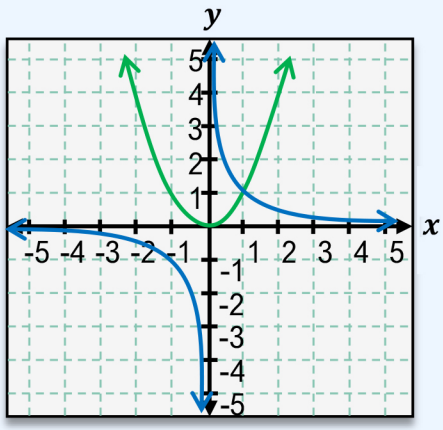
TOPIC: GRAPHING EXPONENTIAL FUNCTIONS

Graphs of Exponential Functions

◆ Graphs of exponential functions are _____ and _____. *(no breaks, no two x's result in same y)*

Recall — Polynomial & Rational Functions



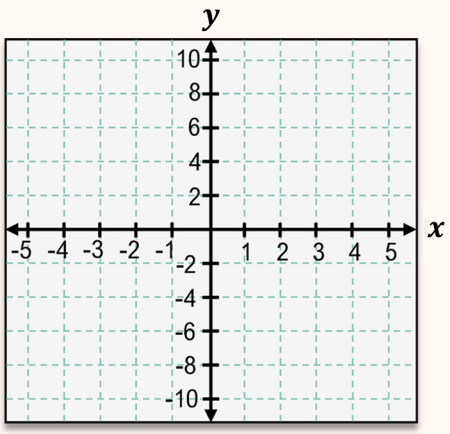
As $x \to \infty$, $f(x) \to \infty$

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

As $x \to \infty$, $f(x) \to 0$

As $x \to -\infty$, $f(x) \to 0$

New — Exponential Functions



x	$f(x) = 2^x$
-3	⅛
-2	¼
-1	
0	
1	
2	
3	
...	
10	1024

As $x \to \infty$, $f(x) \to$ _____

As $x \to -\infty$, $f(x) \to$ _____

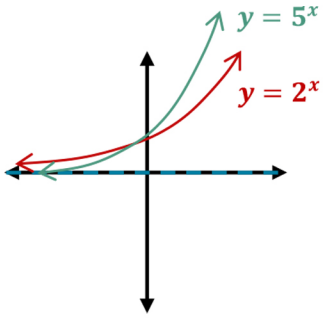
_____ at $y =$ ___

Domain: *always* _____

Range: depends on _____; _____

◆ The direction & steepness of the graph of an exponential function $f(x) = b^x$ depends on the value of ____.

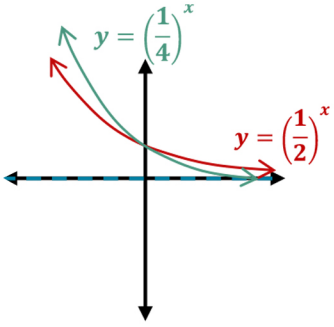
$b > 1$



◆ Graph **[INCREASES | DECREASES]**

◆ Graph gets steeper for **[LARGER | SMALLER]** b

$0 < b < 1$

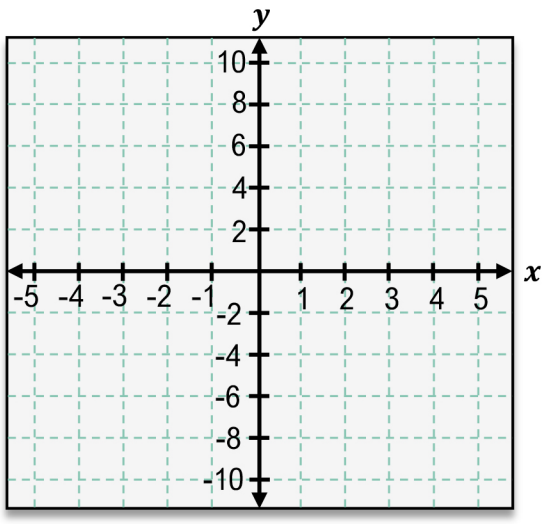


◆ Graph **[INCREASES | DECREASES]**

◆ Graph gets steeper for **[LARGER | SMALLER]** b

TOPIC: GRAPHING EXPONENTIAL FUNCTIONS

EXAMPLE: Sketch the graph of $f(x) = \left(\frac{1}{2}\right)^x$. Identify any asymptotes and determine the domain and range.



x	$f(x) = \left(\frac{1}{2}\right)^x$
-3	
-2	
-1	
0	
1	
2	
3	

Asymptote: _____

Domain: _____

Range: _____

TOPIC: GRAPHING EXPONENTIAL FUNCTIONS

Transformations of Exponential Graphs

◆ We can graph *ANY* exponential function by applying rules of transformations to its parent function, $f(x) = b^x$

