

Algebra IIB Math
Lesson: April 9, 2020

Learning Target:

Students will identify features of logarithmic graphs

Let's Get Started:

Watch Video: [Characteristics of Logarithmic Functions](#)

The video shows how to graph using our graphing calculators.
You will be using www.desmos.com (from April 8 lesson).

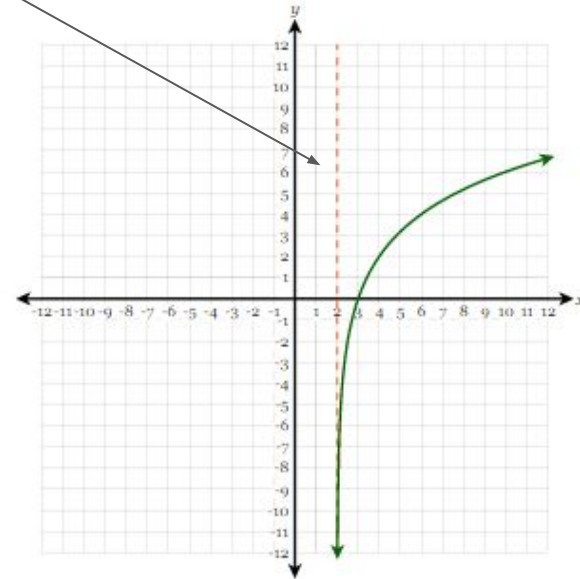
Features we are looking for:

ASYMPTOTE - The line the curve approaches but never crosses.

- In a logarithmic equation it is ALWAYS vertical
- It is the opposite sign of the constant that is inside the parentheses with x
- It is written $x=2$

What are the features of the function $f(x) = 2 \log_2(x - 2)$ graphed below?

Vertical asymptote at $x = 2$



Features we are looking for:

END BEHAVIOR: Focus on the arrows on either end. If the curve continues, where will those arrows eventually end up?

Describe the overall curve: if the right arrow is point up it is an **INCREASING (GROWTH)** model. If it is going down it is **DECREASING (DECAY)** model.

Describe the left arrow:

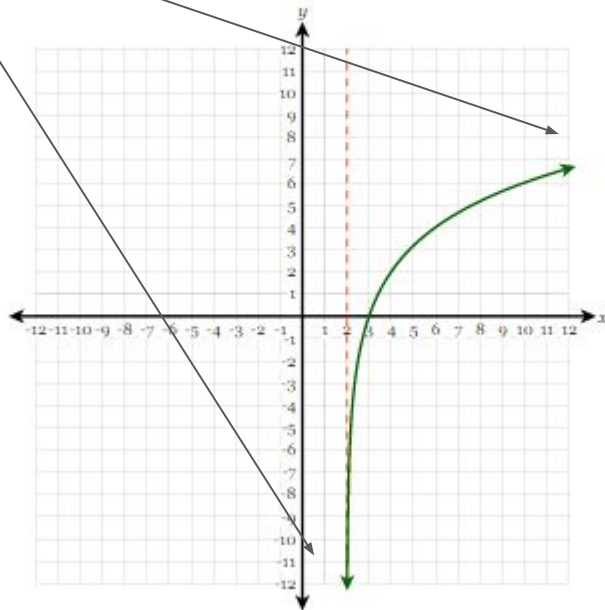
As $x \rightarrow 2$ from the right, $f(x) \rightarrow -\infty$

Describe the right arrow:

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

What are the features of the function $f(x) = 2 \log_2(x - 2)$ graphed below?

Vertical asymptote at $x = 2$



Features we are looking for:

DOMAIN: All the possible x-values of the equation

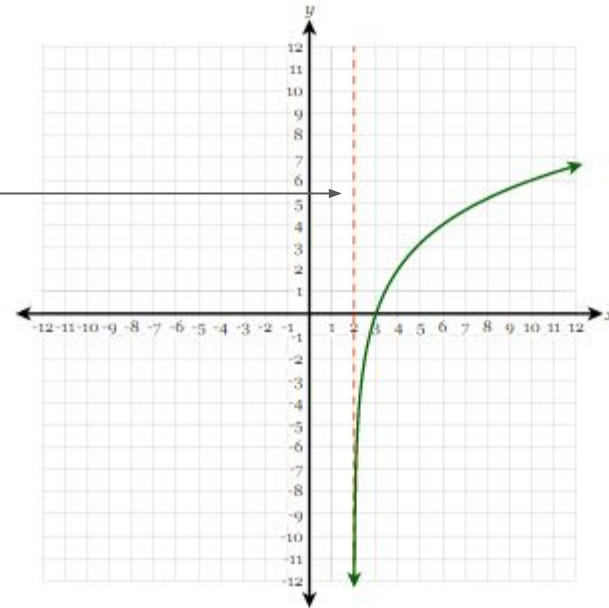
RANGE: All the possible y-values of the equation

In a logarithmic equation the **DOMAIN** is bounded by the asymptote $(2, \infty)$.

