|  |  |
| --- | --- |
| **About the Lesson**  In this activity, students will determine that the inverse of the exponential function is the natural log function by plotting the inverse of exponential solution points. As a result, students will:   * Analyze the function *y* = *ex*, its corresponding inverse function  *y* = ln *x*, and their reflection about the line *y* = *x*. * Analyze the function *y* = 10*x*, its corresponding inverse function *y* = log(*x*), and their reflection about the line *y* = *x*.   **Vocabulary**   * line reflections * natural logarithmic function * exponential function * inverse functions   **Teacher Preparation and Notes**   * Students should be somewhat familiar with the concept of basic logarithms in order to complete this activity. * This activity is suitable for an Algebra 2 class or as a refresher activity for a Precalculus class.   **Activity Materials**   * Compatible TI Technologies:   TI-84 Plus\*  TI-84 Plus Silver Edition\*  ax-icon-color-deviceTI-84 Plus C Silver Edition  ax-icon-color-deviceTI-84 Plus CE  **\*** *with the latest operating system (2.55MP) featuring MathPrint* ***TM*** *functionality.* | **Tech Tips:**   * This activity includes screen captures taken from the TI-84 Plus CE. It is also appropriate for use with the rest of the TI-84 Plus family. Slight variations to these directions may be required if using other calculator models. * Watch for additional Tech Tips throughout the activity for the specific technology you are using. * Access free tutorials at <http://education.ti.com/calculators/pd/US/Online-Learning/Tutorials> * Any required calculator files can be distributed to students via handheld-to-handheld transfer.   **Lesson Files:**   * Exponential\_Reflections\_Student.pdf * Exponential\_Reflections\_Student.doc |

|  |  |
| --- | --- |
| **Problem 1 – Reflecting the Exponential Function** | |
| Students begin by graphing the function, *y* = *ex* and recording the *y*-values for certain *x*-values by using the **Table**.  The students then find the inverse of these collected points by switching the *x*- and *y*-values and plotting them.  **1.** What would the inverse of this graph look like?  **Answer**: The inverse graph would be increasing, concave down, passing through (1, 0), having a domain of  and a range of . |  |
| |  | | --- | | **Tech Tip:** If your students are using the TI-84 Plus CE have them turn on the GridLine by pressing y q [format] to change the graph settings. If your students are using TI-84 Plus, they could use GridDot. | | |
| **2.** Record the *y*-values under the original *y*-value column in the table below.  Next 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.  **Answers**:   |  |  |  |  | | --- | --- | --- | --- | | **Original *x*-value** | **Original *y*-value** | **Inverse *x*-value** | **Inverse *y*-value** | | **–2** | 0.135 | 0.135 | –2 | | **–1** | 0.368 | 0.368 | –1 | | **0** | 1 | 1 | 0 | | **1** | 2.718 | 2.718 | 1 | | **2** | 7.389 | 7.389 | 2 | | **3** | 20.086 | 20.086 | 3 | | |
| The students then find the inverse of these collected points by switching the *x*- and *y*-values and plotting their scatter plot.  **3.** What do you notice about the plotted values?  **Answer:** They appear to reflections of the points on the graph of *y* = *ex* about the line *y* = *x*. |  |
| As the students look at the graph and look for a pattern, it may be helpful for them to plot the function *y* = *x* (in **Y2**) to help them see the reflection. |  |
| After noticing the reflection of the original function, the students are asked to solve the inverse function by hand.  **4.** Find the inverse of *y* = *ex.* This is done by switching *x* and *y* (exchanging the input with the output) in the equation and solving for *y*.  **Answer:**  Have students graph their resulting function to show that it matches the scatter plot. |  |
| **Extension – Reflecting *y* = 10*x*** | |
| In this part of the activity, students repeat the process from Problem 1 using *y* = 10*x*. Students may need to “zoom in” to see portion of the graph of *y* = log(*x*) that exists close to the *y*-axis. Pressing q, selecting **2:Zoom In** and pressing Í will zoom in at the origin and allow the graph to be viewed a little more appropriately. |  |
| **5.** Find the inverse of *y* = 10*x.*  **Answer:**    The students will determine that the inverse of *y* = 10*x* is *y* = log(*x*). | |