Name:______________________ Date:__________

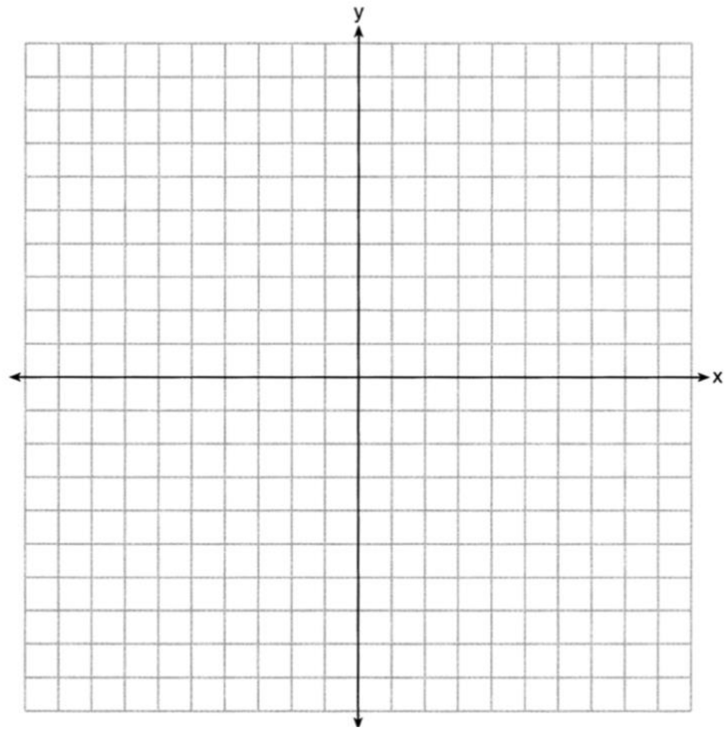
Notes: Graphing Logarithmic Functions

Do Now: What is the inverse of $y = 2^x$?

On the set of axes, graph $y = 2^x$ and its inverse.

x	y

x	y



What Should I Be Able to Do?

- I can describe how a logarithmic equation is being transformed.

- I can graph a logarithmic equation that is undergoing multiple transformations.

- I can determine the asymptote of a logarithmic equation.

- I can determine the domain and range of a logarithmic equation.

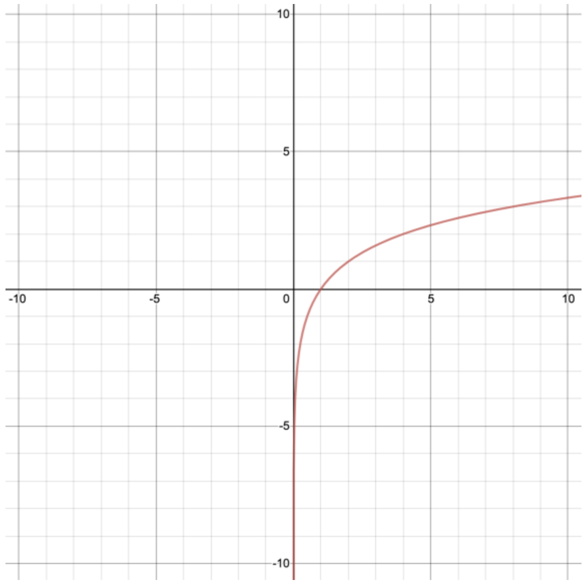
- I can determine the x-intercept of a logarithmic equation.

- I can determine the end behavior of a logarithmic equation.

- I can graph a logarithmic equation with a base such that $0 < b < 1$.

Let's look deeper into the graph of $f(x) = \log_2 x$.

x	$f(x)$
$\frac{1}{4}$	-2
$\frac{1}{2}$	-1
1	0
2	1
4	2
8	3



Domain: ____________ Range: ____________ Asymptote: ___________ X-Intercept: ________

End Behavior:

Left-end Behavior -

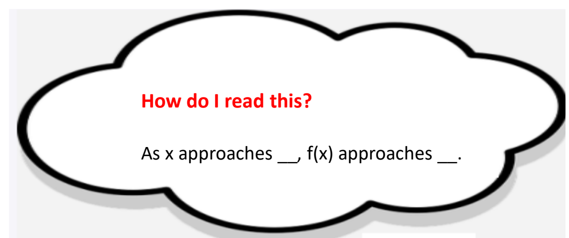
As $x \longrightarrow$ ________

$f(x) \longrightarrow$ ________

Right-end Behavior-

As $x \longrightarrow$ ________

$f(x) \longrightarrow$ ________



Now let's graph the following three equations and see how the graph of $f(x) = \log_2 x$ is changed:

