Lesson 19: Translating 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. $f(x) = x^2$
   $g(x) = x^2 + 3$
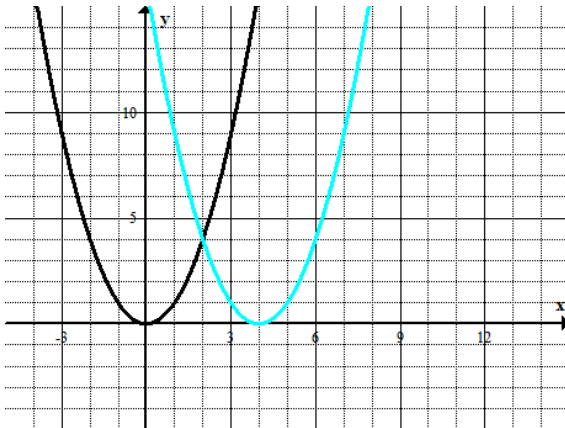 $h(x) = x^2 - 7$

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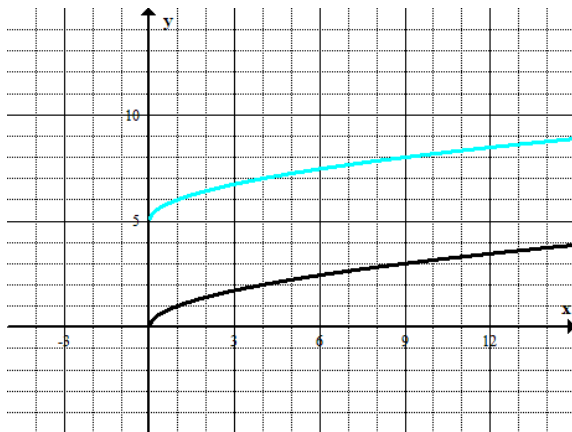 $g(x) = |x + 3|$
   $h(x) = |x - 4|$

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.
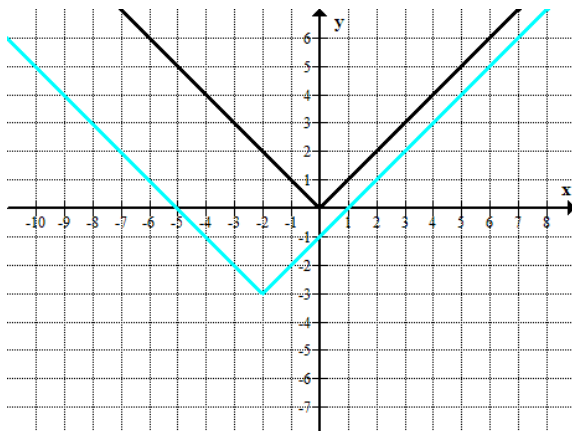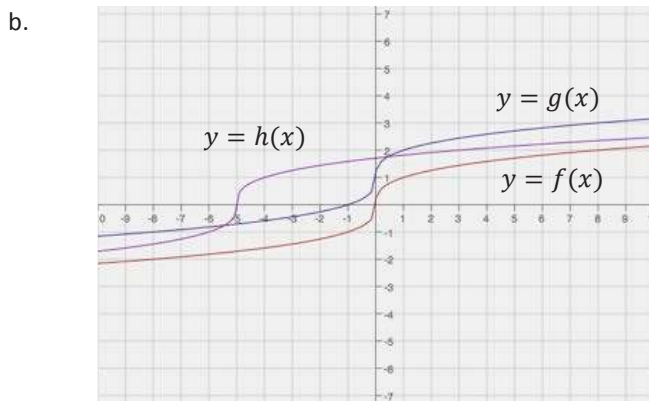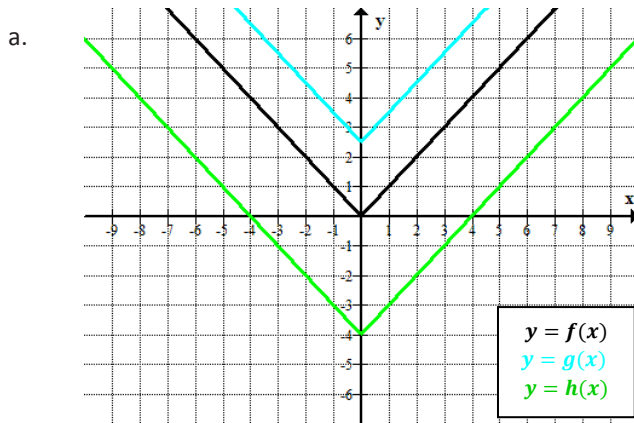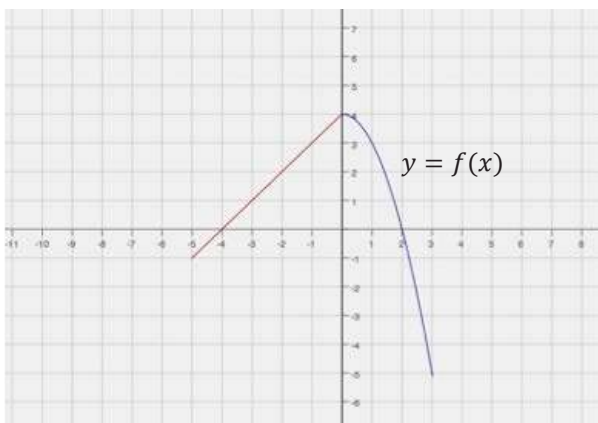
a.

b.

c.

Exercises 1–3

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

a.

