Transformation of Exponential Functions- Part 2
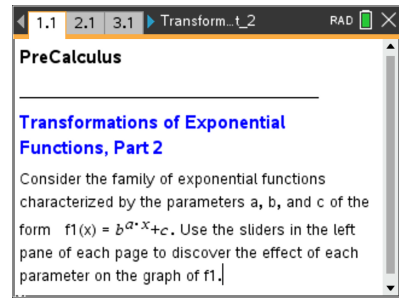## Student Activity

Name _____

Class _____

Open the TI-Nspire document *Transformations_of_Exponential_Functions_Part_2.tns*.

The purpose of this activity is to examine the family of exponential functions of the form $f(x) = b^{a \cdot x} + c$ where a, b, and c are parameters.

Note: The parameter b is the base of the exponential function and $b > 0, b \neq 1$.

Using the sliders in the left panel of each page, change the value of a parameter, and record the effect of each parameter change on the graph of the corresponding exponential function. At the end of this activity, use your results to match each function with its corresponding graph.

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1. The graph of $y = f1(x) = b^x + c$ is shown in the right panel. For a specific value of b, click the arrows to change the value of c and observe the changes in the graph of $f1$. Repeat this process for other values of b.

   a. Explain why for every value of b, the graph of $f1$ passes through the point $(0, c+1)$.

   b. Is it possible for the graph of $y = b^x + c$ to intersect the x-axis? Explain why or why not.

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2. The graph of $y = f1(x) = b^{a \cdot x}$ is shown in the right panel. For a specific value of b, click the arrows to change the value of a and observe the changes in the graph of $f1$. Repeat this process for other values of b.

   a. Describe the effect of the parameter a on the graph of $y = b^{a \cdot x}$. Discuss the effects of both positive and negative values of a.

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3. The graph of $y = f1(x) = b^{a \cdot x} + c$ is shown in the right panel. For specific values of a and b, click the arrows to change the value of c, and observe the changes in the graph of $f1$. Repeat this process for other values of a and b.

    a. Describe the effect of the parameter c on the graph of $y = f1(x) = b^{a \cdot x} + c$. Discuss the effects of both positive and negative values of c.

Move to page 5.1.

4. Display the graphs of $y = f1(x) = 3^{2x}$ and $y = f2(x) = 9^x$.

    a. Describe the similarities between these two graphs. Use the properties of exponents to justify your answer.

    b. Insert a new problem, and display the graph of $y = f1(x) = 3^{-2x}$. Use the properties of exponents to find a function of the form $f2(x) = b^x$ such that the graphs of $f1$ and $f2$ are the same. Verify your answer.

    c. Use your answers to parts (a) and (b) to explain the relationship between a horizontal dilation of the graph of an exponential function and a change of base of an exponential function.

5. Without using your calculator, match each equation with its corresponding graph.
   Check your answers by graphing each function on your calculator.

   (a) $f(x) = 2^{3x}$
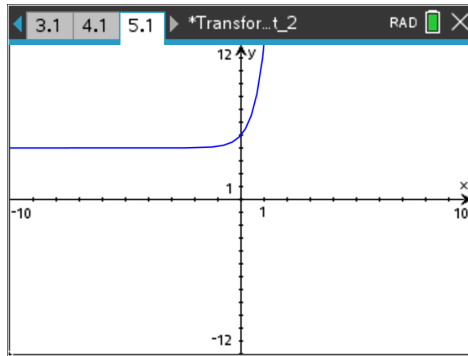
   (b) $f(x) = -(2)^{3x}$

   (c) $f(x) = 2^{-3x}$

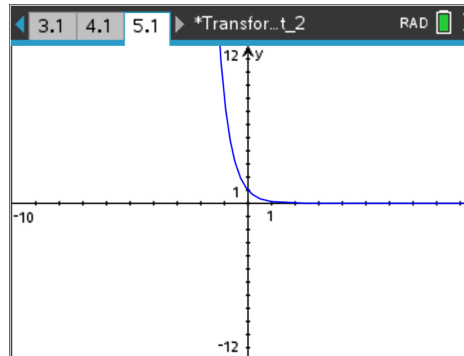   (d) $f(x) = 2^{3x} + 4$

   (e) $f(x) = e^{-x}$

   (f) $f(x) = e^x - 3$

Note: The function in part (e) is the "natural" exponential function and involves the number
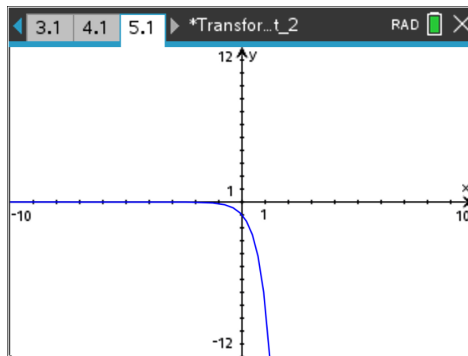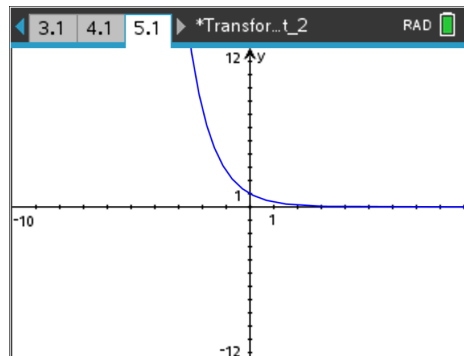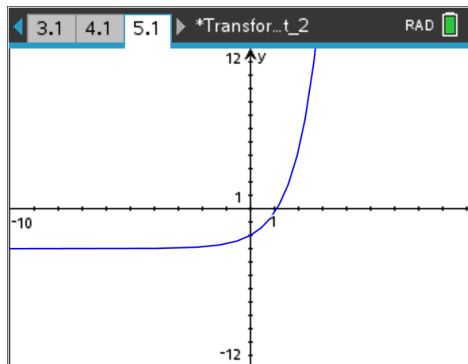$e \approx 2.71828...$

(i)

(ii)

(iii)

(iv)

(v)

(vi)