

5.2.3 What can I learn about logs?

Investigating the Family of Logarithmic Functions



In the last two lessons you have learned what a log is and how to convert an equation in log form to exponential form (and back again). In this lesson, you will explore logs as a family of functions.

5-81. INVESTIGATING THE FAMILY OF LOGARITHMIC FUNCTIONS

You have learned that a logarithm is the inverse of an exponential function. Since exponential functions can have different bases, so can logarithms. Investigate the family of logarithmic functions $y = \log_b(x)$. The questions below will help you investigate. Explore using [Log & Exponential Graphs](#) (Desmos).

Your Task: Generate data with your team and use it to write summary statements about this family of functions. For each summary statement you find, prepare a poster that shows and explains the summary statement and be prepared to present it to the class. Remember that summary statements should always include thorough justification.

Discussion Points

How can we collect data for this family? How much data is enough?

What have we learned about logs and inverses that can help us work with this family? How can “DrawInv” help?

What patterns can we find in our data? Why do they happen?

What are all the possible inputs for our function? Are there some x -values that do not make sense? Why or why not? How do these results appear in different mathematical representations?

What are some characteristics that all logarithmic functions have in common?

What happens as the value of b changes? What values of b make sense?

Further Guidance

5-82. As a team, begin your investigation of $y = \log_b x$ by choosing a positive value for b and work together to generate a table and a graph. Then, have each member of your team choose a different value for b . Since there is no key for a log of base b on your calculator, you will need to find another method to generate data for a table. Several strategies are suggested below.

- While it may still be hard to make a table for your equation, your knowledge of inverses will help you. Write the inverse of your equation and make an $x \rightarrow y$ table for it. Use this table to help you make a table

for your original function.

- Use the calculator to guess and check possible outcomes.
- Rewrite your log equation as an equivalent exponential equation and reverse your thinking.

*Further Guidance
section ends here.*

5-83. LEARNING LOG

Write a Learning Log entry about the family of functions $y = \log_b x$. Include the summary statements your team came up with and any others that you think should be added from the class discussion. As you write, think about which statements are very clear to you and which need further clarification. Title this entry “The Family of Logarithmic Functions” and label it with today's date.



5-84. Write the equation of an increasing exponential function that has a horizontal asymptote at $y = 15$. [Help \(Html5\)](#) \Leftrightarrow [Help \(Java\)](#)

5-85. If $x = 7^y$, how would you write this equation in $y =$ form? Explain. [Help \(Html5\)](#) \Leftrightarrow [Help \(Java\)](#)

5-86. Solve for n : $n^3 = 49$. [Help \(Html5\)](#) \Leftrightarrow [Help \(Java\)](#)

5-87. A circle has the equation $x^2 + (y + 2)^2 = r^2$. If the circle is shifted 2 units to the left, 5 units up, and the radius is doubled, what will its new equation be? [Help \(Html5\)](#) \Leftrightarrow [Help \(Java\)](#)

5-88. On Wednesdays at Tara's Taquería four tacos are the same price as three burritos. Last Wednesday the Lunch Bunch ordered five tacos and six burritos, and their total bill was \$8.58 (with no tax or drinks included). Nobody in the Lunch Bunch can remember the cost of one of Tara's tacos. Help them figure it out. [Help \(Html5\)](#) \Leftrightarrow [Help \(Java\)](#)

5-89. Graph the two functions below on the same set of axes. [Help \(Html5\)](#) \Leftrightarrow [Help \(Java\)](#)

$$y = 3(2^x)$$

$$y = 3(2^x) + 10$$

a. How do the two graphs compare?

b. Suppose the first equation is $y = km^x$ and the graph is shifted up b units. What is the new equation?

5-90. Solve each equation or inequality. [Help \(Html5\)](#) \Leftrightarrow [Help \(Java\)](#)

a. $|x - 1| = 9$

b. $2|x + 1| + 3 = 9$

c. $|x - 1| < 3$

d. $|x + 5| \geq 8$

5-91. Factor each expression below. [Help \(Html5\)](#) \Leftrightarrow [Help \(Java\)](#)

a. $x^2 + 8x$

b. $x^2y^2 - 81z^2$

c. $2x^2 + 14x - 16$

d. $3x^2 - 11x - 4$

5-92. For each of the following rational expressions, add or subtract, then simplify. [Help \(Html5\)](#) \Leftrightarrow [Help \(Java\)](#)

a. $\frac{2-x}{x+4} + \frac{3x+6}{x+4}$

b. $\frac{3}{(x+2)(x+3)} + \frac{x}{(x+2)(x+3)}$

c. $\frac{3}{x-1} - \frac{2}{x-2}$

d. $\frac{8}{x} - \frac{4}{x+2}$