Algebra 2 Workbook

Exponential and logarithmic functions

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WHAT IS A LOGARITHM?

■ 1. How would you read the logarithmic equation out loud?

$$\log_7 57 = y$$

■ 2. Rewrite the equation in logarithmic form.

$$64^{\frac{1}{2}} = 8$$

■ 3. Rewrite the equation in exponential form.

$$\log_u \frac{19}{20} = v$$

■ 4. Use the general log rule to solve for x.

$$\log_5(125) = x$$

■ 5. Use the general log rule to solve the logarithm.

$$\log_8 64 = x$$

6. Write the logarithm that answers this question: To what power do you have to raise 289 in order to get 17?

COMMON BASES AND RESTRICTED VALUES

- 1. Is there something wrong with the logarithm? If so, what is it?

$$\log_{-5}(8)$$

- 2. Is there something wrong with the logarithm? If so, what is it?

$$\log_5(-8)$$

- 3. Is the following statement true or false? Why?

$$\log 5 = \log_{10} 5$$

- 4. How else can you write $\log_e 7$?

- 5. Solve the logarithm for x.

$$\log(10{,}000) = x$$

- 6. Solve the logarithm for x.

$\ln(e^5) = x$

EVALUATING LOGS

■ 1. Find the exact value of the logarithm.

$$\log_{\frac{1}{3}} \frac{1}{27}$$

■ 2. Find the exact value of the logarithm.

$$\log_9 \frac{1}{81}$$

■ 3. Find the value given by the log.

$$\log_{7,776} 6$$

■ 4. Find the exact value of the logarithm.

$$\log_{343} 7$$

■ 5. Find the exact value of the logarithm.

$$\log_{\frac{1}{4}}(1{,}024)$$

6. Find the exact value of the logarithm.

$$\log_{64} \frac{1}{4}$$

LAWS OF LOGARITHMS

■ 1. Write the expression as a single logarithm. Solve if possible.

$$\log_2 2 + \log_2 4$$

■ 2. Write the expression as a single logarithm. Solve if possible.

$$\log_3 216 - \log_3 24$$

■ 3. Write the expression as a single logarithm. Solve if possible.

$$\log_4 10 - 3\log_4 2$$

■ 4. Write the expression as a single logarithm. Solve if possible.

$$2\log_7 4 + 3\log_7 5$$

■ 5. Simplify the logarithmic expression.

$$\log_2\left(\frac{x^4y^2}{z^3}\right)$$

6. Simplify the logarithmic expression.

$$\log_9\left(\frac{9x^3}{2y^4z}\right)$$

LAWS OF NATURAL LOGS

■ 1. Condense the expression into a single logarithm.

$$2\ln 2 - 3\ln 4$$

■ 2. Condense the expression into a single logarithm.

$$\frac{5\ln 2}{4}$$

■ 3. Condense the expression into a single logarithm.

$$3(\ln 2x - \ln 5) + (\ln 4 - \ln 3y)$$

■ 4. Expand the logarithm.

$$\ln (3 \cdot 5)^4$$

■ 5. Expand the logarithm.

$$\ln \left(\frac{4}{5}\right)^2$$

6. Expand the logarithm.

$$\ln(3xy^2)$$

SOLVING LOGARITHMIC EQUATIONS

■ 1. Solve the equation.

$$2\log_b x = \log_b 49$$

■ 2. Solve the equation.

$$\log_{12} x = \frac{3}{2}\log_{12} 16$$

■ 3. Solve the equation.

$$\log_5(x-1) + \log_5(x+5) = \log_5 7$$

■ 4. Solve the equation.

$$\log_9(-4x) - \log_9 12 = \log_9 5$$

■ 5. Solve the equation.

$$\log_a 2 + \log_a 4 = \log_a(x+2)$$

6. Solve the equation.

$$\log_4(x+5) - \log_4(x-2) = \log_4 3$$

CHANGE OF BASE

■ 1. Find the value of the expression to four decimal places.

$$\log_3 6$$

■ 2. Find the value of the expression to four decimal places.

