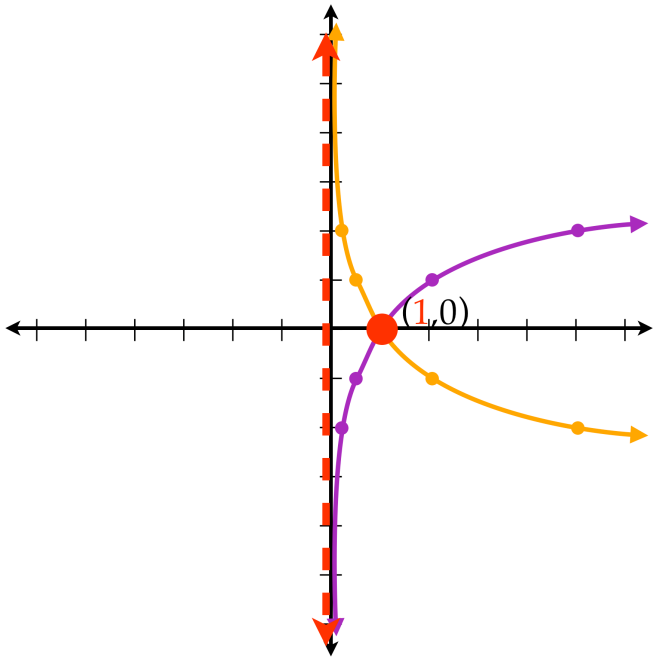
Line $x = 0$ is vertical asymptote

x-intercept: (1,0)

graph contains $(a,1)$ and $(\frac{1}{a}, -1)$

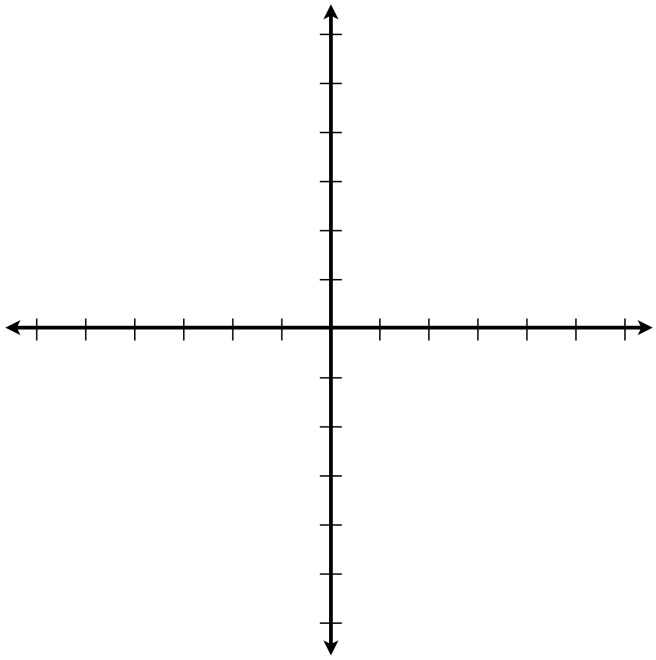
An increasing function if $a > 1$.

A decreasing function if $0 < a < 1$.



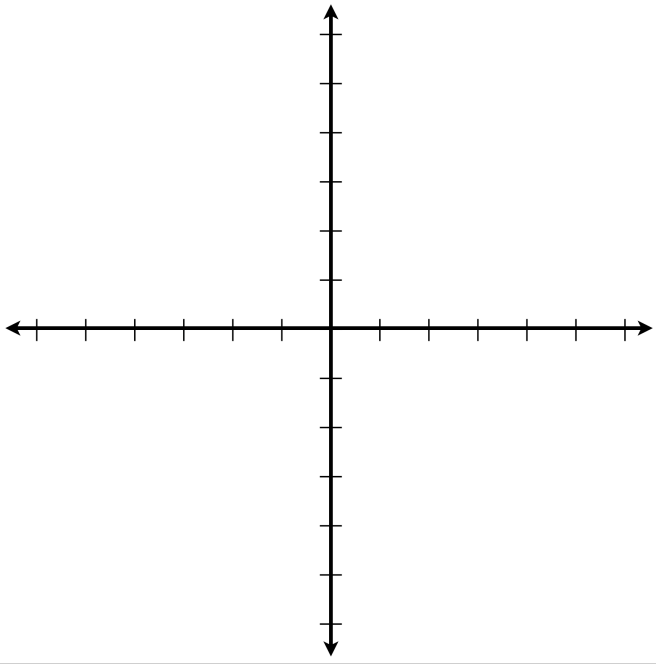
Graph the following using transformations

$f(x) = \log_4 (x + 3) - 2$



Graph the following using transformations

$f(x) = 4 \cdot \log (x - 1) + 3$



Graph the following using transformations

$$f(x) = \log_{\frac{1}{5}}(x - 2) - 1$$