

6.2

Algebra 2

Asymptotes of Logarithmic and Exponential Functions

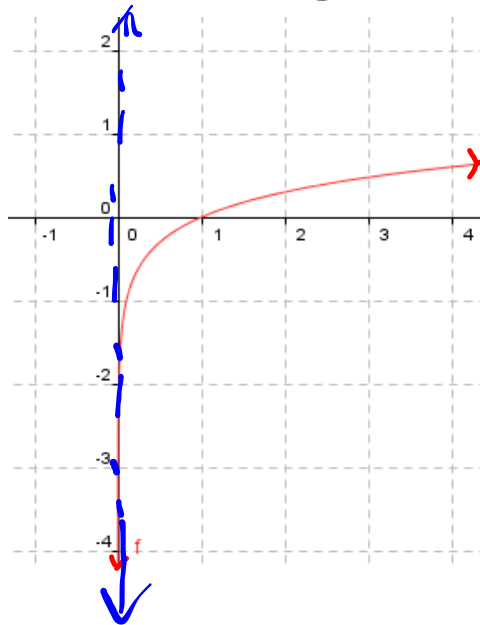
Asymptotes: a dotted line that the graph gets closer and closer to but never crosses.

Horizontal Asymptote: $y = n$, where n is a value of y that the function will never equal.

Vertical Asymptote: $x = m$, where m is a value of x that cannot be plugged into the function.

Find the domain and range of the function.
Then find the horizontal and vertical asymptotes.

$$f(x) = \log(x)$$



Domain: $\{x | x > 0\}$

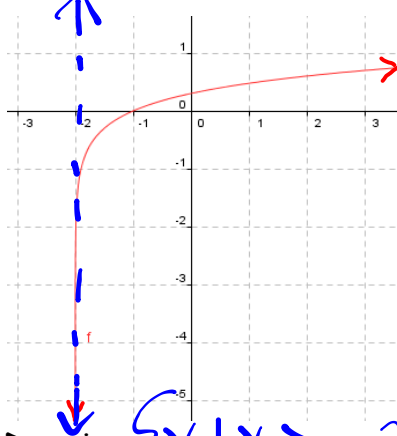
Range: $\{y | y \in \mathbb{R}\}$

Vertical Asymptote: $x = 0$

Horizontal Asymptote: None

Find the domain and range of the function.
Then find the horizontal and vertical asymptotes.

$$f(x) = \log(x + 2)$$



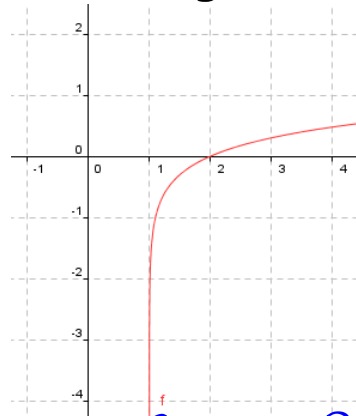
Domain: $\{x \mid x > -2\}$

Range: $\{y \mid y \in \mathbb{R}\}$

Vertical Asymptote: $x = -2$

Horizontal Asymptote: None

$$f(x) = \log(x - 1)$$



Domain: $\{x \mid x > 1\}$

Range: $\{y \mid y \in \mathbb{R}\}$

Vertical Asymptote: $x = 1$

Horizontal Asymptote: None

What do you notice about the domain and range when adding or subtracting a number from the inside of the function?

Opposite

What do you notice about the asymptotes when adding or subtracting a number from the inside of the function?

opposite or same a D & R

How can you find the vertical asymptote from the function?

set the shift = 0 & solve

Find the asymptotes of the given functions.

1. $f(x) = \log(x)$

$$x = 0$$

2. $f(x) = \log(x - 3)$

$$x = 3$$

3. $f(x) = \log(x + 5)$

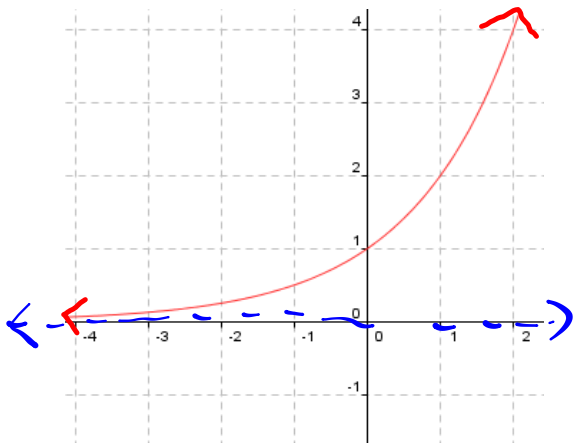
$$x = -5$$

4. $f(x) = \log(x) - 1$

$$x = 0$$

Find the domain and range of the function.
Then find the horizontal and vertical asymptotes.