$g(x) = \log_2(x + 4)$ $\quad$ $h(x) = \log_2 x + 3$ $\quad$ $k(x) = -\log_2 x$

Describe each transformation:

________________________ ______________________ ______________________

Domain: _______________ Domain: _______________ Domain: _______________

Range: _______________ Range: _______________ Range: _______________

Asymptote: _____________ Asymptote: _____________ Asymptote: _____________

X-Intercept: ____________ X-Intercept: ____________ X-Intercept: ____________

Left-end Behavior: Left-end Behavior: Left-end Behavior:

Right-end Behavior: Right-end Behavior: Right-end Behavior:

Describe how $f(x) = \log x$ changes to form each of the following equations:

1) $g(x) = \log(x - 6)$

2) $h(x) = \log x - 9$

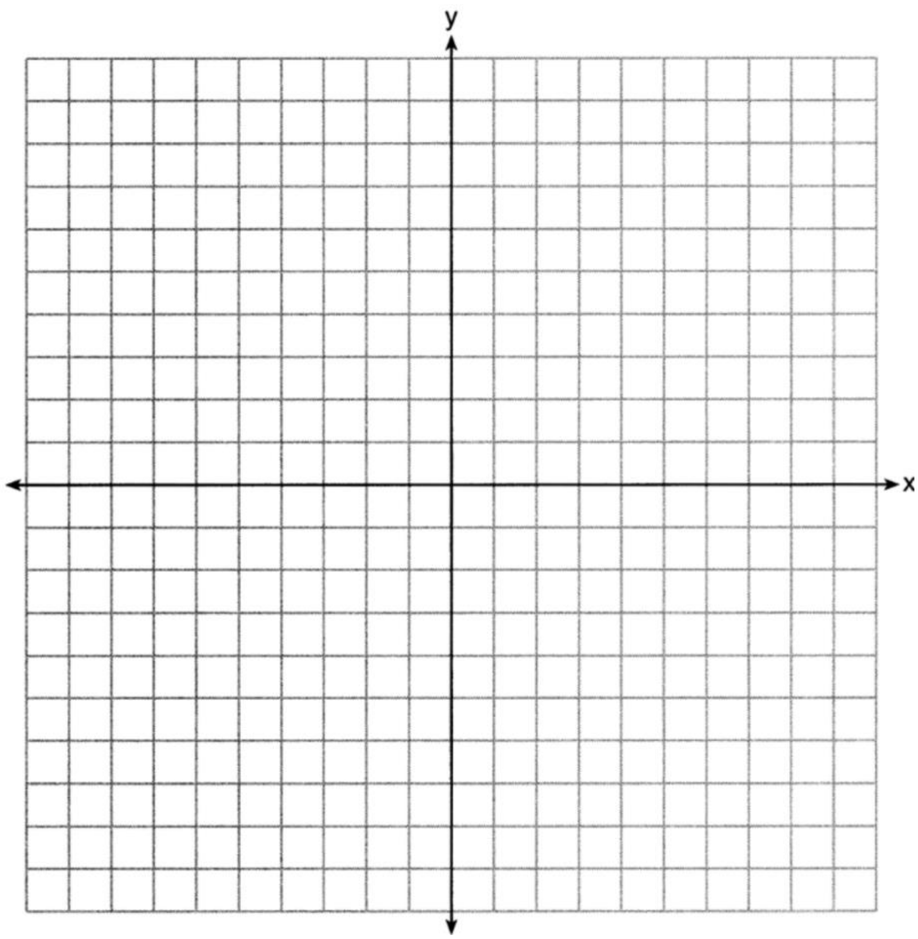
3) $j(x) = \log(x + 1) + 10$

4) $k(x) = -\log x$

5) $m(x) = \log(x - 14) - 21$

6) $n(x) = -\log(x - 1) + 2$

Graph $y = \log_2(x + 4) - 3$ on the set of axes below. Use an appropriate scale to include *both* intercepts.

