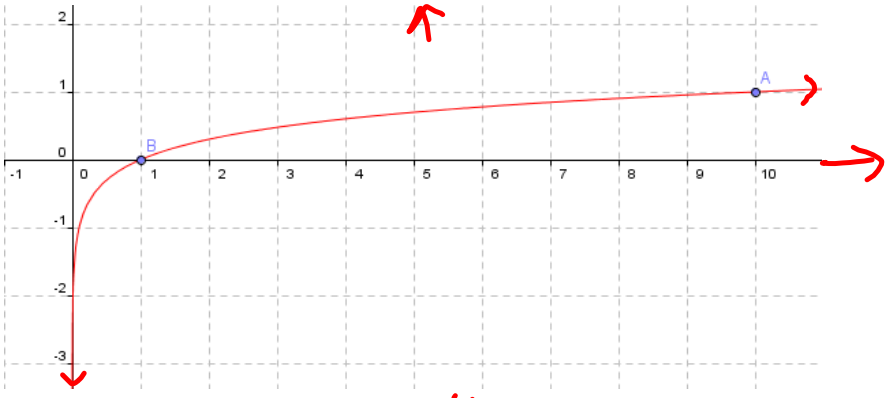
6.1

Algebra 2

Characteristics of Logarithmic and Exponential Functions

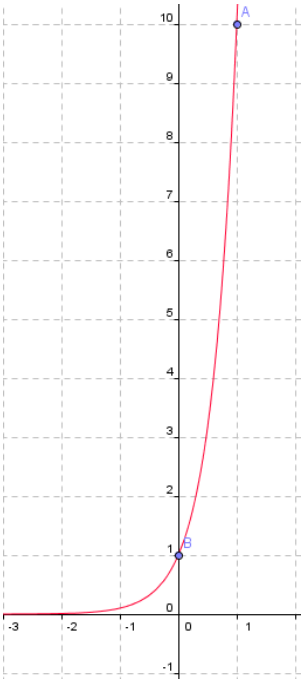
$f(x) = \log(x)$

$f(x) = \log_{10}(x)$



$10^y = x$

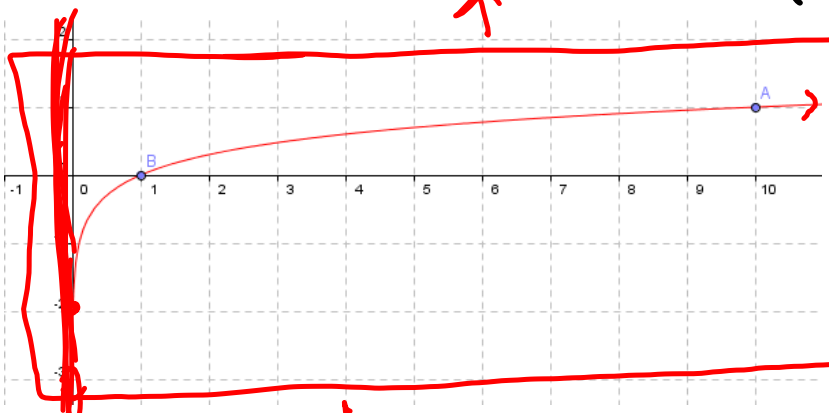
$f(x) = 10^x$



<u>Facts about Logarithms</u>:

- cannot take the log of 0 or a negative number
- have many different parent functions
- Graphs without transformations will always have:
  - an x-intercept of (1,0) because any number to the zero power is 1.
  - a range of All Real Numbers
  - a domain of $\{x|x>0\}$
- Graphs without transformations will never cross the y-axis because you can't take the log of 0 or a negative number.