The **RANGE** is usually all real numbers $(-\infty, \infty)$.

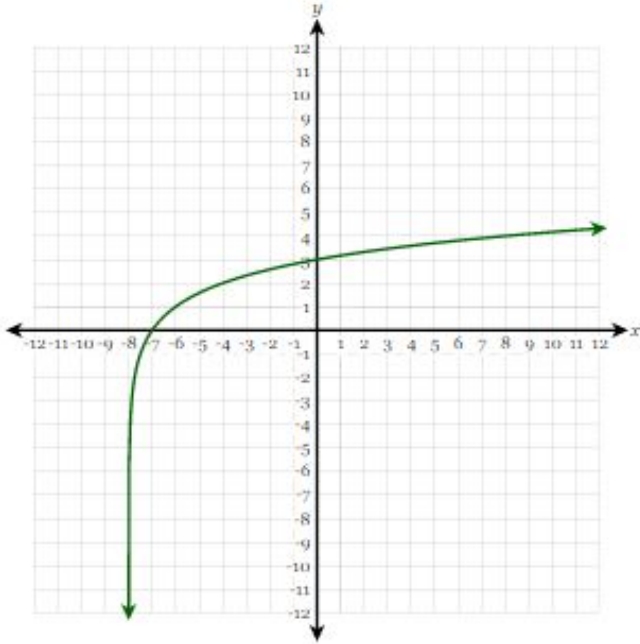
What are the features of the function $f(x) = 2 \log_2 (x - 2)$ graphed below?

Vertical asymptote at $x = 2$



PRACTICE 1

What are the features of the function $f(x) = \log_2(x + 8)$ graphed below?

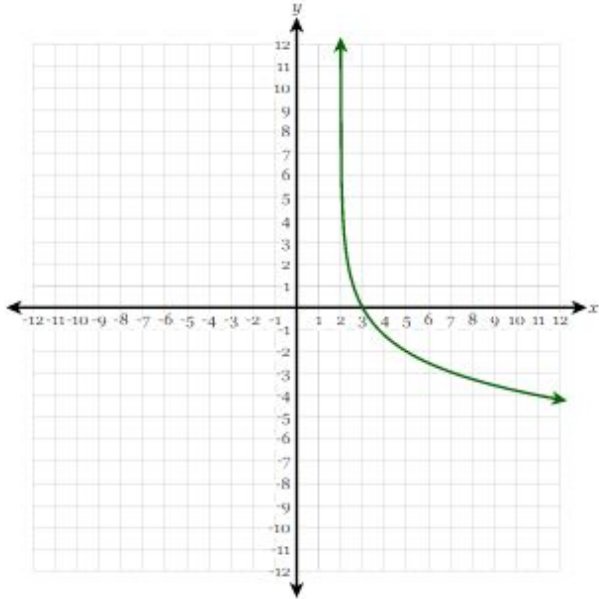


Answer the following questions about the graph to the left on your own paper:

1. Is the graph increasing or decreasing?
2. Write the equation of the asymptote
3. Describe the end behavior
4. What is the domain?
5. What is the range?

PRACTICE 2

What are the features of the function $f(x) = -2 \log_3 (x - 2)$ graphed below?

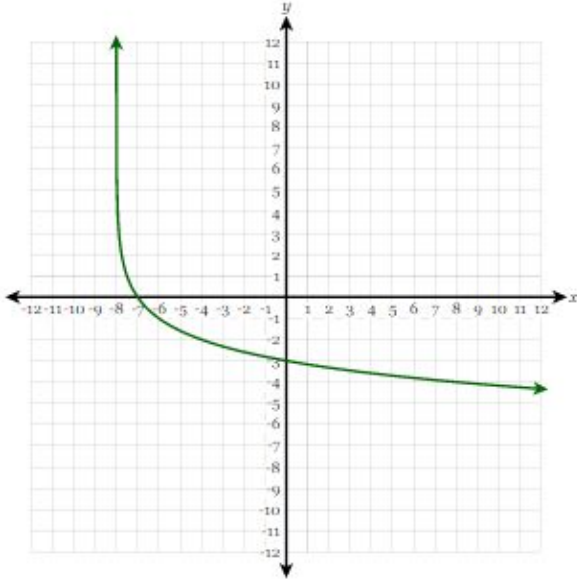


Answer the following questions about the graph to the left on your own paper:

1. Is the graph increasing or decreasing?
2. Write the equation of the asymptote
3. Describe the end behavior
4. What is the domain?
5. What is the range?

