

GUIDED NOTES – 6.4 GRAPHS OF LOGARITHMIC FUNCTIONS

LEARNING OBJECTIVES

In this section, you will:

- Identify the domain of a logarithmic function.
- Graph logarithmic functions.

FINDING THE DOMAIN OF A LOGARITHMIC FUNCTION

- Write out the 3 step process for identifying the domain, given a logarithmic function.

1.

2.

3.

Try It: Read Example 1 in the text, then answer the following.

What is the domain of $f(x) = \log_5(x - 2) + 1$?

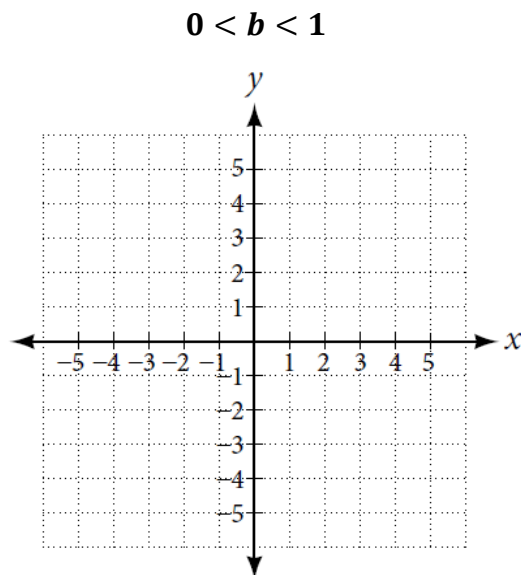
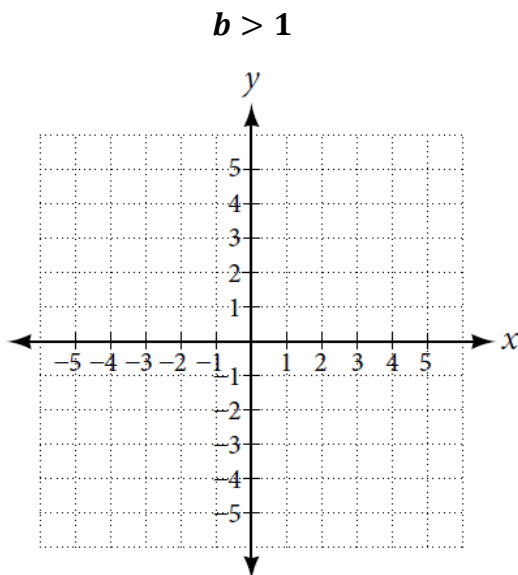
Try It: Read Example 2 in the text, then answer the following.

What is the domain of $f(x) = \log(x - 5) + 2$?

GRAPHING LOGARITHMIC FUNCTIONS

Study the box in your textbook section titled “characteristics of the graph of the parent function, $f(x) = \log_b x$.”

- For any real number x and constant $b > 0, b \neq 1$, we can see the following characteristics in the graph of $f(x) = \log_b(x)$:
 - _____ function
 - Vertical asymptote: _____
 - Domain: _____
 - Range: _____
 - x -intercept: _____, key point: _____
 - y -intercept: _____
 - Increasing if b _____ 1
 - Decreasing if 0 _____ b _____ 1
- Sketch the logarithmic function in the form $f(x) = \log_b x$, when



- Write out the 5 step process for graphing a function, given a logarithmic function with the form $f(x) = \log_b(x)$.

1.

2.

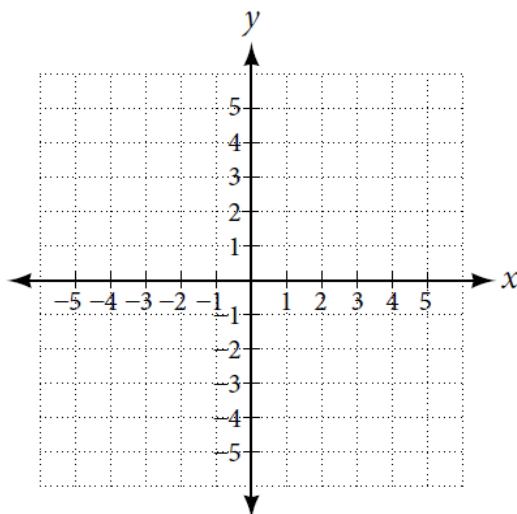
3.

4.

5.

Try It: Read Example 3 in the text, then answer the following.

Graph $f(x) = \log_{\frac{1}{5}}(x)$. State the domain, range, and asymptote.



GRAPHING TRANSFORMATIONS OF LOGARITHMIC FUNCTIONS

Study the box in your textbook section titled “horizontal shifts of the parent function $y = \log_b(x)$ ”.

- For any constant c , the function $f(x) = \log_b(x + c)$
 - Shifts the parent function _____ c units if $c > 0$
 - Shifts the parent function _____ c units if $c < 0$
 - the vertical asymptote is _____
 - Domain: _____
 - Range: _____

- Write out the 5 step process for graphing a translation, given a logarithmic function with the form $f(x) = \log_b(x + c)$.

