Algebra 2/Pre-Calculus

Name_____

Graphing Exponential Functions (Day 4, Exponential Functions)

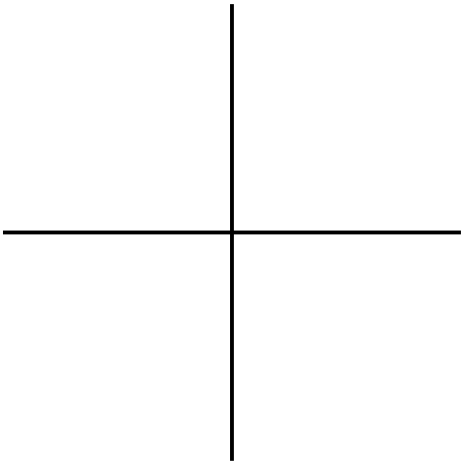
In this problem set, we will learn to graph exponential functions.

1. Consider the function $f(x) = 3 \cdot 2^x$.

a. What is the y-intercept for this function?

b. Fill in the following table. Then sketch the graph. ***Caution:*** How do we do negative exponents?

x	$f(x)$
-3	
-2	
-1	
0	
1	
2	
3	
4	



c. Describe what happens on the graph as x gets smaller.

d. As x gets smaller, the y-values on the graph get closer and closer to the x-axis. Will the graph ever touch the y-axis? Explain how you know.

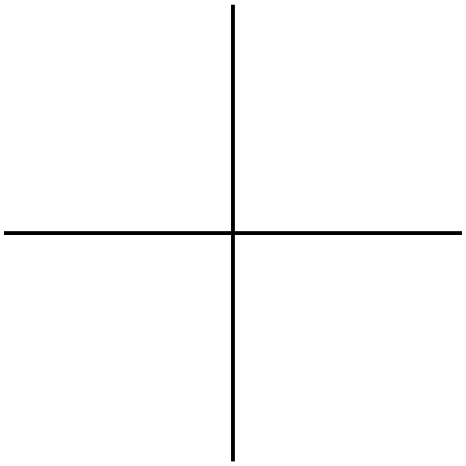
Definition: When a graph gets "infinitely close" to a line, we say that line is an ***asymptote***. In the last problem, the asymptote was the line $y = 0$.

2. Consider the function $g(x) = (\frac{1}{3})^x$.

a. What is the y-intercept for this function?

b. Fill in the following table. Then sketch the graph. ***Caution:*** How do we do negative exponents?

x	***g*(*x*)**
-3	
-2	
-1	
0	
1	
2	
3	
4	

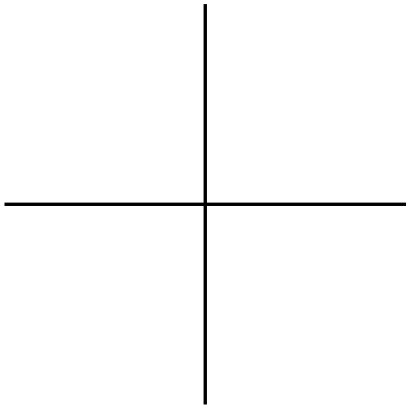


c. Describe how this graph compares to the graph in problem **1**. What's similar? What's different? Explain.

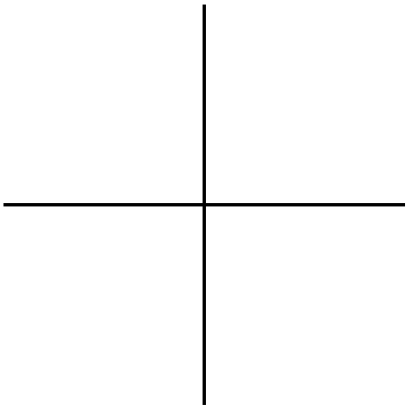
d. What's the equation of the asymptote for this graph?

3. Sketch the graph for each of the following. Include the coordinates of the y-intercept. Then check your graphs by graphing on your calculator. ***Note:*** You can make tables for these graphs if you want, but you might be able to figure them out without making tables. Think about how these graphs relate to the graphs you found in problems **1** and **2**.