Let's take a closer look at $f(x) = \log(x)$



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

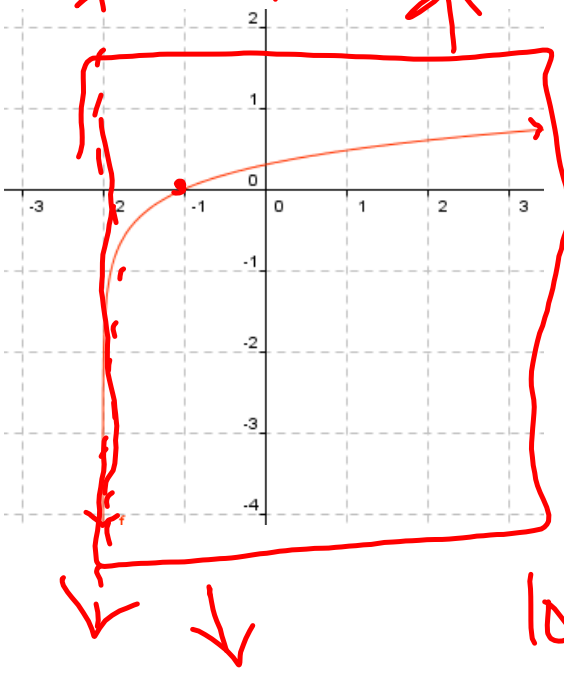
Range: $\{y \mid y \in \mathbb{R}\}$

y-intercept: none

x-intercept: $(1, 0)$

List the transformations from the parent function. Then give the domain, range and intercepts.

$f(x) = \log_{10}(x + 2)$ left 2



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

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

x-intercept: $(-1, 0)$

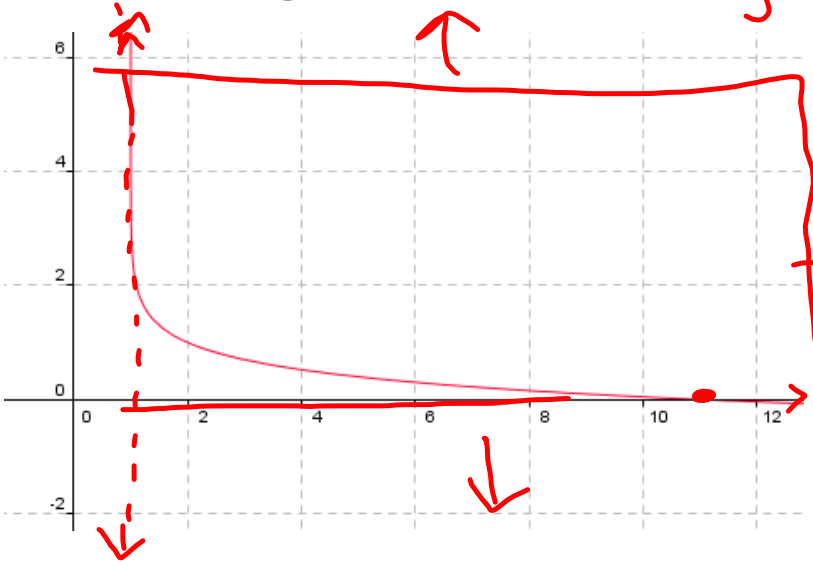
y-intercept: $(0, .3)$

$\log_{10}(0+2) = .3$

List the transformations from the parent function.
Then give the domain, range and intercepts.

