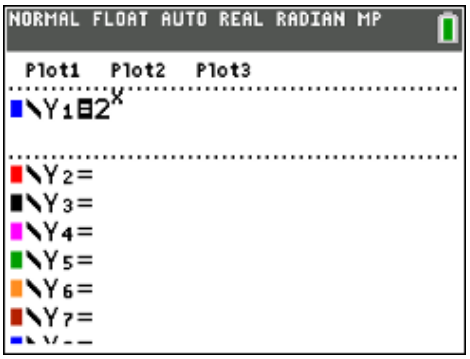
Exponential Reflections

Student Activity

Name _____

Class _____

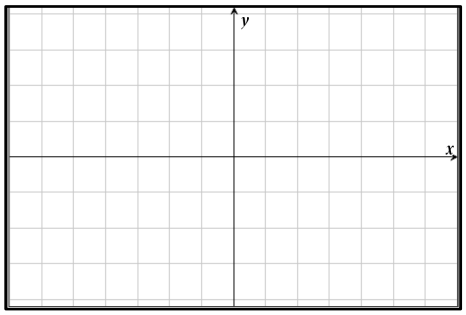
In this activity, you will investigate the inverse of an exponential function. You will also investigate the symmetry of the exponential function and its inverse.



Problem 1 – Reflecting an Exponential Function

1. Enter the exponential function $f(x) = 2^x$ on the [y=] screen. Then press [zoom] and select 4: ZDecimal.

   A function is invertible if each output value is mapped from a unique input value. Is the function $f(x) = 2^x$ invertible? What would the inverse of this graph look like? Sketch the function $y = 2^x$ and its inverse on the grid to the right.



2. Press [2nd] [table] to access a table of values for your function.

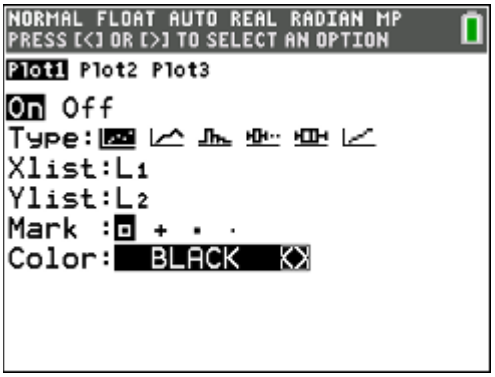
   Record the *y*-values under the original *y*-value column in the table below. Recall that if the function $f(x) = 2^x$ consists of input-output pairs (a, b), then the inverse function consists of input-output pairs (b, a). Record the inverses of each point by switching the *x*- and *y*-values and recording the results in the inverse columns in the table below.

Original *x*-value	Original *y*-value	Inverse *x*-value	Inverse *y*-value
–2			
–1			
0			
1			
2			
3			

3. Plot these inverse points by pressing [stat] and selecting 1: Edit. Enter the inverse values in **L1** and **L2**.

   To set up the scatter plot of the two lists, press [2nd] [stat plot] and match the screen to the right. Now press [graph] to observe the plotted values.

   Do your plotted points appear to be on the graph of the inverse function that you sketched in Question 1?



4. The inverse of a general exponential function $f(x) = b^x$ is a logarithmic function of the form $g(x) = log_b x$. Write the inverse function of $f(x) = 2^x$.

5. Check your result by graphing this function in Y2 to see if it passes through all the plotted points. Also graph the identity function Y3 $= x$. Are the two graphs symmetric with respect to the line $y = x$?

   Note: The $log_b x$ is found by pressing [math] and A: logBASE(.

Problem 2 – The inverse of $f(x) = e^x$. This function has a natural base of *e*.

6. Graph *Y1* = e^x. Repeat the steps in **Problem 1** using $f(x) = e^x$.

   What is the inverse function of $f(x) = e^x$?

   Note: The inverse of $f(x) = e^x$ is called a Natural Logarithmic function.

Problem 3 – The inverse of $f(x) = 10^x$.

7. Graph *Y1* = 10^x

   Find the inverse function of $f(x) = 10^x$. Check the symmetry of the function and its inverse by graphing.

   Note: The inverse of $f(x) = 10^x$ is called a Common Logarithmic function.