$$f(x) = 2^x$$



Domain: $\{x \mid x \in \mathbb{R}\}$

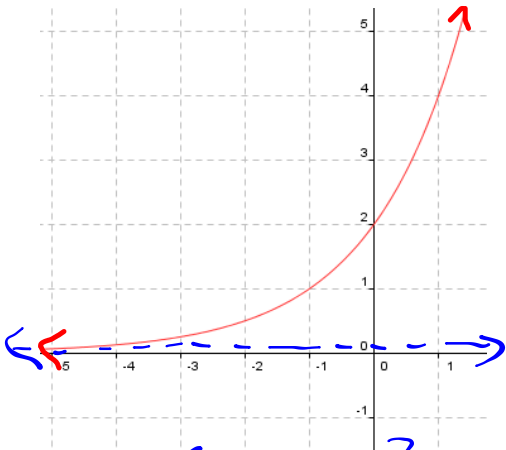
Range: $\{y \mid y > 0\}$

Vertical Asymptote: None

Horizontal Asymptote: $y = 0$

Find the domain and range of the function.
Then find the horizontal and vertical asymptotes.

$$f(x) = 2^{(x+1)} + 0$$



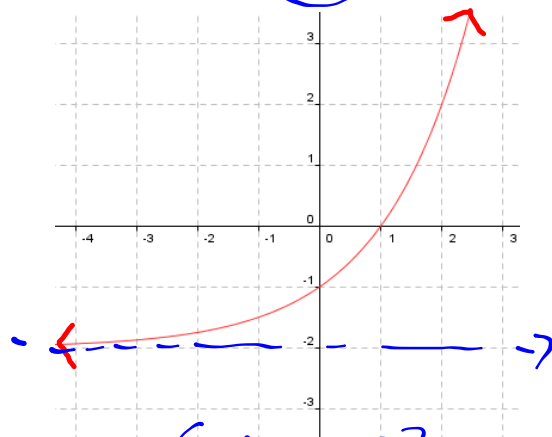
Domain: $\{x | x \in \mathbb{R}\}$

Range: $\{y | y > 0\}$

Vertical Asymptote: None

Horizontal Asymptote: $y = 0$

$$f(x) = 2^x - 2$$



Domain: $\{x | x \in \mathbb{R}\}$

Range: $\{y | y > -2\}$

Vertical Asymptote: None

Horizontal Asymptote: $y = -2$

What do you notice about the domain and range when adding or subtracting a number from the inside or outside of the function?

stay the same

What do you notice about the asymptotes when adding or subtracting a number from the inside or outside of the function?

Same

How can you find the horizontal asymptote from the function?

$y =$ number on outside

Do you see a connection between the asymptotes of a logarithmic function and an exponential function?

Find the asymptotes of the given functions.



1. $f(x) = 2^x + 0$

$$y = 0$$

2. $f(x) = 2^{(x+5)} + 0$

$$y = 0$$

3. $f(x) = 2^{(x)} + 6$

$$y = 6$$

4. $f(x) = 2^{(x)} - 3$

$$y = -3$$

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What is the vertical asymptote of the graph of $y = \log_4(x - 3)$?

A) $x = -3$

B) $x = 0$

C) $x = 3$

D) $x = 4$

$$x = 3$$

Recap:

Horizontal Asymptotes ($y =$)

- **Logarithmic Functions** do not have horizontal asymptotes because the range is always all real numbers.
- **Exponential Functions** look at the number being added or subtracted from the outside of the function. (for example $f(x) = 2^x - 3$ so $y = -3$ is the horizontal asymptote.)

Vertical Asymptotes ($x =$)

- **Logarithmic Functions** look at what you are taking the log of. Set it equal to zero and solve for x . You can't take the log of or a negative number. (for example $f(x) = \log(x + 2)$ so set $x + 2 = 0$ and $x = -2$ is the vertical asymptote.)
- **Exponential Functions** do not have vertical asymptotes because the domain is always all real numbers.