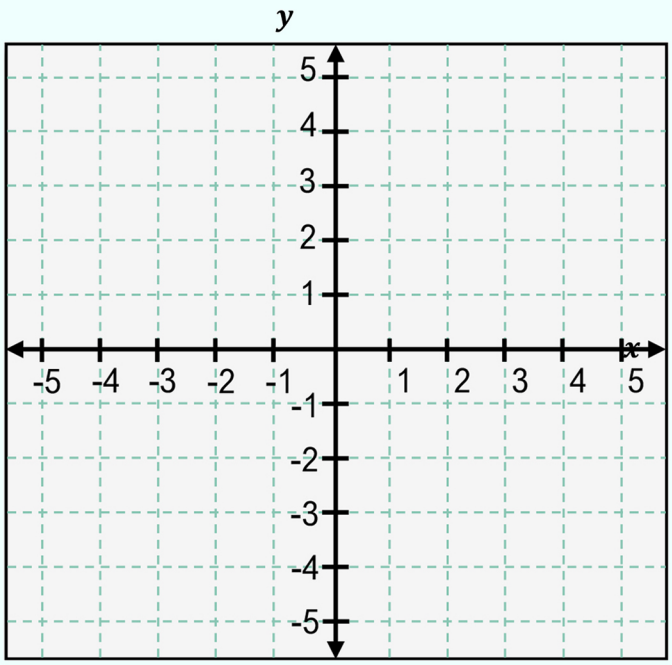
- Graph the parent function _____, then apply transformations to graph the new function.

Recall **Transformations**

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

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

EXAMPLE Graph $g(x) = 2^{x-1} - 4$



HOW TO: GRAPH

0) Identify & graph parent function, $f(x) = b^x$

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

b. Horiz. Asymp. at: y = _____

1) Shift Horiz. Asymp. to y = _____: y = _____

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

b. Shift test points by (_____, _____)

3) Sketch curve approaching asymptote

PROPERTIES

Domain: *always* _____

Range: If ABOVE asymp.: (_____,∞)

If BELOW asymp.: (−∞,_____)

TOPIC: GRAPHING EXPONENTIAL FUNCTIONS

EXAMPLE: Graph the given function as a transformation of $f(x) = \left(\frac{1}{2}\right)^x$

$g(x) = -\left(\frac{1}{2}\right)^x + 3$

TO GRAPH

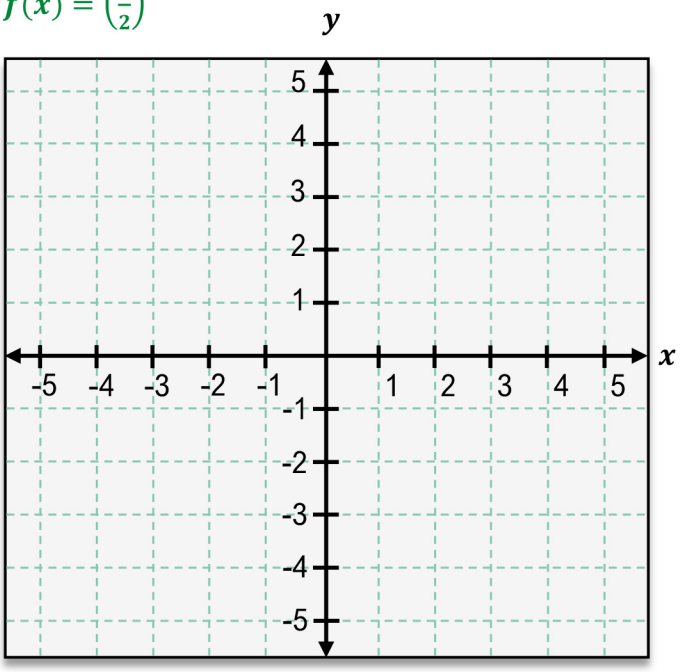
0) Identify & graph parent function, $f(x) = b^x$
   a. Plot: $(-1, \underset{1/b}{\_\_\_}), (0,1), (1, \underset{b}{\_\_})$, connect
   b. HA at: $y = 0$
1) Shift HA to $y = k$: $y =$ _____
2) a. Reflect? □ → test points over $[x \mid y]$
   b. Shift test points by $(\underset{h}{\_\_\_}, \underset{k}{\_\_\_})$
3) Sketch curve approaching asymptote

FROM GRAPH

Domain: *always* _____

Range: If ABOVE asymp.: (k, ∞)

If BELOW asymp.: $(-\infty, \underset{k}{\_\_\_})$



PRACTICE: Graph the given function.