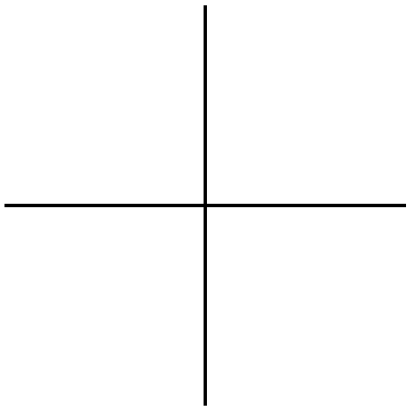
a. $y = 3^x$



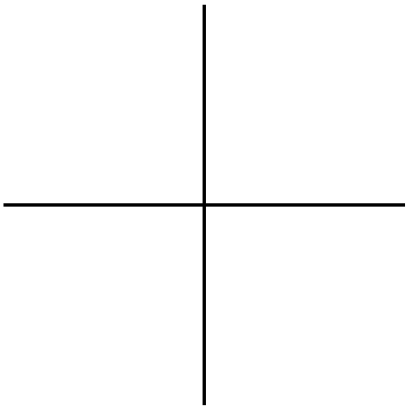
b. $y = (\frac{1}{5})^x$



c. $y = 2 \cdot 10^x$



d. $y = 3(0.8)^x$



4. Suppose $f(x) = ab^x$ where $a > 0$.

a. What does the graph of $f(x) = ab^x$ look like if $b > 1$? Sketch it below.

b. What does the graph of $f(x) = ab^x$ look like if $0 < b < 1$? Sketch it below.

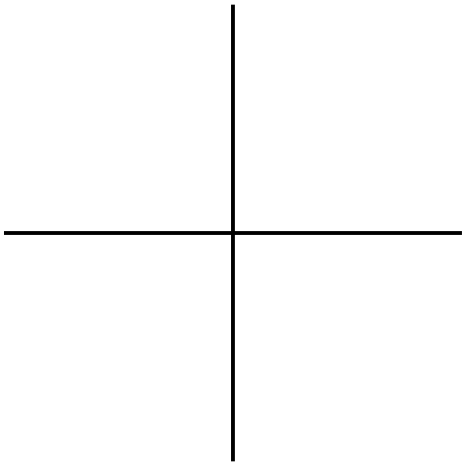
5. Consider the following two functions: $f(x) = 2 \cdot 3^x$ and $g(x) = 6^x$. Are these two functions the same? Explain why or why not. ***Hint:*** Make a table of values for both functions.

6. Consider the function $h(x) = -3 \cdot 2^x$.

a. What is the y-intercept for this function?

b. Fill in the following table. Then sketch the graph. ***Caution:*** How do we do negative exponents?

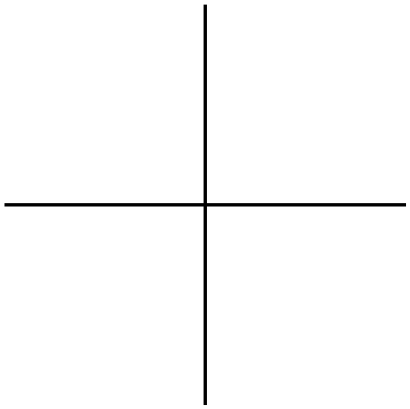
x	$h(x)$
-3	
-2	
-1	
0	
1	
2	
3	
4	



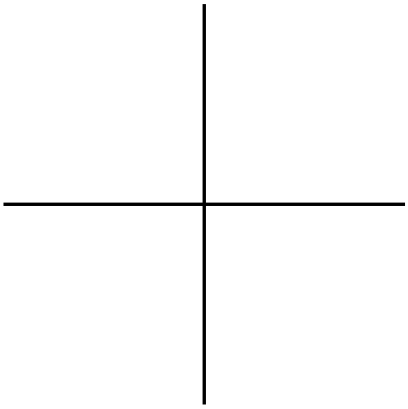
c. How does the graph of $h(x) = -3 \cdot 2^x$ compare with the graph of $f(x) = 3 \cdot 2^x$ from problem **1**?

7. Sketch the graph for each of the following. Include the coordinates of the y-intercept. Then check your graphs by graphing on your calculator. ***Note:*** In all of these graphs, the a-value is negative. How does this influence the appearance of the graph?