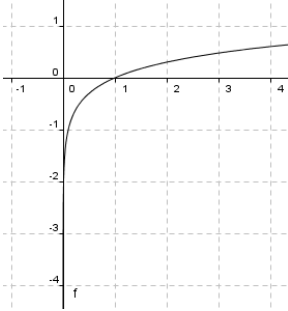
Algebra 2

6.2 Asymptotes of Logarithmic and Exponential Functions

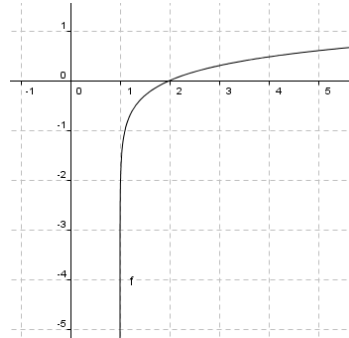
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Find the domain and range of the function. Then find the asymptotes.

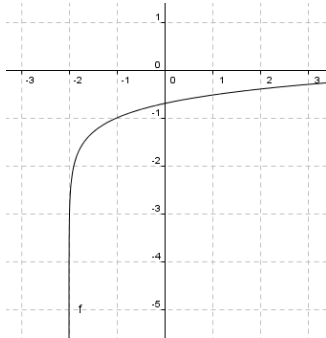
1. $f(x) = \log(x)$



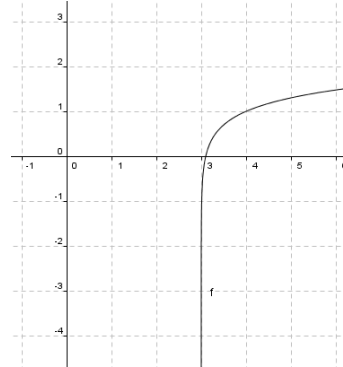
2. $f(x) = \log(x - 1)$



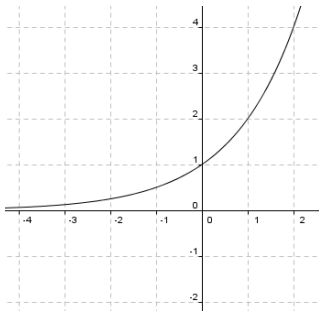
3. $f(x) = \log(x + 2) - 1$



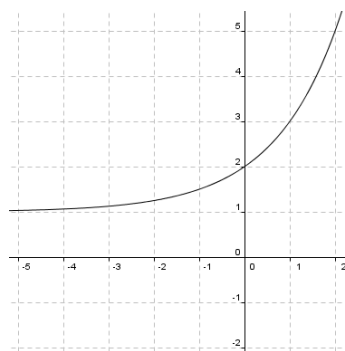
4. $f(x) = \log(x - 3) + 1$



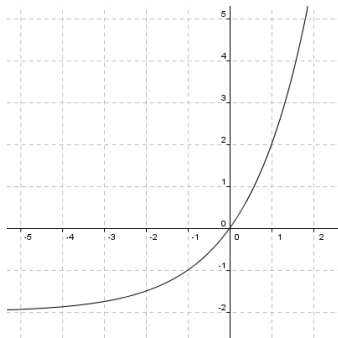
5. $f(x) = 2^x$



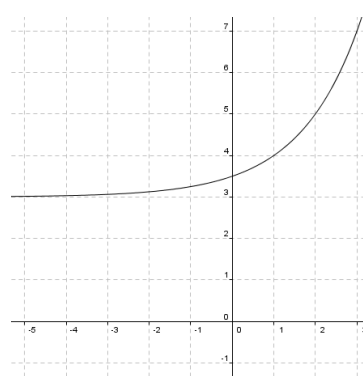
6. $f(x) = 2^x + 1$



7. $f(x) = 2^{(x+1)} - 2$



8. $f(x) = 2^{(x-1)} + 3$



Find the domain and range of the function. Then find the asymptotes.

9. $f(x) = \log(x + 5)$

10. $f(x) = \log(x - 4) + 3$

11. $f(x) = \log(x + 8) - 5$

12. $f(x) = \log(x - 7) + 4$

13. $f(x) = 2^{(x)} + 7$

14. $f(x) = 2^{(x - 3)} - 5$

15. $f(x) = 2^{(x + 4)} - 3$

16. $f(x) = 2^{(x - 5)} + 8$