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

reflects over x-axis
right 1 up 1



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

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

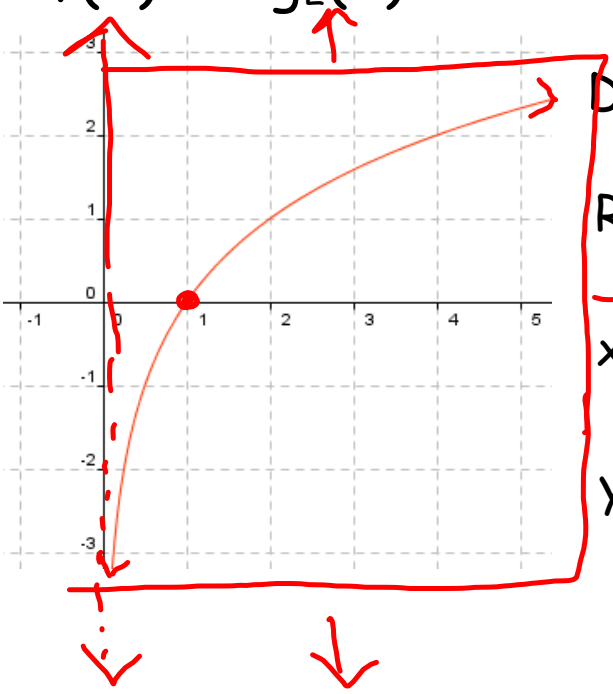
x-intercept: $(11, 0)$

y-intercept: None

List the transformations from the parent function.
Then give the domain, range and intercepts.

$f(x) = \log_2(x)$

No transformations



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

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

x-intercept: $(1, 0)$

y-intercept: None

Domain and Range:

-the **domain** of a **logarithmic** function can be found by setting what you are taking the log of > 0 and solve for x.

(for example f(x) = log(x + 2) set (x + 2) > 0)

-the **range** of a **logarithmic** function is *always* All Real Numbers.

D: $x+2>0$ $\{x \mid x > -2\}$

$x > -2$

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

Give the domain and range then list the transformations.