1.

a.

b.

2.

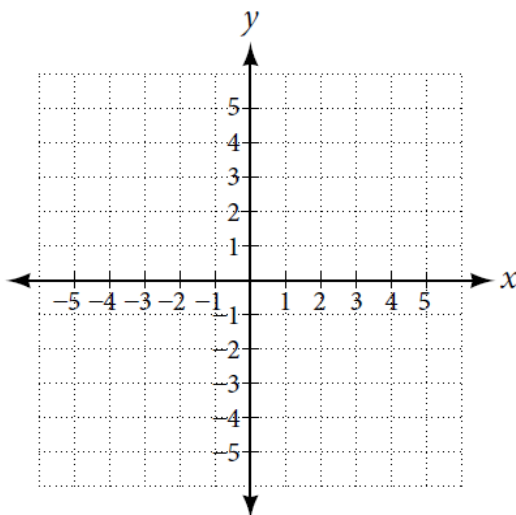
3.

4.

5.

Try It: Read Example 4 in the text, then answer the following.

Sketch a graph of $f(x) = \log_3(x + 4)$ alongside its parent function. Include the key points and asymptotes on the graph. State the domain, range, and asymptote.



Study the box in your textbook section titled “vertical shifts of the parent function $y = \log_b(x)$ ”.

- For any constant d , the function $f(x) = \log_b(x) + d$
 - Shifts the parent function $y = \log_b(x)$ _____ d units if $d > 0$
 - Shifts the parent function $y = \log_b(x)$ _____ d units if $d < 0$
 - the vertical asymptote is _____
 - Domain: _____
 - Range: _____

- Write out the 5 step process for graphing a translation, given a logarithmic function with the form $f(x) = \log_b(x) + d$.

1.

a.

b.

2.

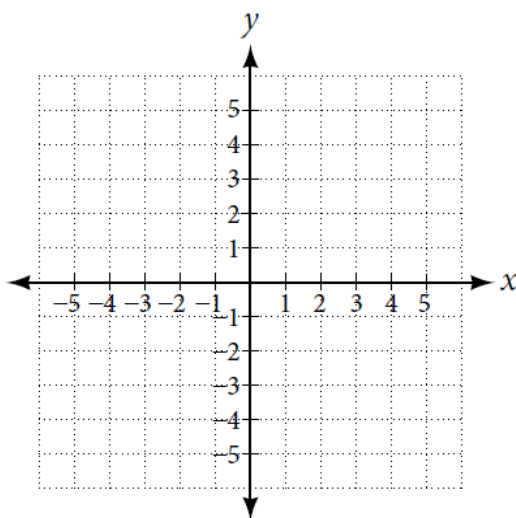
3.

4.

5.

Try It: Read Example 5 in the text, then answer the following.

Sketch a graph of $f(x) = \log_2(x) + 2$ alongside its parent function. Include the key points and asymptotes on the graph. State the domain, range, and asymptote.



Study the box in your textbook section titled “vertical stretches and compressions of the parent function $y = \log_b(x)$ ”.

- For any constant $a > 1$, the function $f(x) = a\log_b(x)$
 - Stretches the parent function $y = \log_b(x)$ _____ by a factor of _____ units if a _____ 0
 - Compresses the parent function $y = \log_b(x)$ _____ by a factor of _____ units if a _____ 0
 - the vertical asymptote is _____
 - $(1,0)$ is the _____
 - Domain: _____
 - Range: _____

- Write out the 5 step process for graphing a translation, given a logarithmic function with the form $f(x) = a\log_b(x)$, $a > 0$.

1.

a.

b.

2.

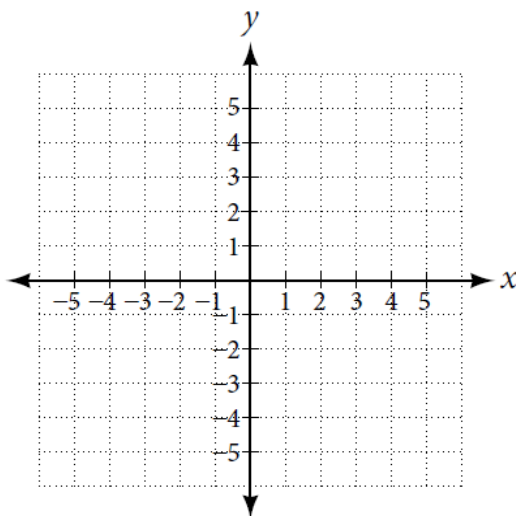
3.

4.

5.