$g(x) = 4^{-x} - 1$

TO GRAPH

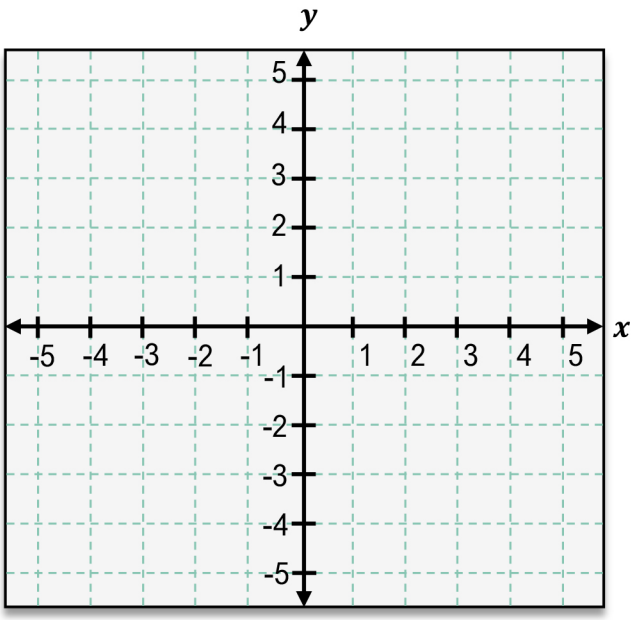
0) Identify & graph parent function, $f(x) = b^x$
   a. Plot: $(-1, \underset{1/b}{\_\_\_}), (0,1), (1, \underset{b}{\_\_})$, connect
   b. HA at: $y = 0$
1) Shift HA to $y = k$: $y =$ _____
2) a. Reflect? □ → test points over $[x \mid y]$
   b. Shift test points by $(\underset{h}{\_\_\_}, \underset{k}{\_\_\_})$
3) Sketch curve approaching asymptote

FROM GRAPH

Domain: *always* _____

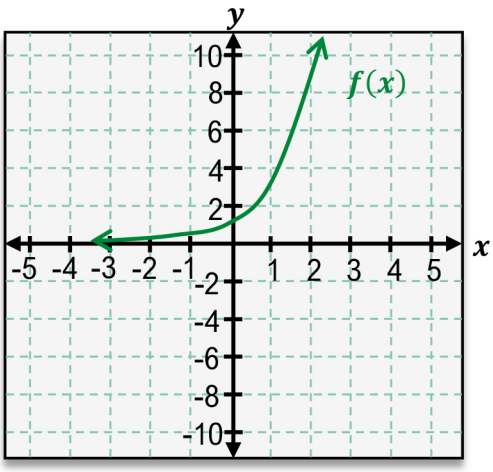
Range: If ABOVE asymp.: $(\underset{k}{\_\_\_}, \infty)$

If BELOW asymp.: $(-\infty, k)$



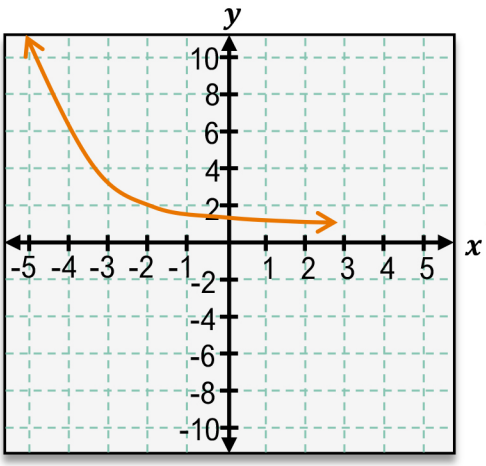
TOPIC: GRAPHING EXPONENTIAL FUNCTIONS

PRACTICE: The graph for the function $f(x) = 3^x$ is shown below. Match the given function, $g(x)$, to its graph.

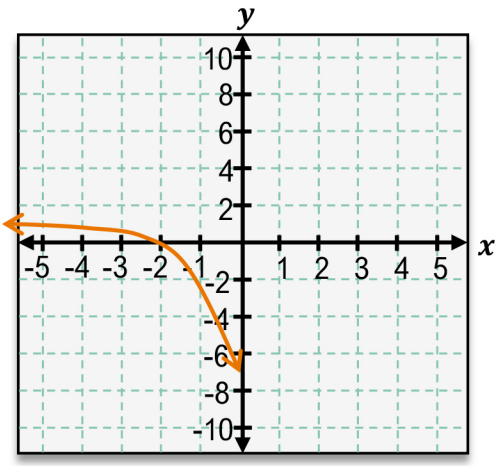


$$g(x) = -3^{x+2} + 1$$

(A)



(B)



(C)