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

Domain: $\{x \mid x > 4\}$

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

$x - 4 > 0$

$x > 4$

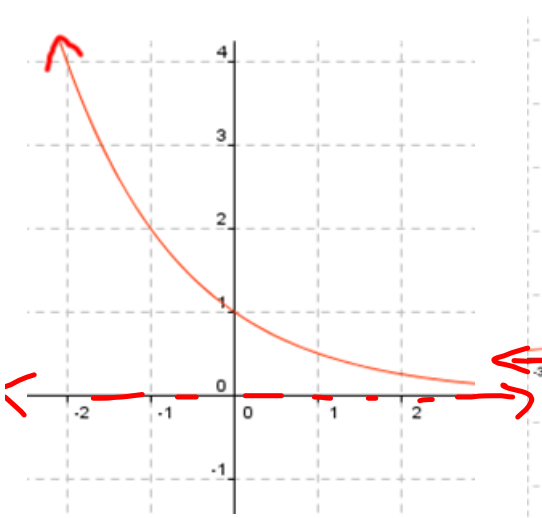
$f(x) = -\log_2(x) - 3$

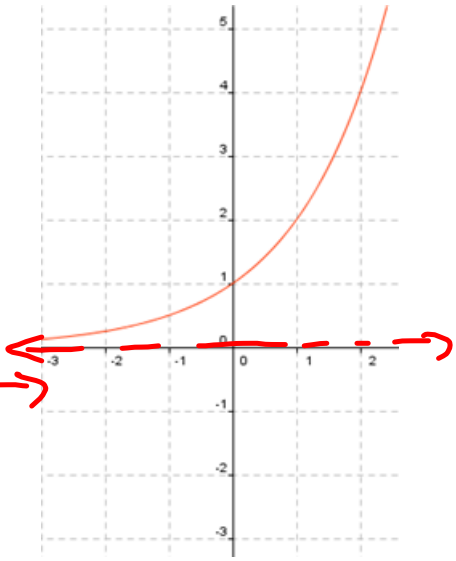
Domain: $\{x \mid x > 0\}$

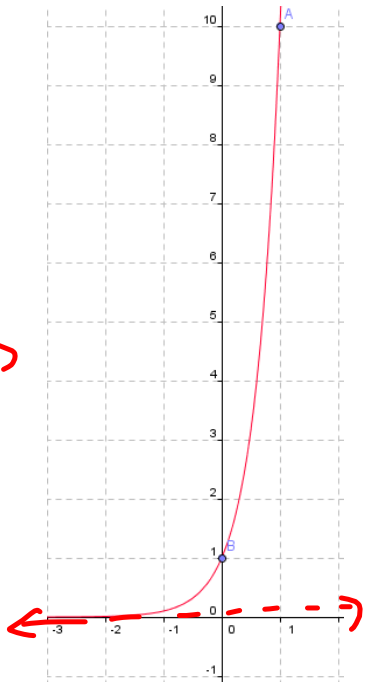
Range: $\{y \mid y \in \mathbb{R}\}$

$x > 0$

$f(x) = \left(\frac{1}{2}\right)^x$ $f(x) = 2^x$ $f(x) = 10^x$



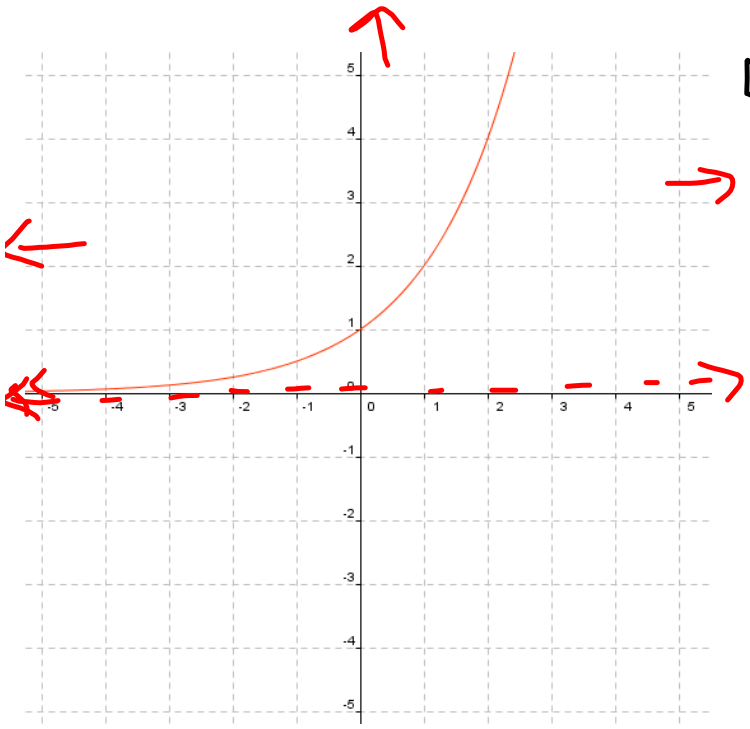




<u>Facts about Exponential Functions</u>:

- many different parent functions
- Graphs without transformations will always have:
    - an y-intercept of (0,1) because any number to the zero power is 1.
    - a domain of All Real Numbers
    - a range of $\{y|y>0\}$
- Graphs without transformations will never cross under the x-axis because negative exponents make the base flip which in turn makes the graph reflect over the x-axis.

Let's take a closer look at $f(x) = 2^x$



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

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

x-intercept: none

y-intercept: $(0,1)$

List the transformations from the parent function. Then give the domain, range and intercepts.

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

No transformations

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

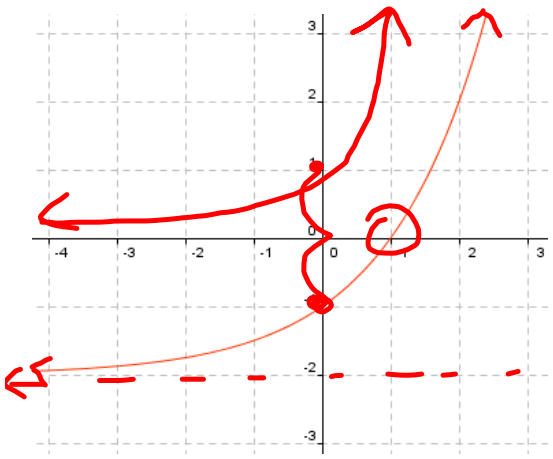
Range: $\{y \mid y > 0\}$

x-intercept: none

y-intercept: $(0,1)$

List the transformations from the parent function. Then give the domain, range and intercepts.