PRACTICE 3

What are the features of the function $f(x) = -\log_2(x + 8)$ graphed below?

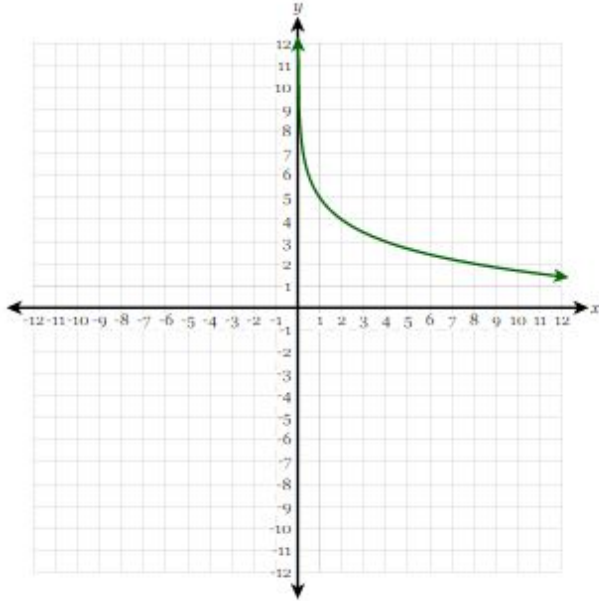


Answer the following questions about the graph to the left on your own paper:

1. Is the graph increasing or decreasing?
2. Write the equation of the asymptote
3. Describe the end behavior
4. What is the domain?
5. What is the range?

PRACTICE 4

What are the features of the function $f(x) = -\log_2 x + 5$ graphed below?

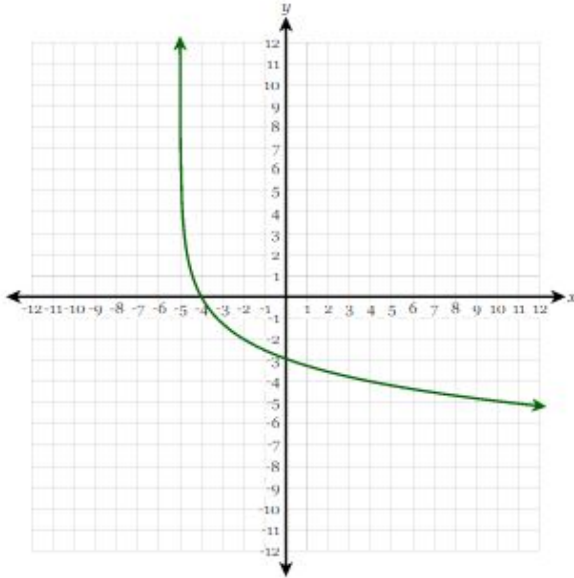


Answer the following questions about the graph to the left on your own paper:

1. Is the graph increasing or decreasing?
2. Write the equation of the asymptote
3. Describe the end behavior
4. What is the domain?
5. What is the range?

PRACTICE 5

What are the features of the function $f(x) = -2 \log_3 (x + 5)$ graphed below?

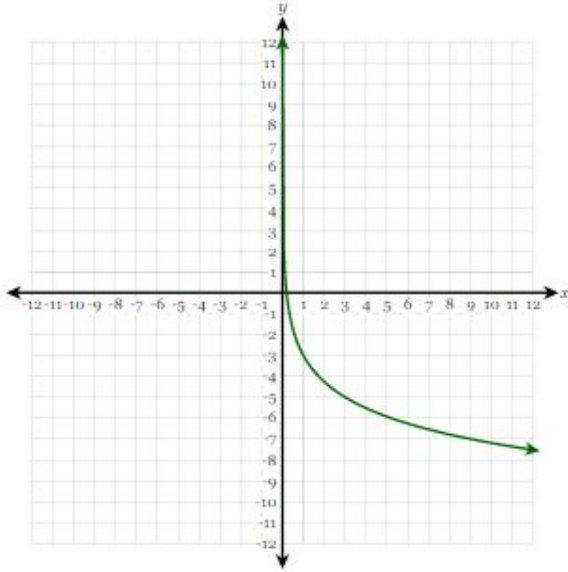


Answer the following questions about the graph to the left on your own paper:

1. Is the graph increasing or decreasing?
2. Write the equation of the asymptote
3. Describe the end behavior
4. What is the domain?
5. What is the range?