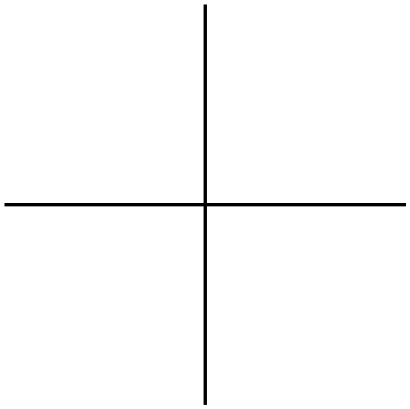
a. $y = -5^x$



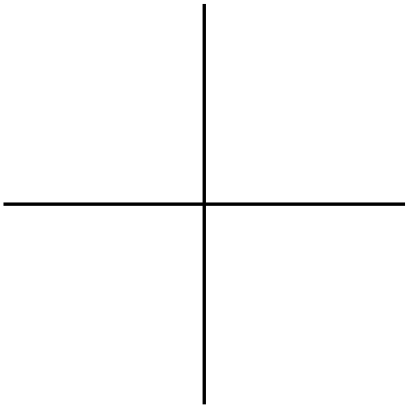
b. $y = -3 \cdot 10^x$



c. $y = -(0.2)^x$



d. $y = -4(\frac{1}{2})^x$



Functions of the form $f(x) = ab^x + c$ are not technically exponential functions, but their graphs follow similar rules. We will explore these rules in the next problem.

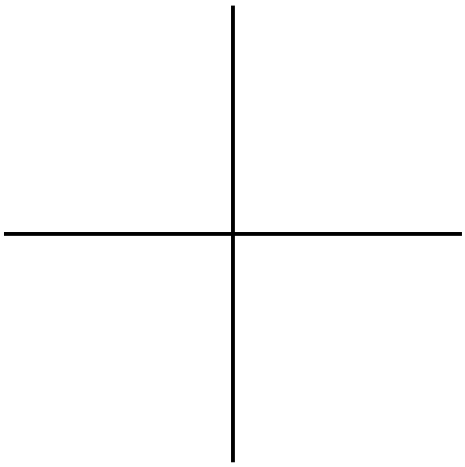
8. Consider the function $f(x) = 3 \cdot 2^x + 4$. ***Note:*** This is almost the same as the function in problem **1**, but with the addition of the "+4."

a. Before doing any calculations, describe in words how you think this graph will compare to the graph in problem **1**.

b. What is the y-intercept for this function?

c. Fill in the following table. Then sketch the graph. ***Note:*** You can check your answer by graphing on the calculator.

x	***f*(*x*)**
-3	
-2	
-1	
0	
1	
2	
3	
4	

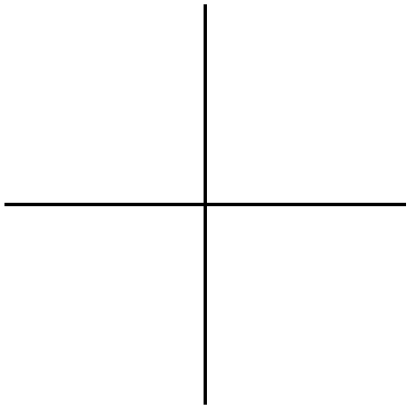


d. Write the equation for the asymptote. ***Hint:*** The asymptote is not $y = 0$.

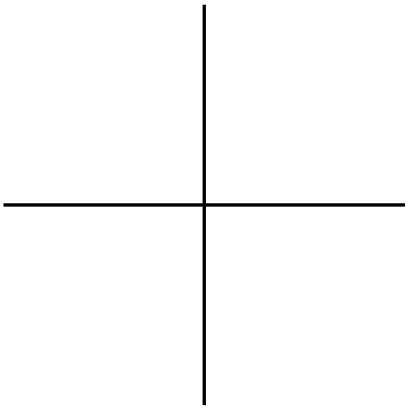
e. Explain in words how this graph compared to the graph from problem **1**. Did you have the right answer in part **a** of this problem?

9. You should have found that the graph of $y = 3 \cdot 2^x + 4$ was the same as the graph of $y = 3 \cdot 2^x$ but shifted up by 4. The asymptote also shift up by 4, from $y = 0$ to $y = 4$. Use this idea to sketch the graph for each of the following functions. Include the coordinates of ***Note:*** As always, you can check your answers by graphing on the calculator.