$$\frac{\log 25}{\log 5} - \frac{\log 25}{\log 125}$$

■ 3. Find the approximate value to the expression to the nearest ten thousandth.

$$\frac{\log 18}{\log 2} - \frac{\log 9}{\log 2}$$

■ 4. Write the log expression in terms of natural logs.

$$\log_4 6.7$$

■ 5. Find the exact value of the logarithmic expression.

$$\frac{\ln(16{,}807)}{\ln(7)}$$

6. Use logarithms to solve the equation to the nearest ten thousandth.

$$8 \cdot 6^{3x} = 4{,}104$$

GRAPHING EXPONENTIAL FUNCTIONS

■ 1. Will the function have a vertical or horizontal asymptote? Where is it located? What is the end behavior of the function?

$$y = \left(\frac{1}{3}\right)^{x-2} + 3$$

■ 2. Will the function have a vertical or horizontal asymptote? Where is it located? What is the end behavior of the function?

$$x = -4^{y+3} - 2$$

■ 3. Graph the exponential function.

$$f(x) = \left(\frac{4}{5}\right)^{x}$$

■ 4. What is the x-intercept of the function?

$$x = \left(\frac{11}{8}\right)^{y} - 4$$

■ 5. Sketch the graph of the function by finding the y-intercept and figuring out the function's end behavior.

$$y = -2^{x+1} - 5$$

■ 6. Sketch the graph of the function using the x-intercept and the end behavior.

$$x = \left(\frac{1}{4}\right)^{y+2} - 2$$

GRAPHING TRANSFORMATIONS OF EXPONENTIAL FUNCTIONS

■ 1. Sketch the graph of the function.

$$y = 3^{x-2} - 3$$

■ 2. Sketch the graph of the function.

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

■ 3. Graph the exponential function.

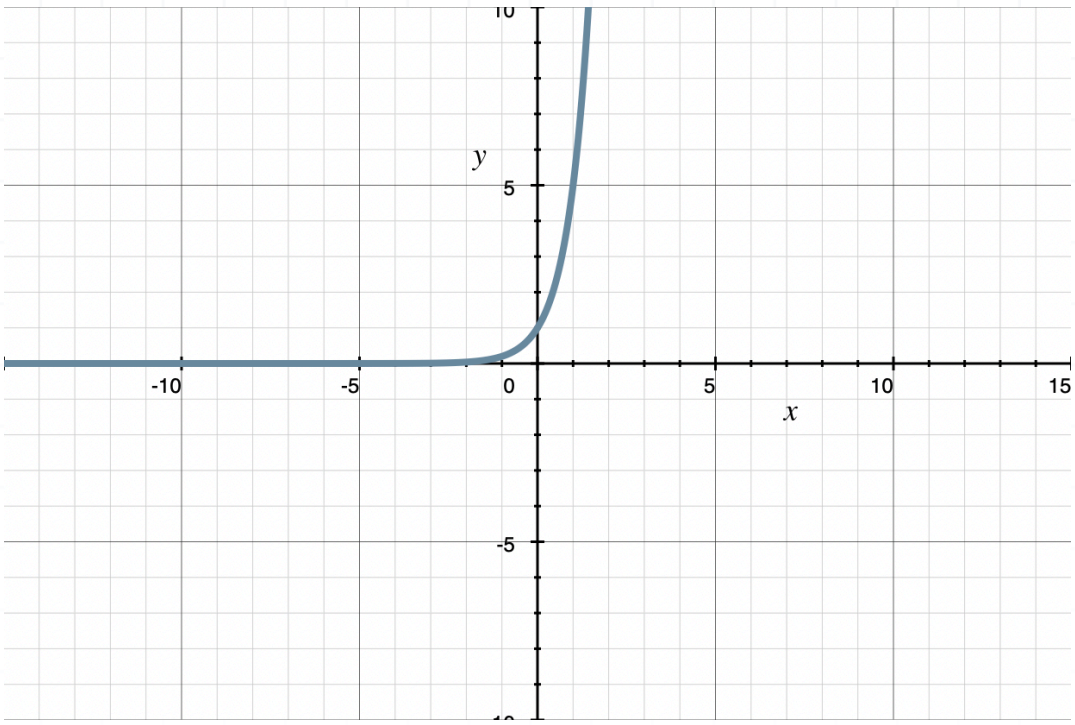
$$f(x) = \left(\frac{1}{2}\right)^{-x-2} - 5$$

■ 4. Write the equation for the function that results from applying the list of transformations below to the parent function $y = 6^x$. The list of transformations is not necessarily given in the order in which they should be applied.

