

## Lesson 19: Translating Graphs of Functions

### Classwork

#### Opening Exercise

Graph each set of three functions in the same coordinate plane (on your graphing calculator or a piece of graph paper). Then, explain what similarities and differences you see among the graphs.

a.  $f(x) = x$   
 $g(x) = x + 5$   
 $h(x) = x - 6$

b.  $f(x) = x^2$   
 $g(x) = x^2 + 3$   
 $h(x) = x^2 - 7$

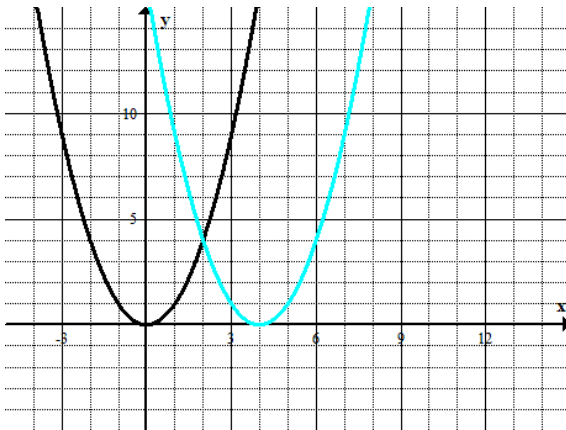
c.  $f(x) = |x|$   
 $g(x) = |x + 3|$   
 $h(x) = |x - 4|$

**Example**

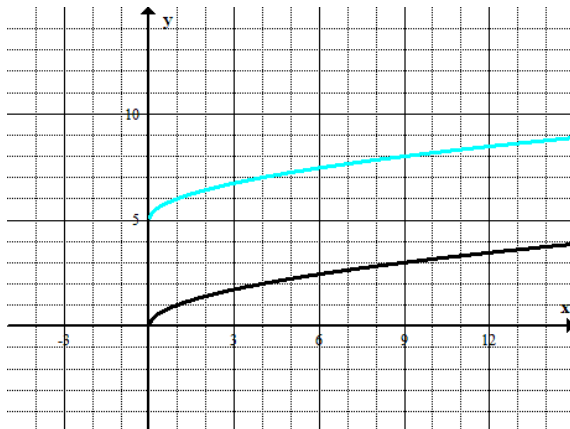
For each graph, answer the following:

- What is the parent function?
- How does the translated graph relate to the graph of the parent function?
- Write the formula for the function depicted by the translated graph.

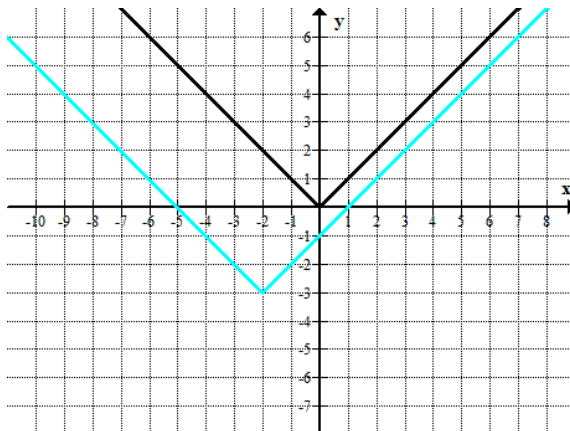
a.



b.

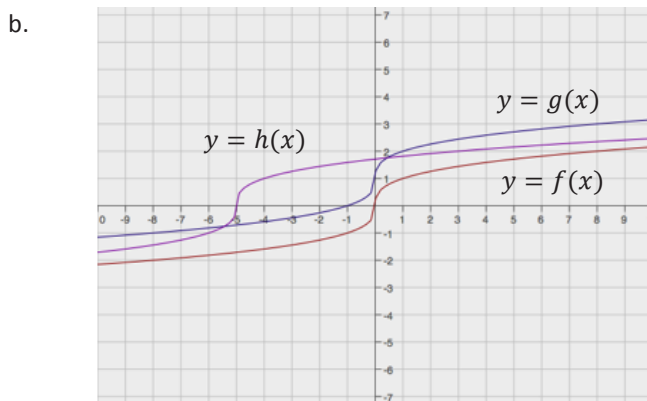
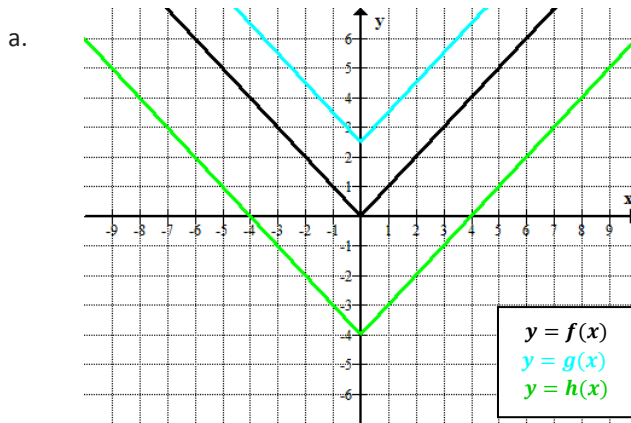


