|  |  |
| --- | --- |
| **Open the TI-Nspire document *What\_is\_Log.tns.***You may have noticed that above s is Ö. What does *log* mean? Why is Ö placed above an exponential key? You will investigate these questions in this activity.  |  |

|  |
| --- |
| **Move to page 1.2.**1. The graph of the function *f*(*x*) = 2*x* is shown. a. What are the domain and range of*?*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* to 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*) = log2(*x*). In general, log*b* *x* = *y* is equivalent to *by = x* for *x* > 0, *b* > 0 and *b* ≠ 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 21 = 2.  has the coordinates. The point (2, 1) on  indicates that log2 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)  | 21 = 2 |  |
| (2, 4) |  |  |  |
|  | (8, 3)  |  |  |
|  |  | 20 = 1 |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |

2. You have discussed the idea of reflecting the exponential function over the line $y=x$. The result of  this reflection is the logarithmic function. Now we will discuss any tabular relationships that are formed  between an exponential function and a logarithmic function. Using the first and second columns from the table above, fill in the following tables.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|

|  |  |
| --- | --- |
| $$x$$ | $$f\left(x\right)= 2^{x}$$ |
| -3 |  |
| -2 |  |
| -1 |  |
| 0 |  |
| 1 |  |
| 2 |  |
| 3 |  |

 |

|  |  |
| --- | --- |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

|  |  |
| --- | --- |
| $$x$$ | $$f^{-1}\left(x\right)= log\_{2}x$$ |
| $$^{1}/\_{8}$$ |  |
| $$^{1}/\_{4}$$ |  |
| $$^{1}/\_{2}$$ |  |
| 1 |  |
| 2 |  |
| 4 |  |
| 8 |  |

 |

1. Briefly explain your process of filling in the tables on the previous page.
2. With a classmate, discuss and describe the patterns you see in each individual column.
3. Write down a rule for each table that you can use to classify the function as either exponential or logarithmic.
 |
| **Move to page 1.3.** |
| 3. Solve the logarithmic equation log232 = *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? |
| **Move to page 2.1.** |
| 4. Solve the equation. Then, use the slider to change the *n*-value to solve the logarithmic equation. How does the exponential equation verify your result? |
| 5. Maya solved the logarithmic equation. She says the answer is 4 since 4 × 4 = 16. Is her answer correct? Why or why not? |
| 6. Alex says that when solving a logarithmic equation in the form log*b a* = *y*, he can rewrite it as *ba* = *y*. Is this a good strategy? Why or why not? |