a. $y = (\frac{1}{2})^x + 3$

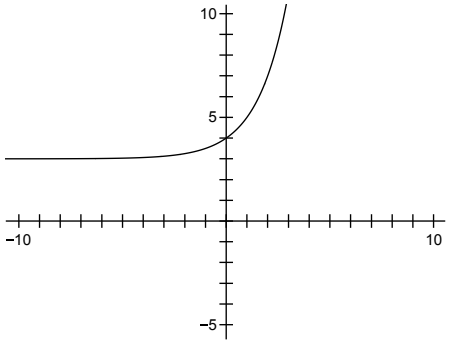


b. $y = 4 \cdot 2^x - 8$

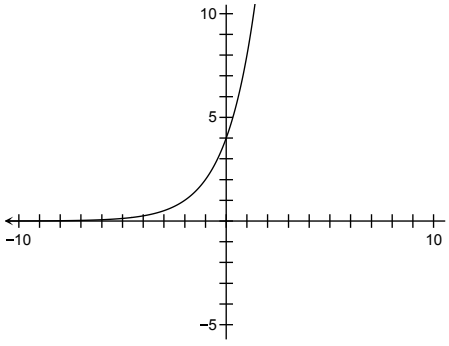


10. Consider the two graphs below. One of these is the graph of $y = 4 \cdot 2^x$. The other is the graph of $y = 2^x + 3$. Which is which?

Graph 1



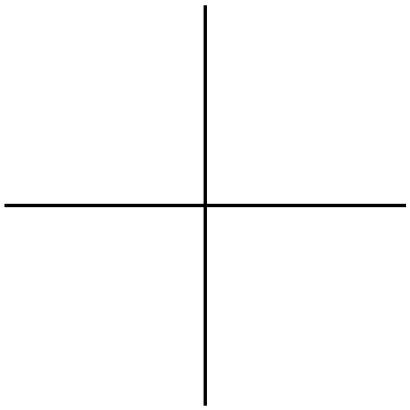
Graph 2



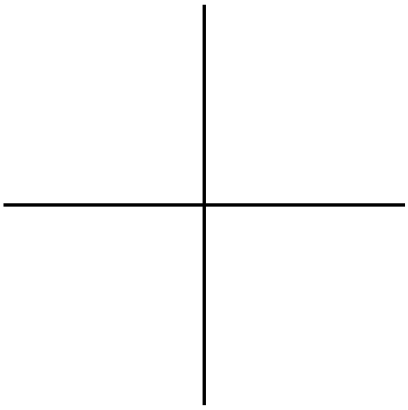
Note: You should have found that Graph 1 was $y = 2^x + 3$. Notice that we can see that its asymptote is at $y = 3$. Look back at your graphs in problem **9** and make sure the asymptotes on your graphs are clearly visible.

11. More practice! Sketch the graph for each of the following. Include the coordinates of the y-intercept and the equation for the asymptote. Then check your graphs by graphing on your calculator.

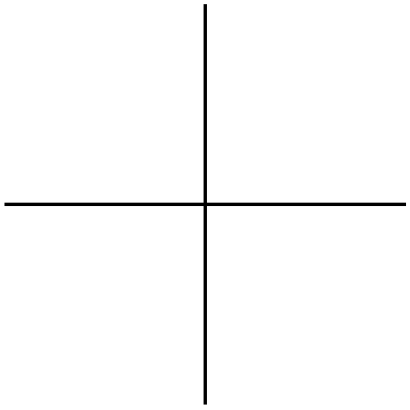
a. $y = 3 \cdot 4^x + 5$



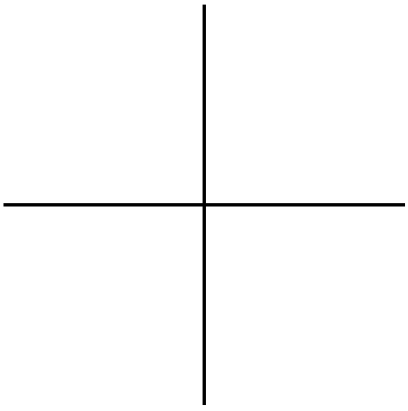
b. $y = 3(\frac{1}{4})^x + 5$



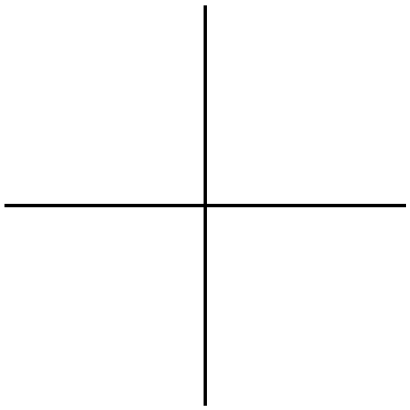
c. $y = -2^x - 4$



d. $y = -3(\frac{1}{3})^x$



e. $y = (0.99)^x$



f. $y = 40(.8)^x + 10$