Math Virtual Learning

Algebra IIB

Logarithmic Transformations

April 13, 2020

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Lesson: April 13, 2020

Objective/Learning Target: Students will write a logarithmic function based on a given transformation

Let's Get Started:

Review: How is the function **$f(x)=-3\log(x-4)+2$** transformed when compared to the parent function?

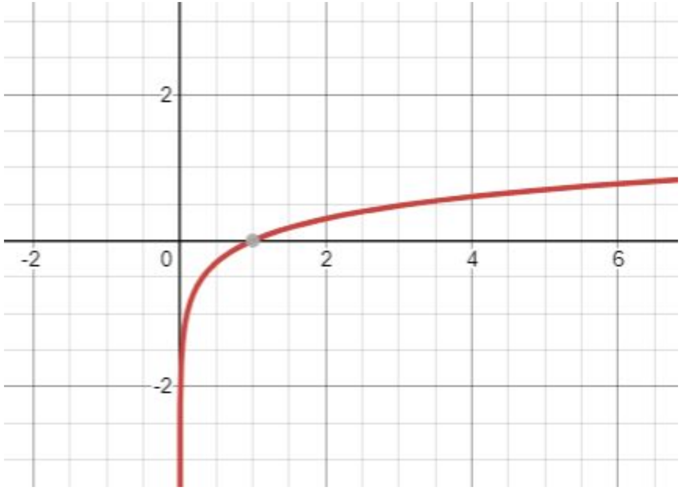
A. What is the parent function?
B. What does the parent function look like?
C. What does the new function look like?
D. How is the new function different from the parent function?

Use www.desmos.com to check your answer.

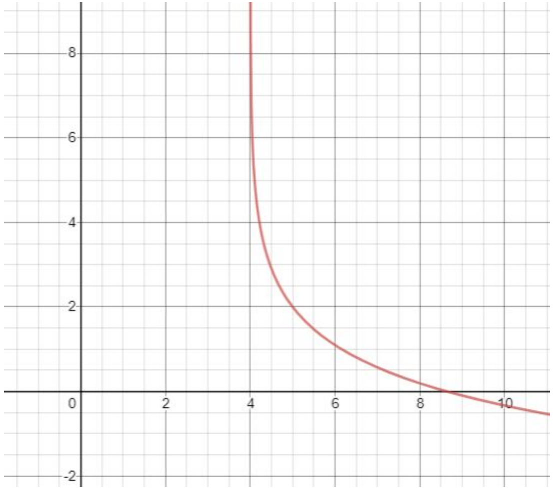
Review Answers

A. f(x)=log(x)

B.



C.



D. It reflected vertically, moved to the right 4 spaces and up 2 spaces. It also stretched vertically by a factor of 3

Introduction to writing logarithmic functions based on a tranformation

Watch Video: [Writing equations of functions using transformations]

Now the video did not show any transformations of logarithms but stated that ALL transformations act in the same way. Let's turn the last example in the video into a logarithm:

Find the function that is finally graphed after the following transformations are applied to the graph of $y = \log_3(x)$.

a. Vertically compress by a factor of ½
b. Shift right 2 units
c. Reflect about the y-axis

ANSWER

Find the function that is finally graphed after the following transformations are applied to the graph of $y = \log_3(x)$.

a. Vertically compress by a factor of ½

$f(x)= \frac{1}{2} \log_3(x)$.

b. Shift right 2 units

$f(x)= \frac{1}{2} \log_3(x-2)$.

c. Reflect about the y-axis

$f(x)= \frac{1}{2} \log_3(-1[x-2])$.

Distribute the -1

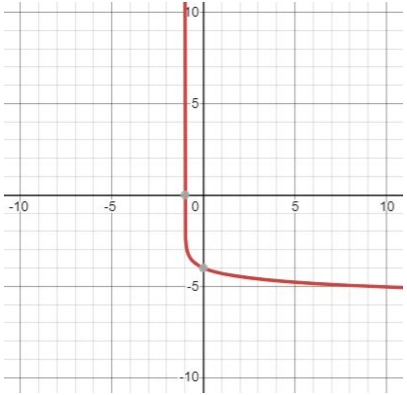
$f(x)= \frac{1}{2} \log_3(-1x+2)$.

Order Matters!

Example 1

Transform y=log(x) by

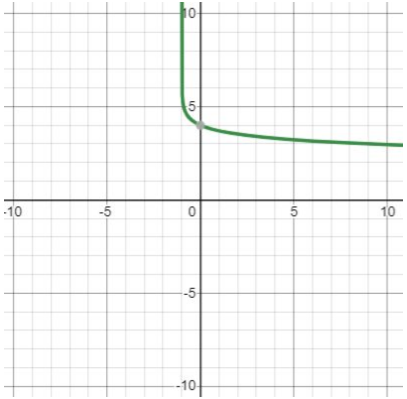
Translating left 1	f(x)=log(x+1)
Translating up 4	f(x)=log(x+1)+4
Reflecting vertically over x-axis	f(x)=-1[log(x+1)+4]
	=-log(x+1)-4



Example 1

Transform y=log(x) by

Reflecting vertically over x-axis	f(x)=-log(x)
Translating left 1	f(x)=-log(x+1)
Translating up 4	f(x)=-log(x+1)+4



Notice that the graphs are not the same!

PRACTICE

Write an equation that models the function described.

1. Shifts the parent function, $y=\log_2 x$, 1 unit left
2. Shifts the parent function, $y=\log_{10} x$, 6 units down
3. Shifts the parent function, $y=\log_2 x$, 3 units up
4. Vertically stretches the parent function, $y=\log_2 x$, by a factor of 4 and reflects it across the x-axis
5. Shifts the parent function, $y=\ln(x)$, 2 units right
6. Shrinks the parent function, $y=\log_2 x$, by a factor of 0.3
7. Vertically stretches the parent function, $f(x)=\log_6 x$, by a factor of 6, followed by a translation 5 units down
8. Reflects the parent function, $f(x)=\log_5 x$ vertically over the x-axis, followed by a translation 9 units left
9. Translates the parent function, $f(x)=\log_{½} x$, 3 units left and 2 units up, followed by a reflection over the y-axis
10. Translates the parent function, $f(x)=\ln(x)$, 3 units right and 1 unit up, followed by a horizontal stretch by a factor of 8

ANSWERS

1. $f(x)=\log_2(x+1)$
2. $f(x)=\log_{10}x-6$
3. $f(x)=\log_2 x+3$
4. $f(x)=-4\log_2 x$
5. $f(x)=\ln(x-2)$
6. $f(x)=0.3\log_2 x$
7. $f(x)=6\log_6 x-5$
8. $g(x)=-\log_5(x+9)$
9. $g(x)=\log_{½}(-x-3)+2$ (ORDER MATTERS!)
10. $g(x)=\ln(8x-24)+1$, 3 units right and 1 unit up, followed by a horizontal stretch by a factor of 8 (ORDER MATTERS!)