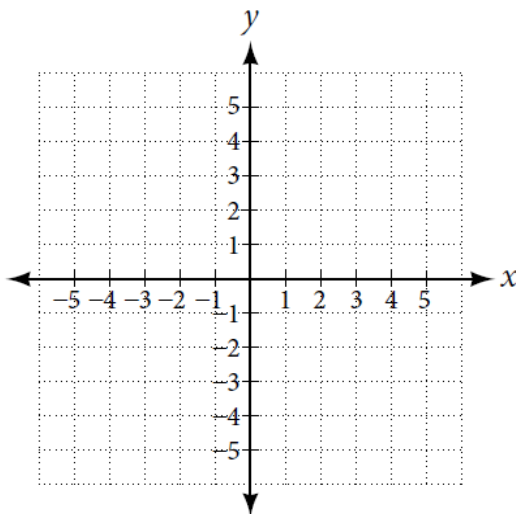
Try It: Read Example 6 in the text, then answer the following.

Sketch a graph of $f(x) = \frac{1}{2} \log_4(x)$ alongside the parent function. Include the key points and asymptotes on the graph. State the domain, range, and asymptote.



Try It: Read Example 7 in _____ the text, then answer the following.

Sketch a graph of $f(x) = 3 \log(x - 2) + 1$. State the domain, range, and asymptote.



Study the box in your textbook section titled “reflections of the parent function $y = \log_b(x)$ ”.

- The function $f(x) = -\log_b(x)$
 - _____ the parent function $y = \log_b(x)$ about the _____
 - the vertical asymptote is _____
 - Domain: _____

▪ Range: _____

• The function $f(x) = \log_b(-x)$

▪ _____ the parent function $y = \log_b(x)$ about the _____

▪ the vertical asymptote is _____

▪ Domain: _____

▪ Range: _____

• Write out the 5 step process for graphing a translation, given a logarithmic function with the parent function $f(x) = \log_b(x)$.

If $f(x) = -\log_b(x)$

1.

2.

3.

4.

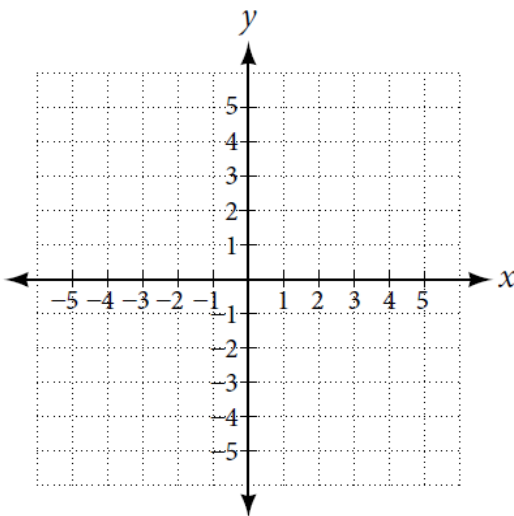
5.

If $f(x) = \log_b(-x)$

- 1.
- 2.
- 3.
- 4.
- 5.

Try It: Read Example 8 in the text, then answer the following.

Graph $f(x) = -\log(-x)$. State the domain, range, and asymptote.



Study your textbook section to fill in the following table.

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Translations of the Parent Function $y = \log_b(x)$	
Translation	Form
Shift _____	$y = \underline{\hspace{2cm}}$
Stretch and Compress _____	$y = \underline{\hspace{2cm}}$
Reflect about the x -axis	$y = \underline{\hspace{2cm}}$
Reflect about the y -axis	$y = \underline{\hspace{2cm}}$
General equation for all translations	$y = \underline{\hspace{2cm}}$

Study the box in your textbook section titled “translations of logarithmic functions”.

- All translations of the parent logarithmic function, $f(x) = \log_b(x)$, have the form

$f(x) = \underline{\hspace{2cm}}$, where the parent function $f(x) = \log_b(x)$, $b > 1$, is

- Shifted vertically _____ d units
- Shifted horizontally to the _____ c units
- _____ vertically by a factor of $|a|$ if $|a| > 1$
- _____ vertically by a factor of $|a|$ if $0 < |a| < 1$
- Reflected about the x -axis when a _____ 0

* For $f(x) = \log(-x)$, the graph of the parent function is reflected about the y -axis.

Try It: Read Example 10 in the text, then answer the following.

What is the vertical asymptote of $f(x) = 3 + \ln(x - 1)$?

Try It: Read Example 11 in the text, then answer the following.

Give the equation of the natural logarithm graphed in **Figure 16**.

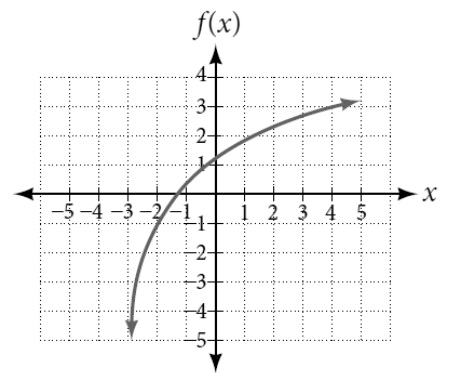


Figure 16