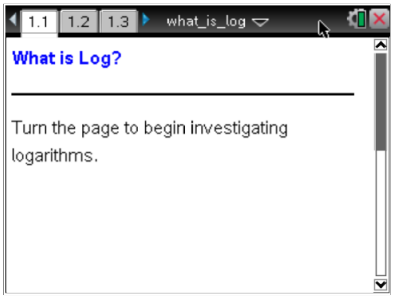
What is Log?
Student Activity

Date _____

Open the TI-Nspire document
What_is_Log.tns.

You may have noticed that above 10^x is $\log$. What does *log* mean? Why is $\log$ placed above the exponential key? You will investigate these questions in this activity.



Move to page 1.2.

Press ctrl ▶ and ctrl ◀ to navigate through the lesson.

1. The graph of the function $f(x) = 2^x$ is shown.
   a. What are the domain and range of $f(x)$?

   b. Recall that $f(x) = 2^x$ is a one-to-one function, so it has an inverse reflected over the line $y = x$. What are the domain and range of $f^{-1}(x)$?

   c. Point P is a point on $f(x)$. Move the Show Reflection slider to *Yes* and then move point P. As you do so, point P' invisibly traces the graph of $f^{-1}(x)$. Since $f(x)$ can be written as $y = 2^x$, write a corresponding equation for the inverse.

   d. The equation $x = 2^y$ cannot be written as a function of y in terms of x without new notation. Move the Show Function slider to *Yes*. The inverse of $f(x)$ is actually $f^{-1}(x) = \log_2(x)$. In general, $\log_b x = y$ is equivalent to $b^y = x$ for $x > 0$, $b > 0$ and $b \neq 1$. Why do you think x and b must be greater than 0? Why can b not be equal to 1?

e. Move point *P* so that its coordinates are $(1, 2)$. The point (1, 2) on $f(x) = 2^x$ indicates that $2^1 = 2$. *P′* has the coordinates $(2, 1)$. The point (2, 1) on $f^{-1}(x) = \log_2(x)$ indicates that $\log_2 2 = 1$. Use this relationship between exponential expressions and logarithmic expressions to complete the following table. (Move point *P* as necessary.)

P	***P′***	**Exponential Expression**	**Logarithmic Expression**
$(1, 2)$	$(2, 1)$	$2^1 = 2$	$\log_2 2 = 1$
$(2, 4)$			
	$(8, 3)$		
		$2^0 = 1$	
		$2^{-1} = \frac{1}{2}$	
$\left(-2, \frac{1}{4}\right)$			
			$\log_2 \frac{1}{8} = -3$

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2. Solve the logarithmic equation $\log_2 32 = y$ using the patterns from question 1. Then, use the slider to change the *n*-value to solve the logarithmic equation. How does the exponential equation verify your result?