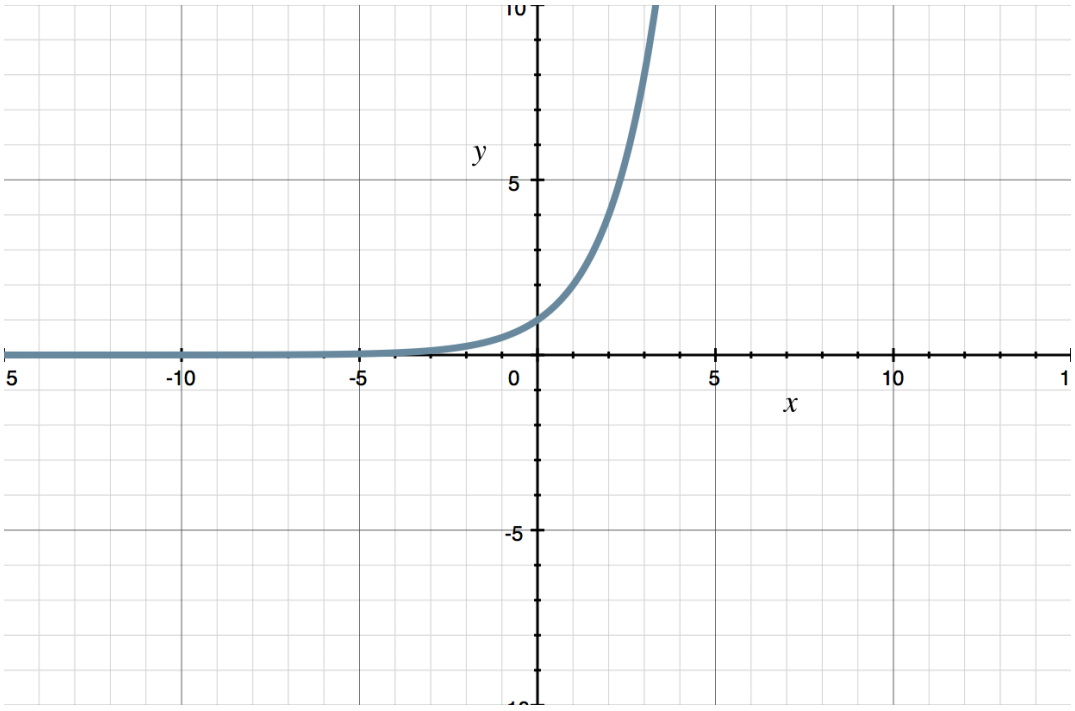
- Vertically stretch by a factor of 2
- Vertical shift 4 units up and horizontal shift 3 units to the right
- Reflection across the x-axis

- Reflection across the y-axis

■ 5. Given the graph of $y = 5^x$, use transformations to graph $y = -5^{x+1} - 2$.



■ 6. Given the graph of $y = 2^x$, use transformations to graph $y = 2^{x-1} + 4$.



THE GENERAL LOG RULE

■ 1. Write the inverse of the log function.

$$\log y = 2x$$

■ 2. Write the inverse of the log function.

