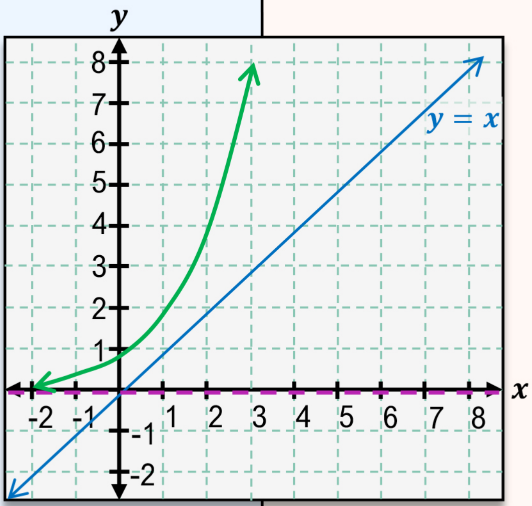
TOPIC: GRAPHING LOGARITHMIC FUNCTIONS

Graphs of Logarithmic Functions

- We can graph a logarithmic function using the fact that it is the ____________ of an exponential function.
  - $f(x) = \log_b x$ can be graphed by ______________ the graph of its inverse function, $y = b^x$ over ________.

Recall	Exponential Functions	New	Logarithmic Functions

x	$f(x) = 2^x$
-2	¼
-1	½
0	1
1	2
2	4
3	8



x	$f(x) = \log_2 x$
¼	
½	
1	
2	
4	
8	

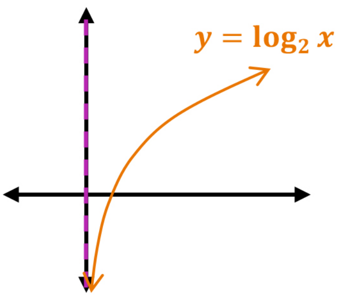
Domain: *always* $\mathbb{R}$ — Range: *always* ________

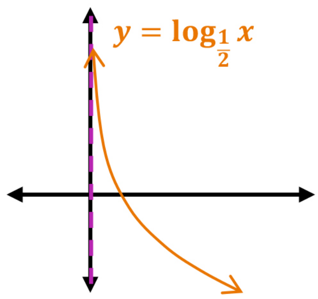
Range: depends on asymp.; $(0, \infty)$ — Domain: depends on __________; ________

Horizontal Asymptote at $y = 0$ ----→ ____________ Asymptote at _______

- Just like its inverse, the direction of the graph of $f(x) = \log_b x$ depends on ___.

$b > 1$	$0 < b < 1$





- Graph **[INCREASES | DECREASES]**
- Graph **[INCREASES | DECREASES]**

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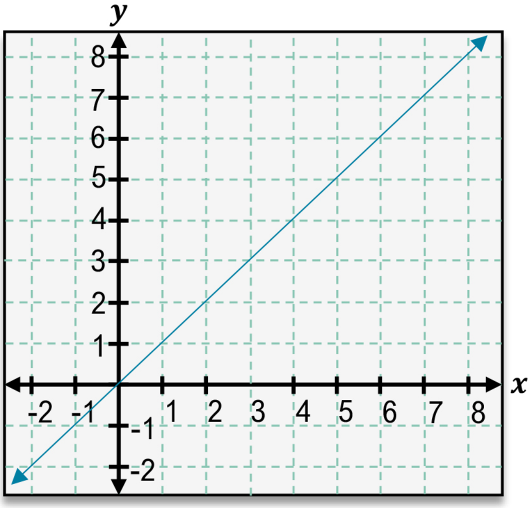
EXAMPLE: Graph $f(x) = 3^x$ and $g(x) = \log_3 x$ on the graph below. Determine the domain and range of each.



x	$f(x) = 3^x$
-2	
-1	
0	
1	
2	

Domain: __________

Range: __________

x	$g(x) = \log_3 x$

Domain: __________

Range: __________

TOPIC: GRAPHING LOGARITHMIC FUNCTIONS

Transformations of Logarithmic Graphs

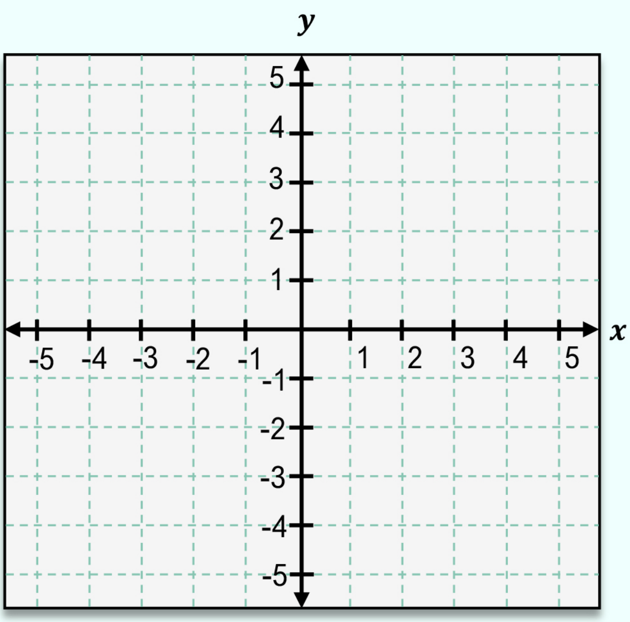
- We can graph logarithmic functions by applying rules of transformations to the parent function, $f(x) = \log_b x$
  - Like we did for exponentials, graph the parent function ___________, then apply transformations.

Recall — **Transformations**

Reflect over	[x | y] axis	[Horiz. | Vert.]	Shift
	[x | y] axis	[Horiz. | Vert.]	

$$g(x) = -f(-x - h) + k$$

EXAMPLE Graph $g(x) = \log_2(x-1) - 4$



HOW TO: GRAPH

0) Identify/graph parent fcn., $f(x) = \log_b x$

a. Plot: $(\_\_\_, -1), (1,0), (\_\_\_, 1)$, connect

b. Vert. Asymp. at: x = ____

1) Shift Vert. Asym. to x= ____: x= _____

2) a. Reflect? □ → test points over [x | y]

b. Shift test points by (_____,_____)

3) Sketch curve approaching asymptote

PROPERTIES

Domain:

If approaching asymp. from right: (_____, ∞)

left: (−∞, _____)

Range: *always* ________________

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PRACTICE: Graph the given function.

$g(x) = -\log_3(x+2)+1$

TO GRAPH

0) Identify/graph parent fcn., $f(x) = \log_b x$

a. Plot: (___ , −1), (1,0), (___ ,1), connect
$1/b$ b

b. Vert. Asymp. at: $x = 0$

1) Shift Vert. Asym. to $x = h$: x = _____

2) a. Reflect? □ → test points over $[x \mid y]$

b. Shift test points by (____ , ____)
h k

3) Sketch curve approaching asymptote

FROM GRAPH

Domain:

If approaching asymp. from right: (____ , ∞)
h

from left: $(-\infty, h)$

Range: *always* _______________