PRACTICE 6

What are the features of the function $f(x) = -2 \log_3 x - 3$ graphed below?



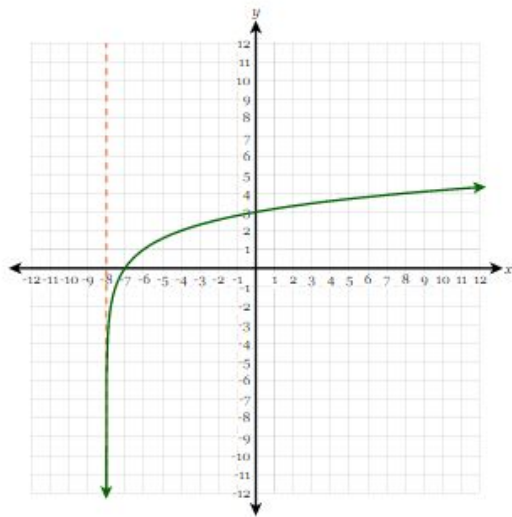
Answer the following questions about the graph to the left on your own paper:

1. Is the graph increasing or decreasing?
2. Write the equation of the asymptote
3. Describe the end behavior
4. What is the domain?
5. What is the range?

Answers 1 and 2

What are the features of the function $f(x) = \log_2(x + 8)$ graphed below?

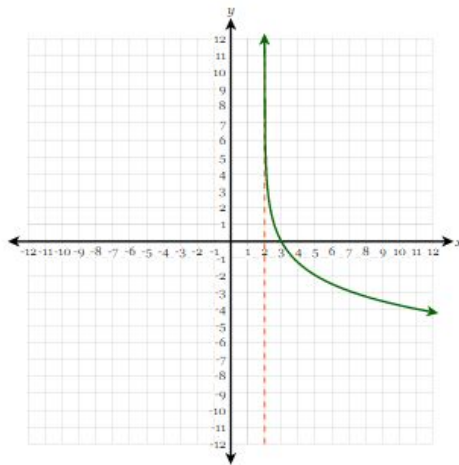
Vertical asymptote at $x = -8$



The function $f(x)$ is a logarithmic function with a vertical asymptote of $x = -8$. The range of the function is $(-\infty, \infty)$, and it is increasing on its domain of $(-8, \infty)$. The end behavior on the LEFT side is as $x \rightarrow -8$ (from the right), $y \rightarrow -\infty$, and the end behavior on the RIGHT side is as $x \rightarrow \infty$, $y \rightarrow \infty$.

What are the features of the function $f(x) = -2 \log_3(x - 2)$ graphed below?

Vertical asymptote at $x = 2$

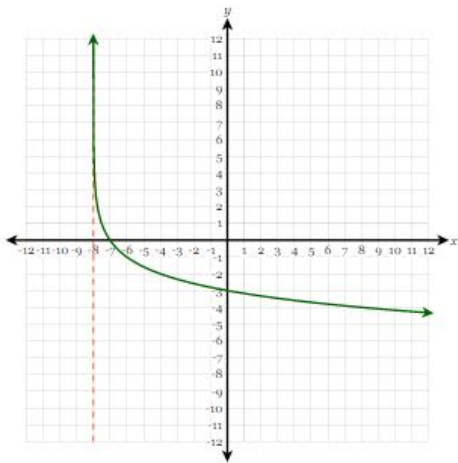


The function $f(x)$ is a logarithmic function with a vertical asymptote of $x = 2$. The range of the function is $(-\infty, \infty)$, and it is decreasing on its domain of $(2, \infty)$. The end behavior on the LEFT side is as $x \rightarrow 2$ (from the right), $y \rightarrow \infty$, and the end behavior on the RIGHT side is as $x \rightarrow \infty$, $y \rightarrow -\infty$.

