

## REFLECTING PARABOLAS

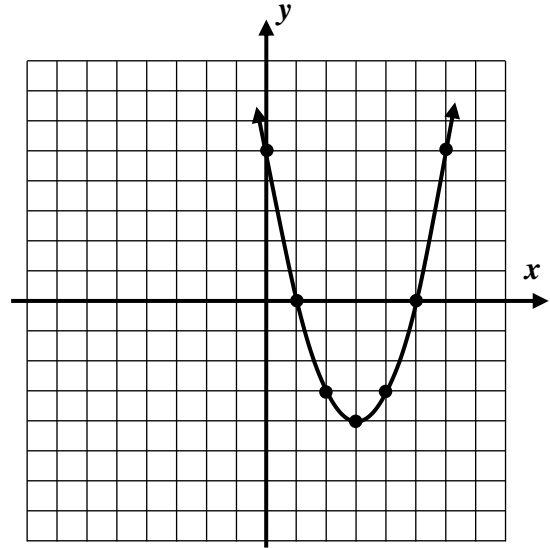
### ALGEBRA 2 WITH TRIGONOMETRY

Reflecting functions in across the  $x$  and  $y$  axes is an important mathematical process that will be explored in this lesson specifically for parabolas. The first exercise gets at both of these important transformations.

**Exercise #1:** The parabola  $f(x) = x^2 - 6x + 5$  is shown on the grid below.

(a) Consider the function  $g(x) = -f(x)$ . Determine a formula for  $g(x)$  and graph it on the grid below.

(b) How was the graph of  $f$  transformed to produce the graph of  $g$ ?



(c) Now consider the function  $h(x) = f(-x)$ . Determine a formula for  $h(x)$  and graph it on the grid above.

(d) How was the graph of  $f$  transformed to produce the graph of  $h$ ?

### REFLECTING FUNCTIONS IN THE $x$ AND $y$ AXES

The function  $-f(x)$  is a reflection of  $f(x)$  in the  $x$ -axis.

The function  $f(-x)$  is a reflection of  $f(x)$  in the  $y$ -axis.

**Exercise #2:** Determine an equation for the linear function  $g(x) = 5x - 7$  both after a reflection in the  $x$ -axis and  $y$ -axis. Label your equations.



**Exercise #3:** If a parabola has the equation  $f(x) = 2x^2 - 3x + 8$ , which of the following represents its equation after a reflection in the  $x$ -axis?

(1)  $y = 2x^2 + 3x + 8$       (3)  $y = -2x^2 + 3x + 8$

(2)  $y = -2x^2 + 3x - 8$       (4)  $y = 2x^2 - 3x - 8$

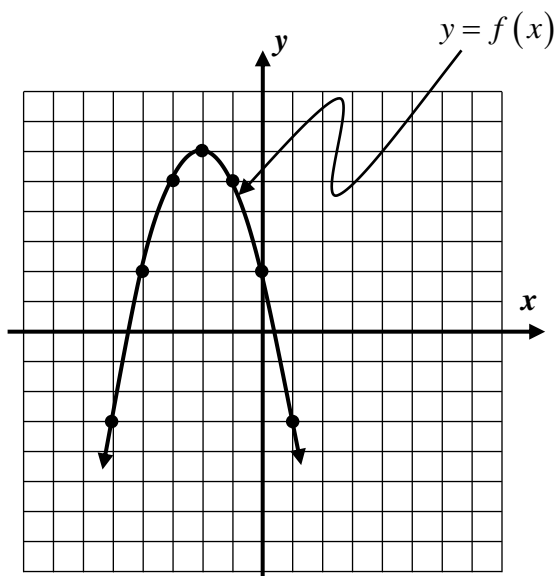
**Exercise #4:** After a reflection in the  $y$ -axis, the quadratic function  $g(x) = 4x^2 - 7x + 2$  would have the equation

(1)  $y = -4x^2 + 7x + 2$       (3)  $y = 4x^2 + 7x + 2$

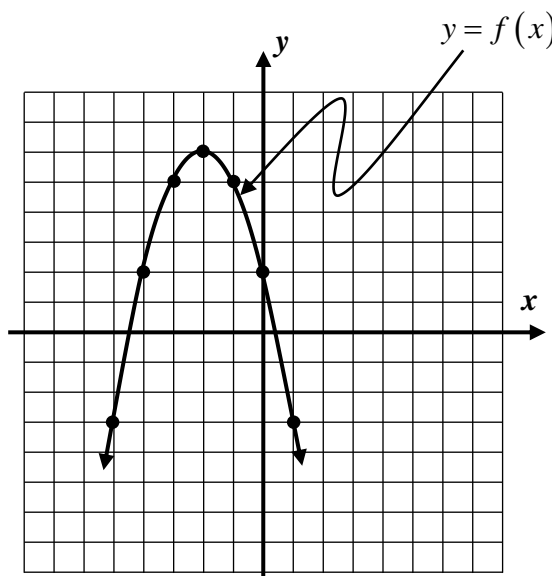
(2)  $y = -4x^2 + 7x - 2$       (4)  $y = 4x^2 + 7x - 2$

**Exercise #5:** Consider the function  $g(x) = -x^2 + 4$ . What two transformations have occurred to the graph of  $y = x^2$  to produce the graph of  $g$ ? Specify the transformations and the order in which they occurred. Note that there exists more than one correct answer. Graph on your calculator to verify.