$f(x) = 2^x - 3$ ↓2



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

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

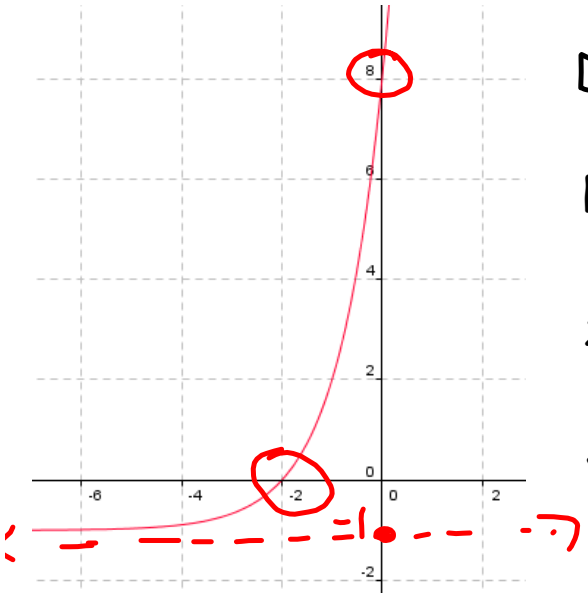
x-intercept: $(1, 0)$

y-intercept: $(0, -1)$

List the transformations from the parent function.
Then give the domain, range and intercepts.

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

$\leftarrow 2 \quad \downarrow 1$



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

Range: $\{y \mid y > -1\}$

x-intercept: $(-2, 0)$

y-intercept: $(0, 8)$

$3^{0+2} - 1$

$3^2 - 1$

$9 - 1 = 8$

Domain and Range:

- the **domain** of an **exponential** function is *always* All Real Numbers

- the **range** of an **exponential** function can be found by looking to see what is being added or subtracted from the outside of the function. The range will always be the y-values that are greater than that number.

  (for example $f(x) = 2^x + 3$ so the range is {yly > 3}

Give the domain and range then list the transformations.

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

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

Range: $\{y \mid y > -1\}$

$f(x) = 3^{x-1} + 4$

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

Range: $\{y \mid y > 4\}$

You Try:

Ms. Juarez showed the graphs of the functions $y = \log_2 x$ and $y = \log_4 x$ to her students. Which conclusion is *incorrect*?

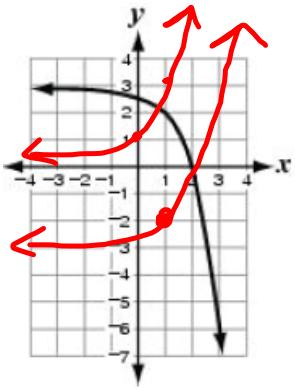
A) The x-intercept of each graph is 0.

B) The graphs never intersect the y-axis.

C) The domain of each function is $\{x : x > 0\}$.

D) The range of each function is $\{y : \text{all real numbers}\}$.

Which function is represented by the graph?



A) $y = -3^x + 3$

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

C) $y = -3^{x-1} + 3$

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

3^x

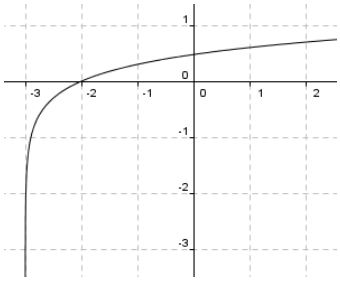
x	y
0	1
1	3

Algebra 2 Section 6.1 Worksheet
Characteristics of Exponential and Logarithmic Functions

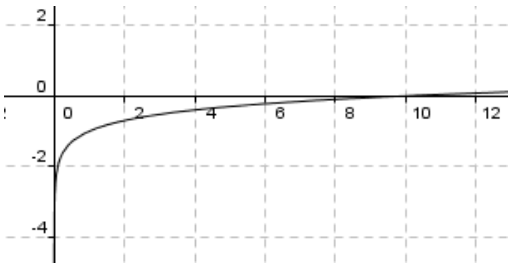
Name:_____ Date:_____ Hour:_____

Use the graph to find the domain, range, and intercepts.