c.



Exercises

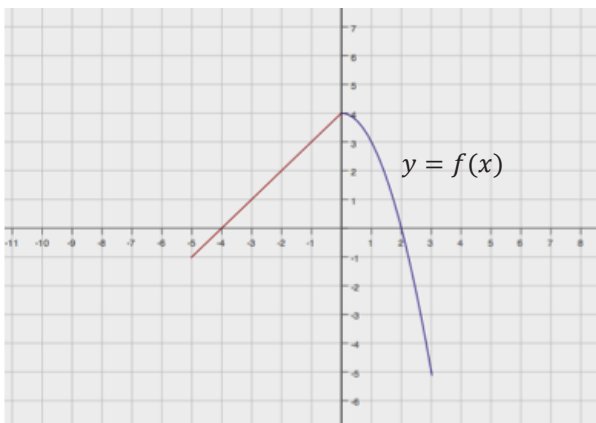
1. For each of the following graphs, use the formula for the parent function  $f$  to write the formula of the translated function.



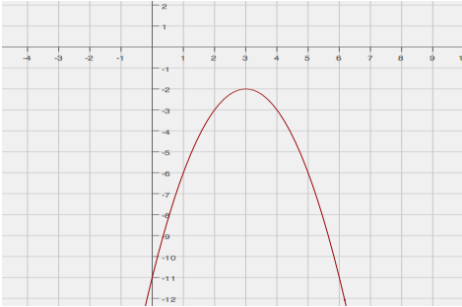
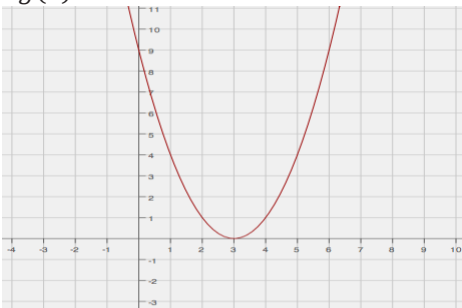
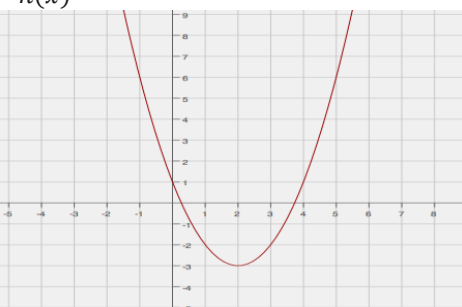
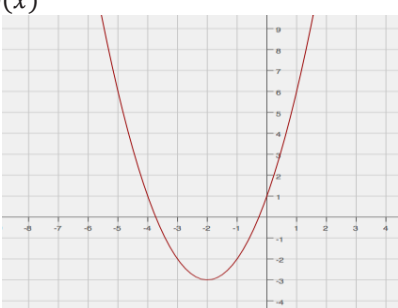
2. Below is a graph of a piecewise function  $f$  whose domain is  $-5 \leq x \leq 3$ . Sketch the graphs of the given functions on the same coordinate plane. Label your graphs correctly.

