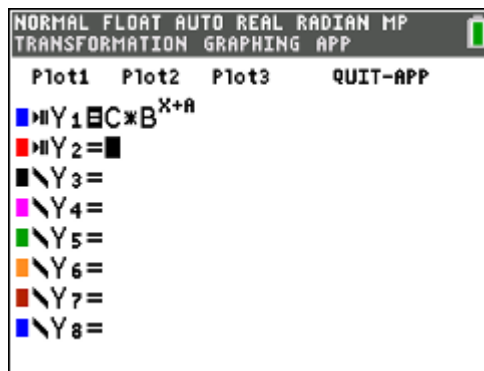




In this activity, you will examine the family of exponential functions of the form $f(x) = c \cdot b^{x+a}$ where a , b , and c are parameters. You will use the **Transformation App** (Transfrm) on your handheld to manipulate these parameters in Questions 1 - 3.



The parameter b is the base of the exponential function and $b > 0, b \neq 1$. Using the transformation app, change the value of a parameter by entering the equation for each question into Y_1 and Y_2 , and pressing the arrow keys to manipulate each parameter of the function on the graph.

Question 1

1. Graph the following function: $Y_1 = B^x$. Press the arrows to change the value of B , and observe the changes in the graph of Y_1 .
 - a. Explain why for every value of B the graph of Y_1 passes through the point $(0,1)$.
 - b. For $B > 1$, describe the graph of $Y_1 = B^x$.
 - c. For $0 < B < 1$, describe the graph of $Y_1 = B^x$.
 - d. Find the domain and range of function $Y_1 = B^x$ for all possible values of B .
 - e. Does the graph of $Y_1 = B^x$ intersect the x -axis? Explain why or why not.



Question 2

2. Graph the following function: $Y_2 = B^{x+A}$. For a specific value of B , click the arrows to change the value of A , and observe the changes in the graph of Y_2 . Repeat this process for other values of B . Describe the effect of the parameter A on the graph of $Y_2 = C \cdot B^{x+A}$. Discuss the effects of both positive and negative values of A .

Question 3

3. Graph the following function: $Y_2 = C \cdot B^{x+A}$. For specific values of A and B , click the arrows to change the value of C , and observe the changes in the graph of Y_1 . Describe the effect of the parameter C on the graph of $Y_2 = C \cdot B^{x+A}$. Discuss the effects of both positive and negative values of C .

Question 4

4. Turn off the Transformation App by selecting Quit-App on the $y =$ screen. Graph each function given and answer the following questions.
- a. Display the graphs of $Y_1 = 3^{x+2}$ and $Y_2 = 9 \cdot 3^x$.
- (i) How is the graph of Y_2 related to the graph of Y_1 ?
- (ii) Use the properties of exponents to justify your answer.
- b. Display the graph of $Y_1 = 3^{x-2}$ and $Y_2 = \left(\frac{1}{9}\right) \cdot 3^x$.
- (i) How is the graph of Y_2 related to the graph of Y_1 ?
- (ii) Use the properties of exponents to justify your answer.
- c. Use your answers to parts (a) and (b) to explain the relationship between a horizontal translation and a vertical dilation of the graph of an exponential function.



Question 5

5. Without using your calculator, match each equation with its corresponding graph.

Check your answers by graphing each function on your calculator.

(a) $f(x) = 3^{x-4}$

(b) $f(x) = -\left(\frac{1}{3}\right)^x$

(c) $f(x) = (0.7)^{x-4}$

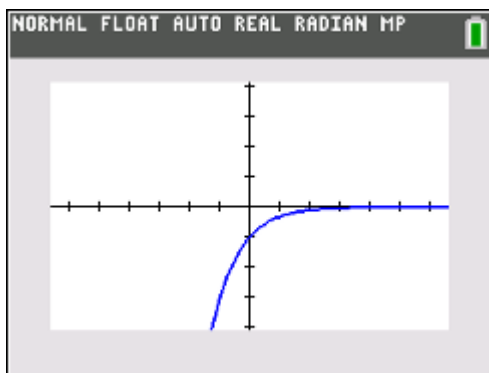
(d) $f(x) = -2(0.1)^{x+3}$

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

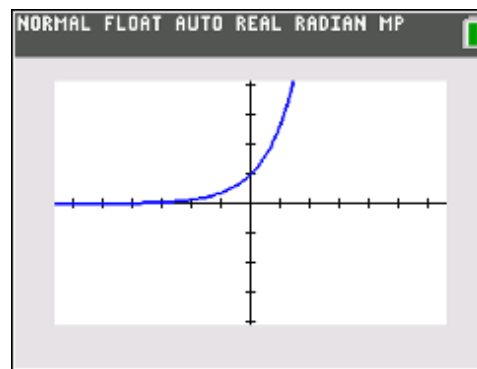
(f) $f(x) = -\left(\frac{1}{2}\right) \cdot \pi^x$

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

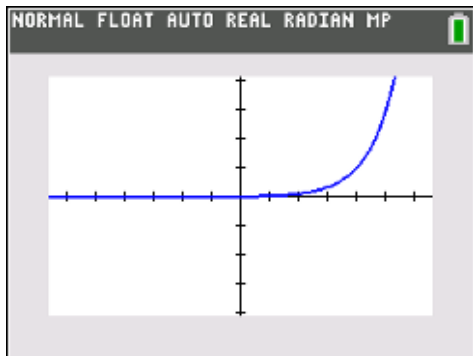
(i)



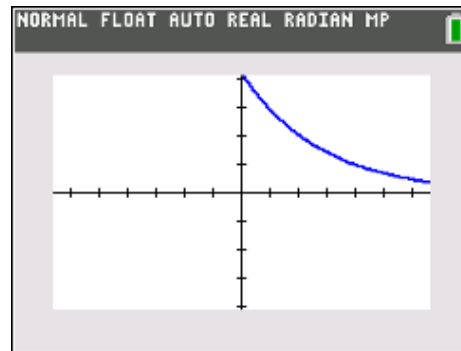
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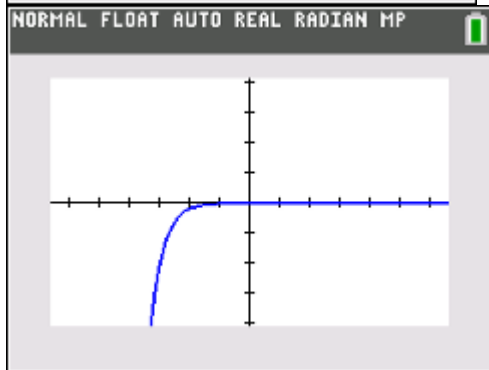
(iii)



(iv)



(v)



(vi)