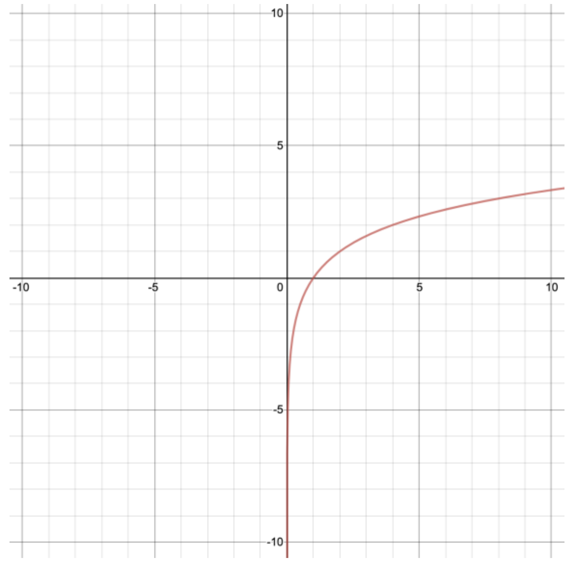


Describe the behavior of the given function as x approaches -4 and as x approaches positive infinity.

Let’s take a look at when the bases of logarithm equations ($f(x) = \log_b x$) are different...

Base Greater Than 1 ($b > 1$)

$f(x) = \log_2 x$



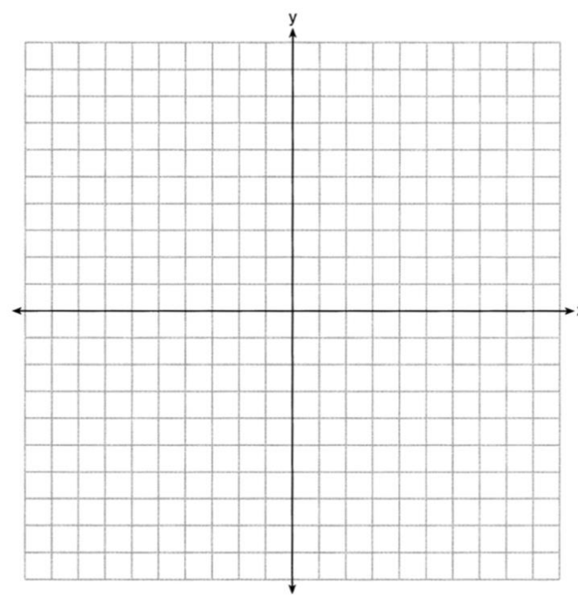
Why do the ends of the graph behave like this?

Left-End:

Right-End:

Base Between 0 and 1 ($0 < b < 1$)

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



Why do the ends of the graph behave like this?

Left-End:

Right-End:

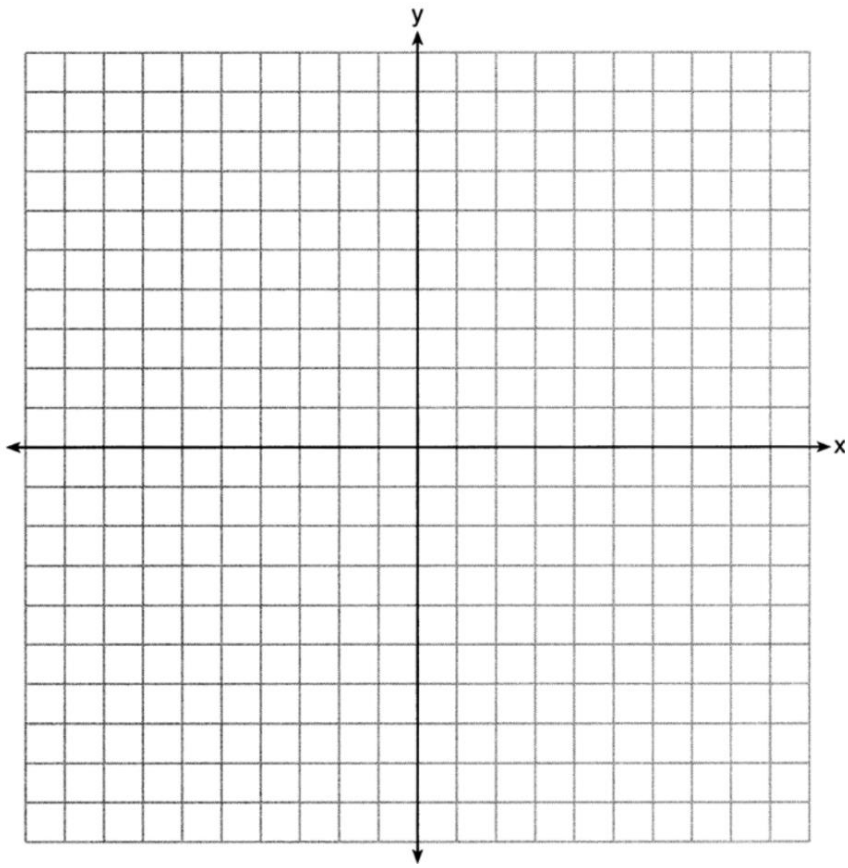
Success Criteria

- I can describe how a logarithmic equation is being transformed.

- I can graph a logarithmic equation that is undergoing multiple transformations.

- I can determine the asymptote, domain, range, x-intercept, and end behavior of a logarithmic equation.

Graph $y = \log_2(x - 2) - 3$ on the set of axes below.



Describe the transformation from the parent function, $y = \log_2 x$:

____

Domain: ____________ Range: ____________ Asymptote: ___________ X-Intercept: ________

End Behavior:

Left-end Behavior -

As $x \longrightarrow$ ________

$f(x) \longrightarrow$ ________

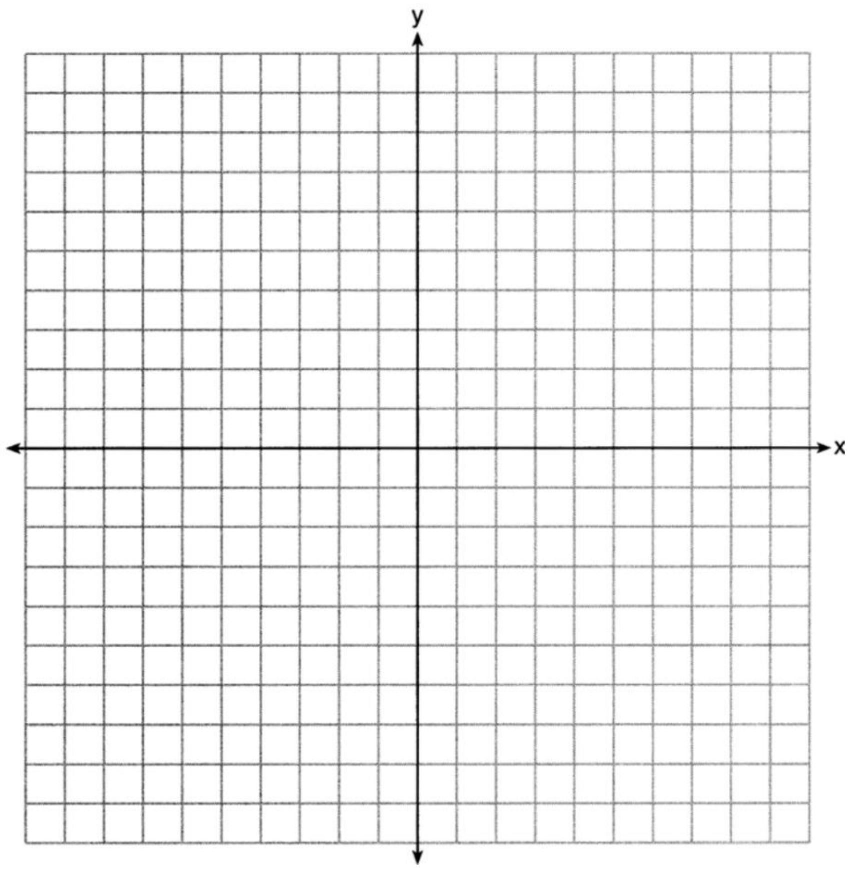
Right-end Behavior-

As $x \longrightarrow$ ________

$f(x) \longrightarrow$ ________

- I can graph a logarithmic equation with a base such that $0 < b < 1$.

Graph $y = \log_{\frac{1}{3}}(x)$ on the set of axes below.