**Exercise #5:** The graph of a function  $f(x)$  is shown below on two grids. Sketch (a) the graph of  $-f(x)$  and (b) the graph of  $f(-x)$ .



(a) Graph and label  $-f(x)$ .



(b) Graph and label  $f(-x)$ .



**REFLECTING PARABOLAS**  
**ALGEBRA 2 WITH TRIGONOMETRY - HOMEWORK**

**SKILLS**

1. Which of the following equations would represent the graph of the parabola  $y = 3x^2 - 4x - 1$  after a reflection in the  $x$ -axis?

(1)  $y = -3x^2 - 4x - 1$                       (3)  $y = 3x^2 + 4x - 1$

(2)  $y = -3x^2 + 4x - 1$                       (4)  $y = -3x^2 + 4x + 1$                       \_\_\_\_\_

2. The graph of  $y = 10 - x^2$  represents the graph of  $y = x^2$  after

- (1) a vertical shift of 10 units followed by a reflection in the  $x$ -axis.  
 (2) a reflection in the  $x$ -axis followed by a vertical shift of 10 units.  
 (3) a leftward shift of 10 units followed by a reflection in the  $y$ -axis.  
 (4) a reflection across the  $x$ -axis followed by a rightward shift of 10 units.                      \_\_\_\_\_

3. If  $f(x) = -2x^2 + 5x - 3$  and  $g(x)$  is the reflection of  $f(x)$  across the  $y$ -axis, then an equation of  $g$  is which of the following?

(1)  $g(x) = -2x^2 - 5x - 3$                       (3)  $g(x) = 2x^2 + 5x - 3$

(2)  $g(x) = -2x^2 + 5x + 3$                       (4)  $g(x) = 2x^2 + 5x + 3$                       \_\_\_\_\_

4. If the point  $(-3, -5)$  lies on the graph of a function  $h(x)$  then which of the following points *must* lie on the graph of the function  $-h(x)$ ?

(1)  $(3, 5)$     (3)  $(-5, -3)$

(2)  $(-3, 5)$     (4)  $(3, -5)$     \_\_\_\_\_

5. If the function  $y = -f(x - 4)$  were graphed, it would represent which of the following transformations to the graph of  $y = f(x)$ ?

- (1) A rightward shift of 4 units followed by a reflection in the  $x$ -axis.  
 (2) A rightward shift of 4 units followed by a reflection in the  $y$ -axis.  
 (3) A downward shift of 4 units followed by a reflection in the  $x$ -axis.  
 (4) A leftward shift of 4 units followed by a reflection in the  $y$ -axis.                      \_\_\_\_\_



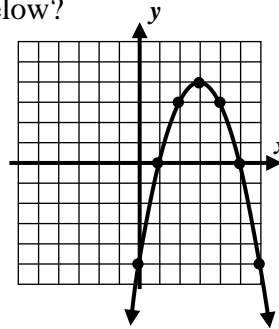
6. After a reflection in the  $x$ -axis, the parabola  $y = x^2 - 4$  would have the equation

- (1)  $y = x^2 + 4$                       (3)  $y = 4 - x^2$   
 (2)  $y = -x^2 - 4$                     (4)  $y = x^2 - 8$

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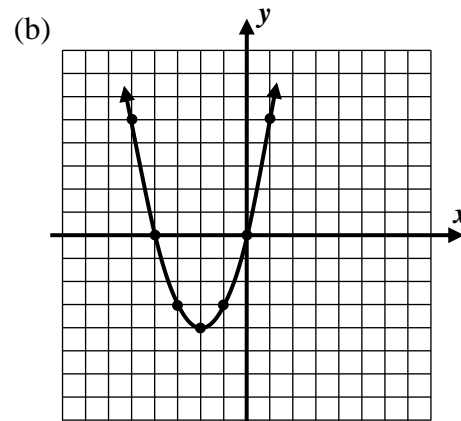
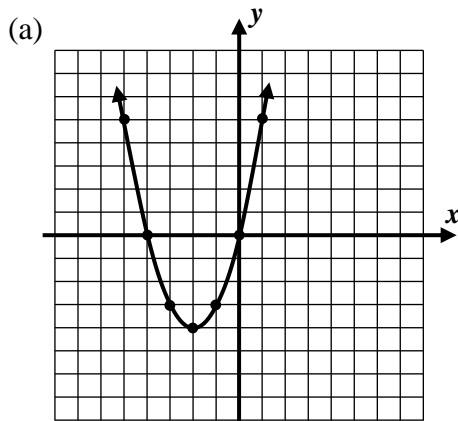
7. Which of the following equations represents the graph shown below?

- (1)  $y = (x+3)^2 + 4$                       (3)  $y = -(x-3)^2 + 4$   
 (2)  $y = -(x+3)^2 + 4$                     (4)  $y = (-x-3)^2 - 4$



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8. The graph of  $f(x) = x^2 + 4x$  is show below on two separate grids. Give an equation and sketch a graph for the functions (a)  $f(-x)$  and (b)  $-f(x)$ .



**REASONING**

9. How would the graph of the function  $h(x)$  compare to the graph of  $f(x)$  if  $h$  is defined by the formula  $h(x) = -f(-x)$ . Explain your reasoning.

