

## Exploring Transformations of Graphs

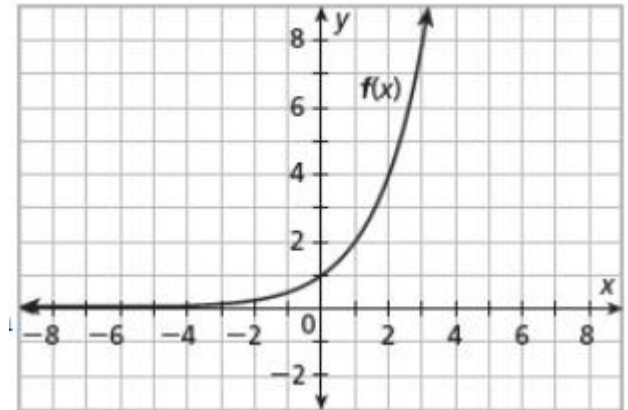
Collected/ Not Collected

Graphing  $f(x) = ab^{x-h} + k$ **1 EXPLORE** Changing  $h$  and  $k$ 

The graph of  $f(x) = 2^x$  is shown here.

Using your graphing calculator graph the following functions on the same coordinate. Sketch your graphs to the right.

$$g(x) = 2^{x-4} \quad h(x) = 2^{x+6}$$

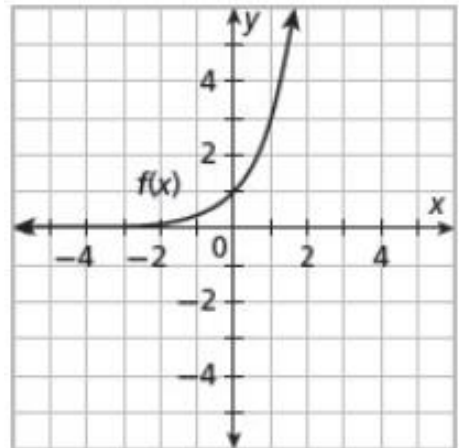


1. Compare the graph of  $f(x) = 2^x$  to the graph of  $g(x) = 2^{x-4}$ . What changed? How did the graph shift?
2. Compare the graph of  $f(x) = 2^x$  to the graph of  $h(x) = 2^{x+6}$ . What changed? How did the graph shift?

The graph of  $f(x) = 3^x$  is shown here.

Using your graphing calculator graph the following functions on the same coordinate. Sketch your graphs to the right.

$$g(x) = -3^x$$

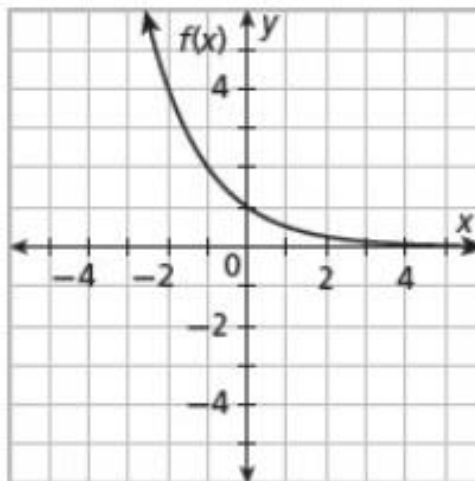


3. Compare the graph of  $f(x) = 3^x$  to the graph of  $g(x) = -3^x$ . What changed? How did the graph shift?
4. We will not discuss the equation  $g(x) = 3^{-x}$  in this form. What is another way to write  $g(x) = 3^{-x}$ ?

The graph of  $f(x) = \left(\frac{1}{2}\right)^x$  is shown here.

Using your graphing calculator graph the following functions on the same coordinate. Sketch your graphs to the right.

$$g(x) = \left(\frac{1}{2}\right)^{x-4} \quad h(x) = \left(\frac{1}{2}\right)^{x+6}$$



5. When the graph is of exponential decay, did the rules for shifting apply the same as when the graph is of exponential growth (the rules you found on the first page)? If they changed, how did the rules change?

6. Based on your findings above, without using a calculator, describe how the graph of  $g(x) = \left(\frac{1}{3}\right)^{x+2} + 1$

compares to its parent function graph of  $f(x) = \left(\frac{1}{3}\right)^x$ .

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### **Reflect**

7. How do you think the value of  $h$  affects the graph of  $g(x) = b^{x-h}$ ?

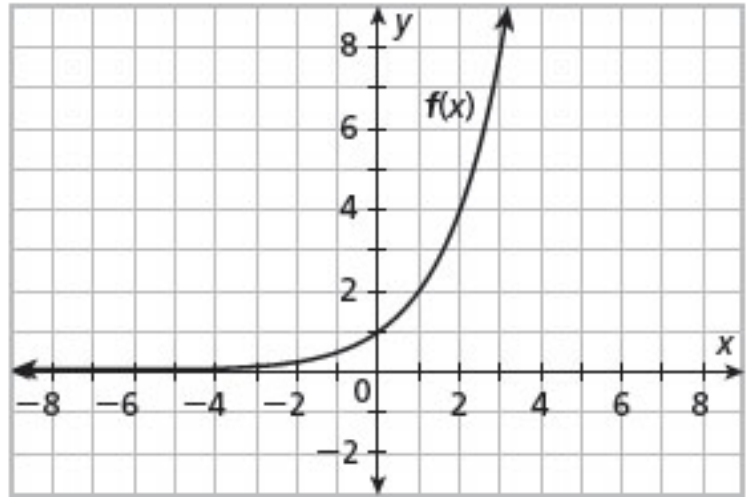
8. How do you think the value of  $k$  affects the graph of  $g(x) = b^x + k$ ?

## 2 EXPLORE Changing a

The graph of  $f(x) = 2^x$  is shown here.

Using your graphing calculator graph the following functions on the same coordinate. Sketch your graphs to the right.

$$g(x) = 3(2)^x \quad h(x) = \frac{1}{2}(2)^x$$



9. Compare the graph of  $f(x) = 2^x$  to the graph of  $g(x) = 3(2)^x$ . What changed?

10. Compare the graph of  $f(x) = 2^x$  to the graph of  $h(x) = \frac{1}{2}(2)^x$ . What changed?

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### **Reflect**

11. For  $a > 0$ , how do you think the value of  $a$  affects the graph of  $g(x) = ab^x$ ?

12. Without graphing, explain how the graph of  $g(x) = 4(2)^{x+1} - 7$  compares to the graph of  $f(x) = 2^x$ .