$$\ln y = x$$

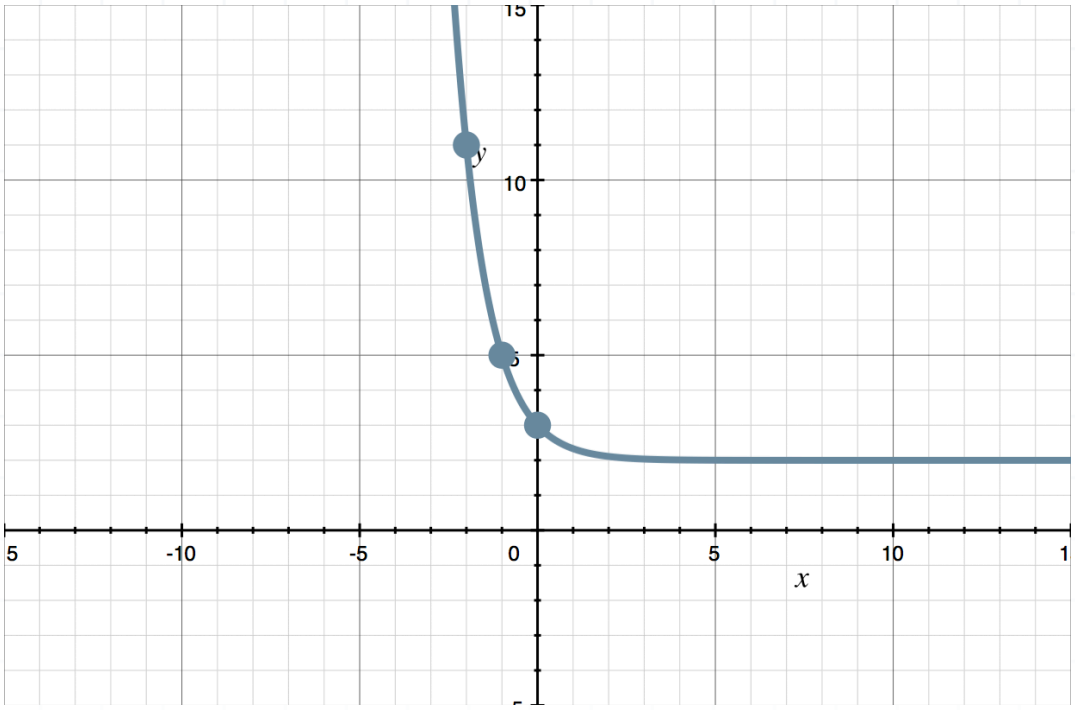
■ 3. The table shows points that satisfy an exponential function. Write a set of four points that will satisfy its inverse.

x	1	2	3	4
$y=a^x$	1.5	2.25	3.375	5.0625

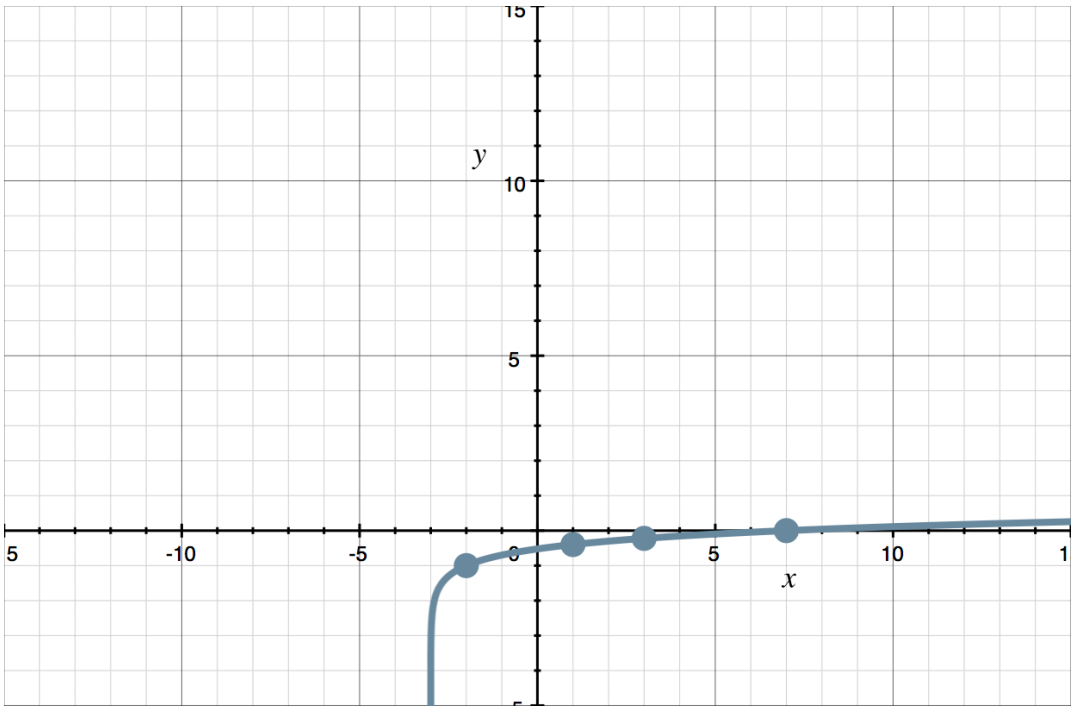
■ 4. The table shows points that satisfy a logarithmic function. Write a set of four points that will satisfy its inverse.