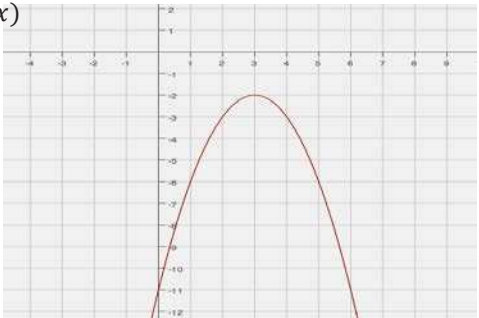| $y = f(x)$ |
| $y = g(x)$ |
| $y = h(x)$ |

b.

$y = g(x)$
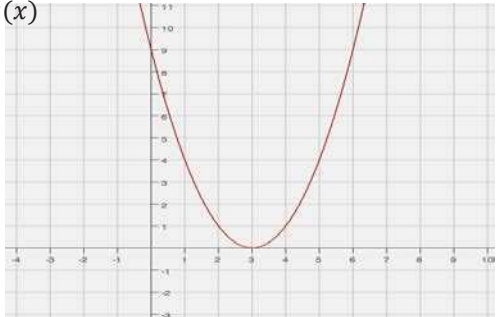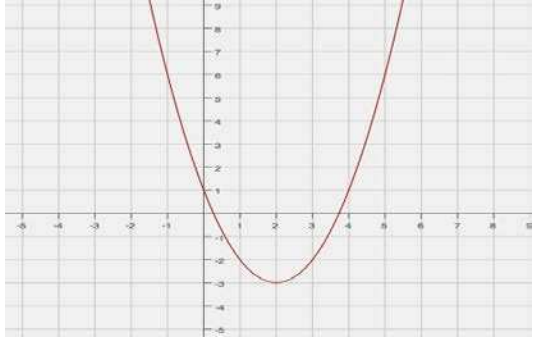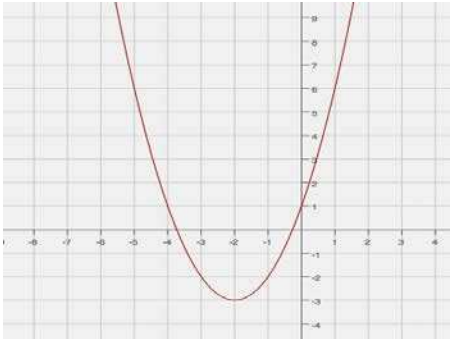
$y = h(x)$

$y = f(x)$

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.

$$g(x) = f(x) + 3 \qquad\qquad h(x) = f(x - 4)$$

$y = f(x)$

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

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

Problem Set

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

    $f(x) = \sqrt{x}$
    $p(x) = 10 + \sqrt{x}$
    $q(x) = \sqrt{x + 8}$
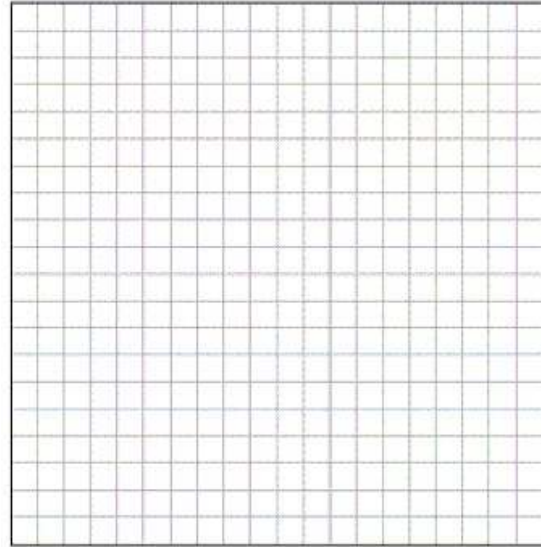
2. Write a function that translates the graph of the parent function $f(x) = x^2$ down 7.5 units and right 2.5 units.

3. How would the graph of $f(x) = |x|$ be affected if the function were transformed to $f(x) = |x + 6| + 10$?

4. Below is a graph of a piecewise function f whose domain is the interval $-4 \le x \le 2$. Sketch the graph of the given functions below. Label your graphs correctly.

    $g(x) = f(x) - 1$ $h(x) = g(x - 2)$ (Be careful, this one might be a challenge.)

$y = f(x)$
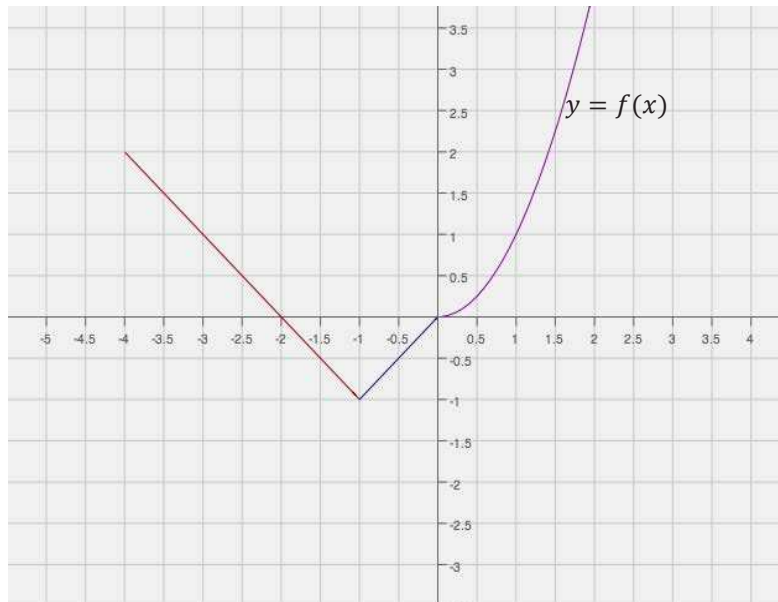
5. Study the graphs below. Identify the parent function and the transformations of that function depicted by the second graph. Then, write the formula for the transformed function.