End Behavior:

Left-end Behavior -

As $x \longrightarrow$ ________

$f(x) \longrightarrow$ ________

Right-end Behavior-

As $x \longrightarrow$ ________

$f(x) \longrightarrow$ ________

Describe why each end behavior behaves the way it does.

Name:______________________ Date:__________

Classwork: Graphing Logarithmic Functions

1) Using $f(x) = \log x$ as the parent function, fill in the following for each of the functions below:

$a(x) = \log x - 3$

$b(x) = \log(x - 3)$

$c(x) = \log(x + 2) - 4$

Describe each transformation:

________________________ ________________________ ________________________

Domain: ________________ Domain: ________________ Domain: ________________

Range: ________________ Range: ________________ Range: ________________

Asymptote: ______________ Asymptote: ______________ Asymptote: ______________

X-Intercept: _____________ X-Intercept: _____________ X-Intercept: _____________

Left-end Behavior: Left-end Behavior: Left-end Behavior:

Right-end Behavior: Right-end Behavior: Right-end Behavior:

2) Find the inverse of the following functions.

a) $y = 5^x$.

b) $y = 10^{3x-5}$.

3) Evaluate the following logarithmic expressions without using a calculator.

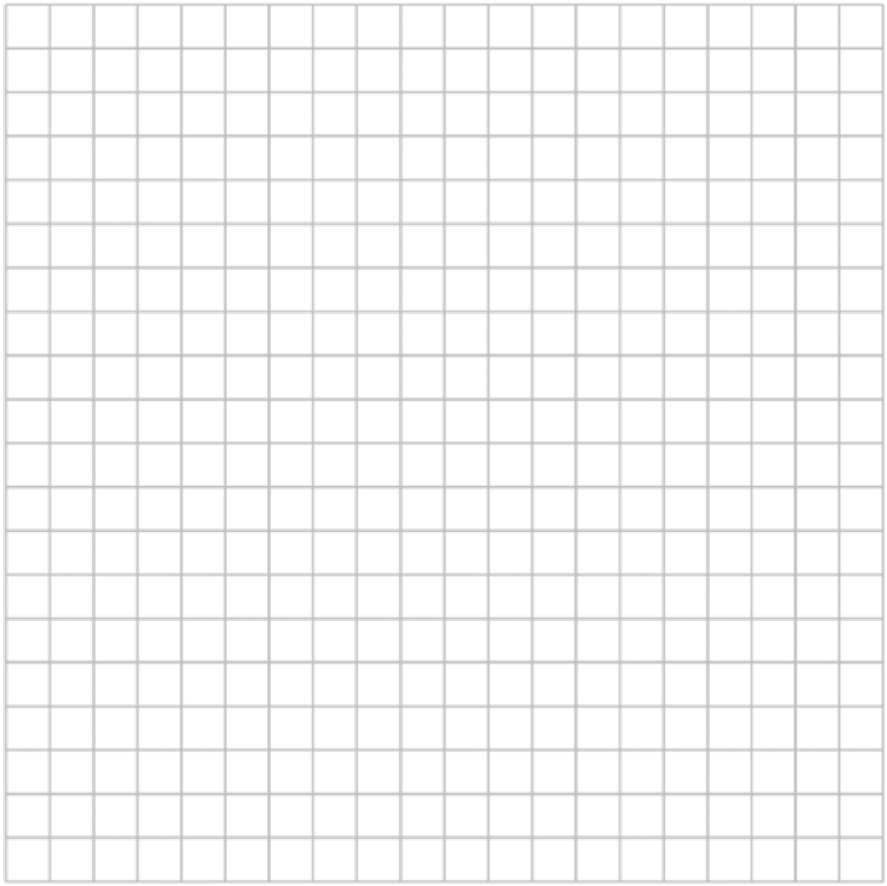
a) $\log_2 \frac{1}{32}$

b) $4e^{\ln 7}$

c) $\log_{81} 3$

4) $\log \sqrt{10}$

4) Graph $y = \log_{\frac{1}{4}} x$ on the set of axes below.



Domain: ______________ Range: ______________ Asymptote: _____________ X-Intercept: _________

End Behavior:

Left-end Behavior -

As $x \longrightarrow$ _________

$f(x) \longrightarrow$ _________

Right-end Behavior-

As $x \longrightarrow$ _________

$f(x) \longrightarrow$ _________