$$g(x) = f(x) + 3$$

$$h(x) = f(x - 4)$$



3. Match the correct equation and description of the function with the given graphs.

Graphs	Equation	Description
<p><math>y = f(x)</math></p>  <p>Equation _____ Description _____</p>	<p>E1. <math>y = (x - 3)^2</math></p> <p>E2. <math>y = (x + 2)^2 - 3</math></p> <p>E3. <math>y = -(x - 3)^2 - 2</math></p> <p>E4. <math>y = (x - 2)^2 - 3</math></p>	<p>D1. The graph of the parent function is translated down 3 units and left 2 units.</p> <p>D2. The graph of the function does not have an <math>x</math>-intercept.</p> <p>D3. The coordinate of the <math>y</math>-intercept is <math>(0, 1)</math>, and both <math>x</math>-intercepts are positive.</p> <p>D4. The graph of the function has only one <math>x</math>-intercept.</p>
<p><math>y = g(x)</math></p>  <p>Equation _____ Description _____</p>		
<p><math>y = h(x)</math></p>  <p>Equation _____ Description _____</p>		
<p><math>y = p(x)</math></p>  <p>Equation _____ Description _____</p>		

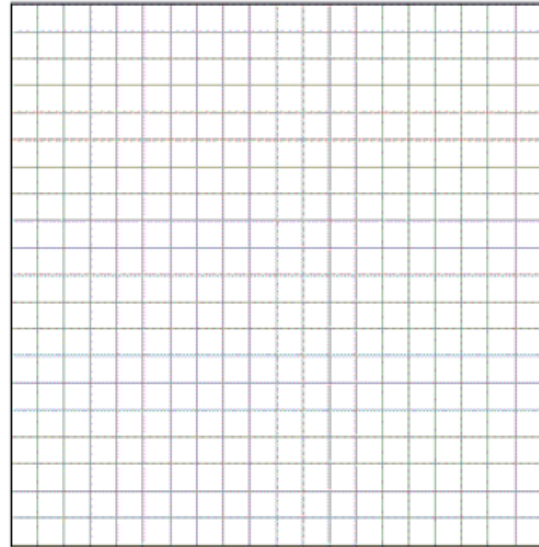
**Problem Set**

- Graph the functions in the same coordinate plane. Do not use a graphing calculator.

$$f(x) = \sqrt{x}$$

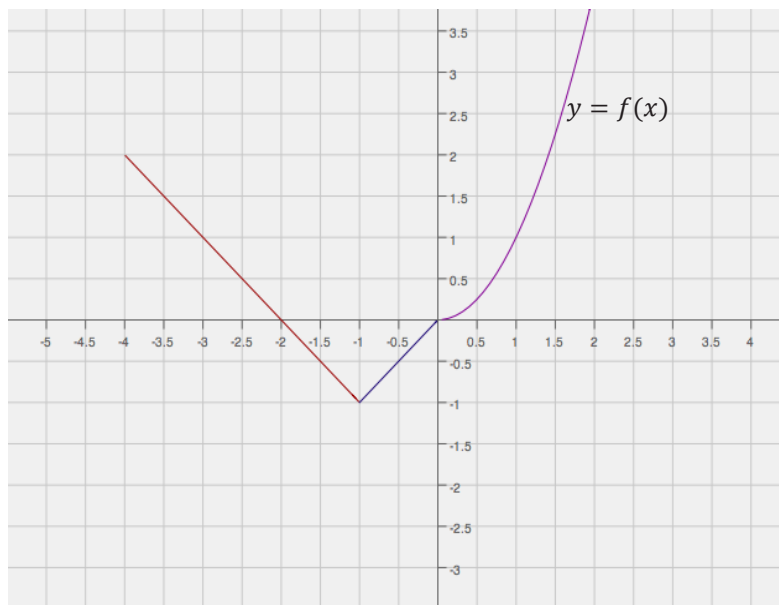
$$p(x) = 10 + \sqrt{x}$$

$$q(x) = \sqrt{x + 8}$$



- Write a function that translates the graph of the parent function  $f(x) = x^2$  down 7.5 units and right 2.5 units.
- How would the graph of  $f(x) = |x|$  be affected if the function were transformed to  $f(x) = |x + 6| + 10$ ?
- Below is a graph of a piecewise function  $f$  whose domain is the interval  $-4 \leq x \leq 2$ . Sketch the graph of the given functions below. Label your graphs correctly.

$$g(x) = f(x) - 1 \quad h(x) = g(x - 2) \text{ [Be careful; this one might be a challenge.]}$$



5. Study the graphs below. Identify the parent function and the transformations of that function depicted by the second graph. Then, write the formula for the transformed function.