Answers 3 and 4

What are the features of the function $f(x) = -\log_2(x + 8)$ graphed below?

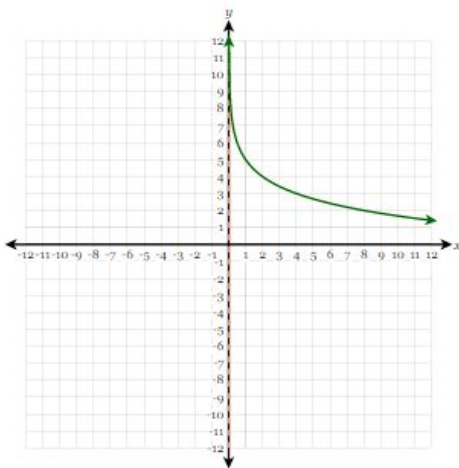
Vertical asymptote at $x = -8$



The function $f(x)$ is a logarithmic function with a vertical asymptote of $x = -8$. The range of the function is $(-\infty, \infty)$, and it is decreasing on its domain of $(-8, \infty)$. The end behavior on the LEFT side is as $x \rightarrow -8$ (from the right), $y \rightarrow \infty$, and the end behavior on the RIGHT side is as $x \rightarrow \infty$, $y \rightarrow -\infty$.

What are the features of the function $f(x) = -\log_2 x + 5$ graphed below?

Vertical asymptote at $x = 0$

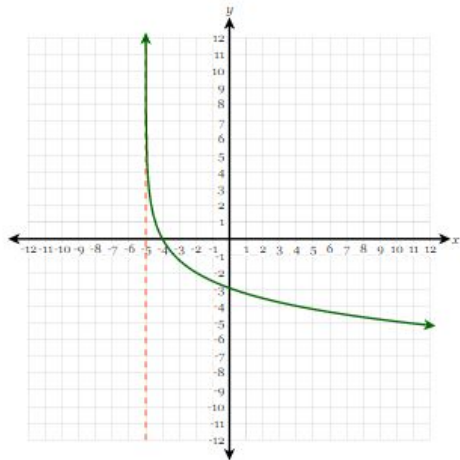


The function $f(x)$ is a logarithmic function with a vertical asymptote of $x = 0$. The range of the function is $(-\infty, \infty)$, and it is decreasing on its domain of $(0, \infty)$. The end behavior on the LEFT side is as $x \rightarrow 0$ (from the right), $y \rightarrow \infty$, and the end behavior on the RIGHT side is as $x \rightarrow \infty$, $y \rightarrow -\infty$.

Answers 5 and 6

What are the features of the function $f(x) = -2 \log_3 (x + 5)$ graphed below?

Vertical asymptote at $x = -5$

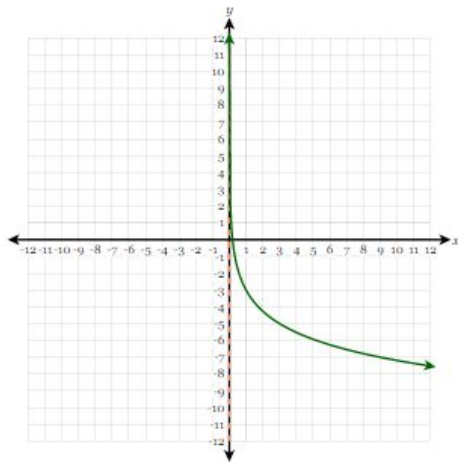


The function $f(x)$ is a logarithmic function with a vertical asymptote of $x = -5$. The range of the function is $(-\infty, \infty)$, and it is decreasing on its domain of $(-5, \infty)$. The end behavior on the LEFT side is as $x \rightarrow -5$ (from the right), $y \rightarrow \infty$, and the end behavior on the RIGHT side is as $x \rightarrow \infty$, $y \rightarrow -\infty$.

Problems taken from
Deltamath.com: features of
exponential and log
functions

What are the features of the function $f(x) = -2 \log_3 x - 3$ graphed below?

Vertical asymptote at $x = 0$



The function $f(x)$ is a logarithmic function with a vertical asymptote of $x = 0$. The range of the function is $(-\infty, \infty)$, and it is decreasing on its domain of $(0, \infty)$. The end behavior on the LEFT side is as $x \rightarrow 0$ (from the right), $y \rightarrow \infty$, and the end behavior on the RIGHT side is as $x \rightarrow \infty$, $y \rightarrow -\infty$.