x	10	100	1,000	10,000
y=log(x)	1	2	3	4

■ 5. The graph shown passes through $(-2,11)$, $(-1,5)$, and $(0,3)$. Sketch the graph of its inverse.



■ 6. The graph shown passes through $(-2,-1)$, $(1,-0.3979)$, $(3,-0.2218)$, and $(7,0)$. Sketch the graph of its inverse.



GRAPHING LOG FUNCTIONS

■ 1. Will the function have a vertical or horizontal asymptote? Where is it located?

$$y = \log_2(x - 1)$$

■ 2. Graph the function $y = \log_6(x)$.

■ 3. Sketch the graph of the function using intercepts and end behavior.

$$y = 5\log_2(x + 4)$$

■ 4. Graph the function $y = \ln(x)$.

■ 5. Sketch the graph of the function by making a table of values.

$$y = \log_5 x$$

■ 6. Sketch the graph of the function using intercepts and end behavior.

$$x = 2\log_3(y + 1)$$

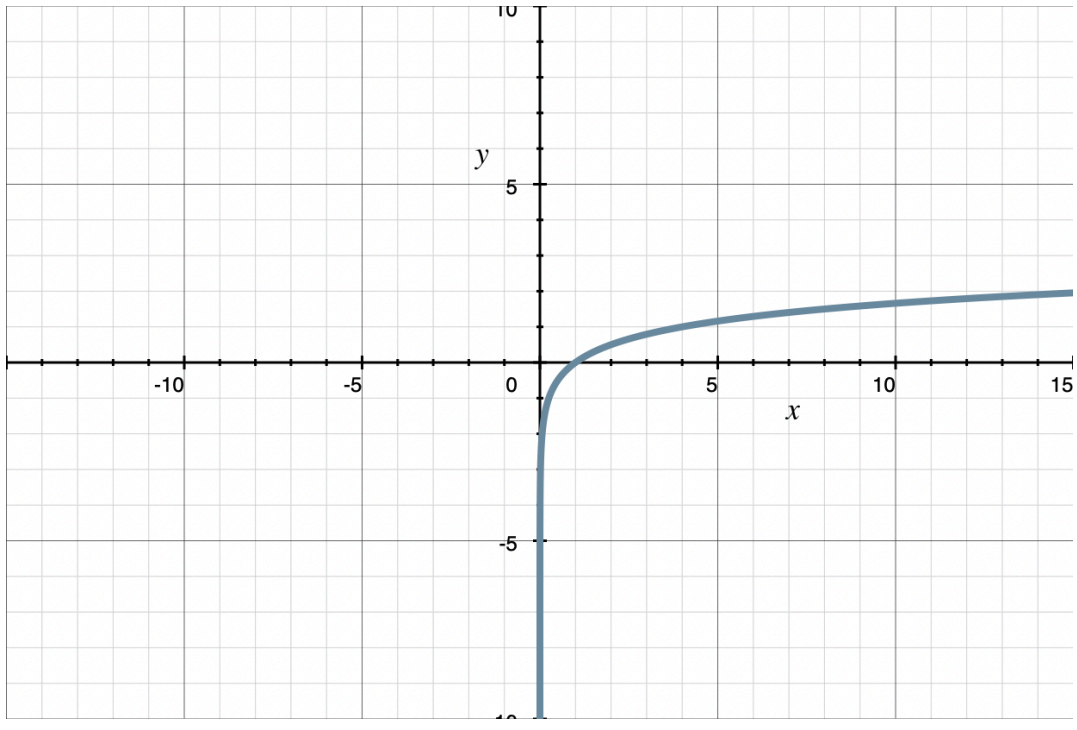
GRAPHING TRANSFORMATIONS OF LOG FUNCTIONS