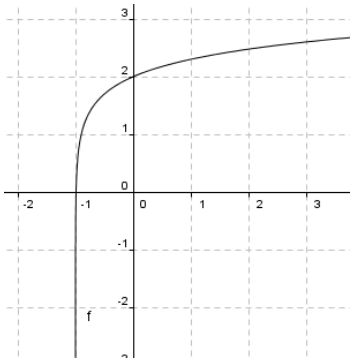
1. $f(x) = \log (x + 3)$



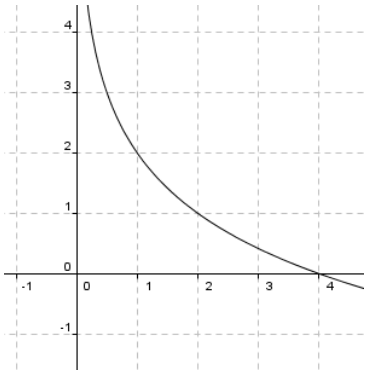
2. $f(x) = \log (x) - 1$



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



4. $f(x) = -\log_2 (x) + 2$



Use the equation to find the domain and range. Then list the transformations.

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

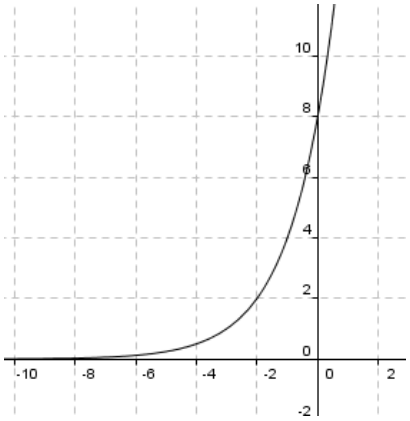
6. $f(x) = \log (x - 3) + 4$

7. $f(x) = \log (x - 1) - 6$

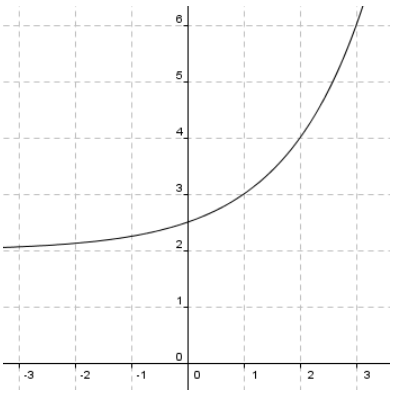
8. $f(x) = \log_2 (x + 4) + 1$

Use the graph to find the domain, range, and intercepts.

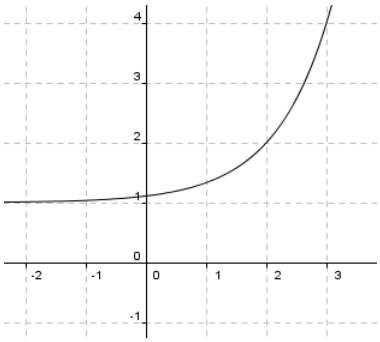
9. $f(x) = 2^{x+3}$



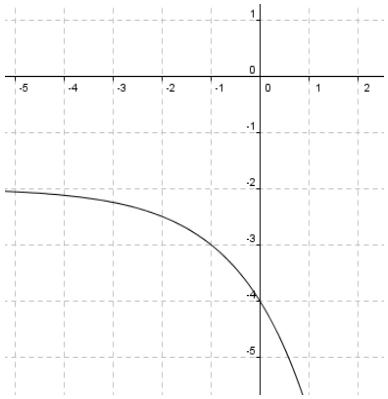
10. $f(x) = 2^{(x-1)} + 2$



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



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



Use the equation to find the domain and range. Then list the transformations.

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

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

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

16. $f(x) = 2^{(x+4)} + 1$