■ 1. Use transformations to sketch the graph of $y = -3\log_7(x-2)+4$.

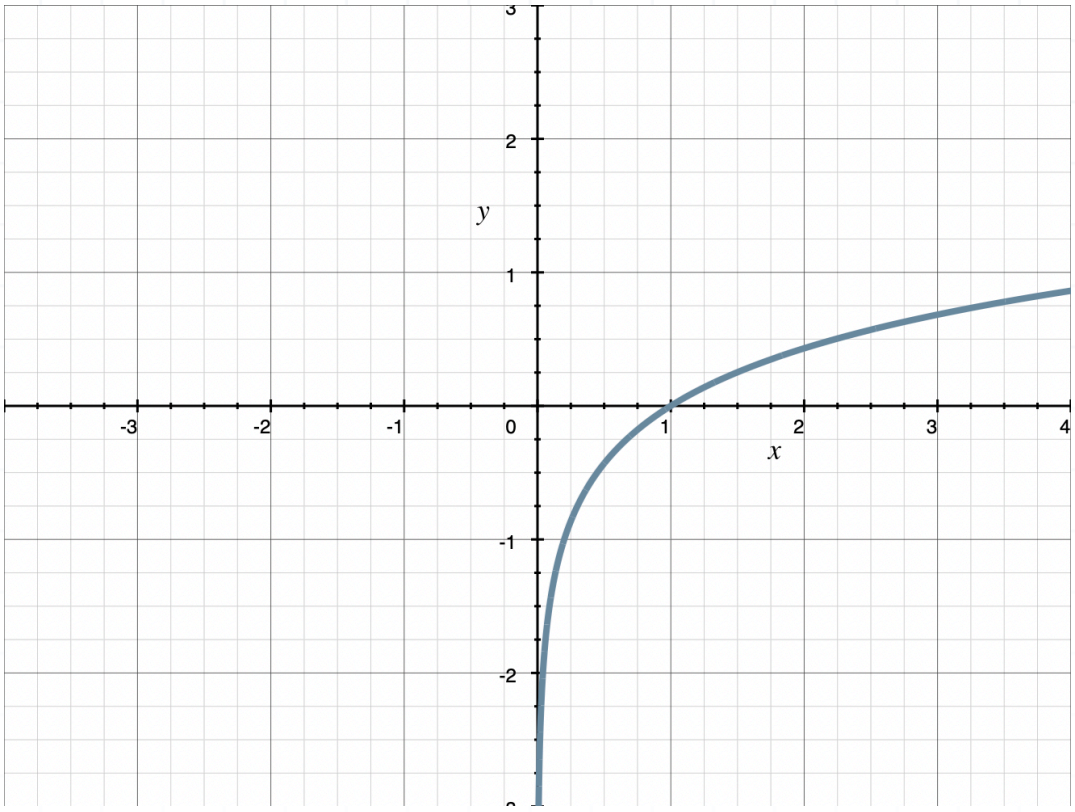
■ 2. Will the function have a vertical or horizontal asymptote? Where is it located?

$$y = \log_4(2x) + \log_4(3)$$

■ 3. Given the graph of $y = \log_4(x)$, use transformations to sketch the graph of $y = \log_4(x-2) - 3$.



■ 4. Given the graph of $y = \log_5(x)$, use transformations to sketch the graph of $y = -\log_5(x + 1) - 2$.



■ 5. Use transformations to sketch the graph of $y = \log_4(x + 8)$.

■ 6. Use transformations to sketch the graph of $y = \log(5x) - 3$.

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