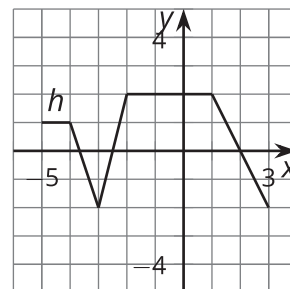
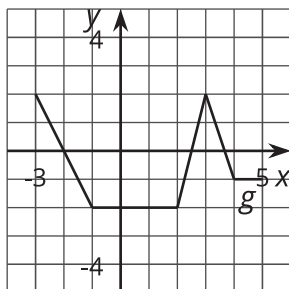
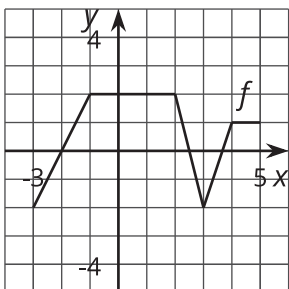


# Reflecting Functions

Let's reflect some graphs.

## 4.1 Notice and Wonder: Reflections

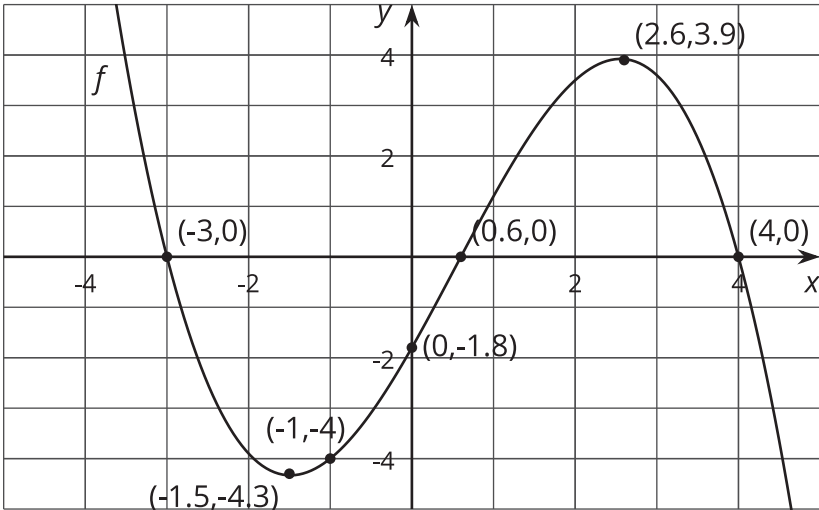
What do you notice? What do you wonder?



4.2

Reflecting Across

Here is the graph of function  $f$  and a table of values.



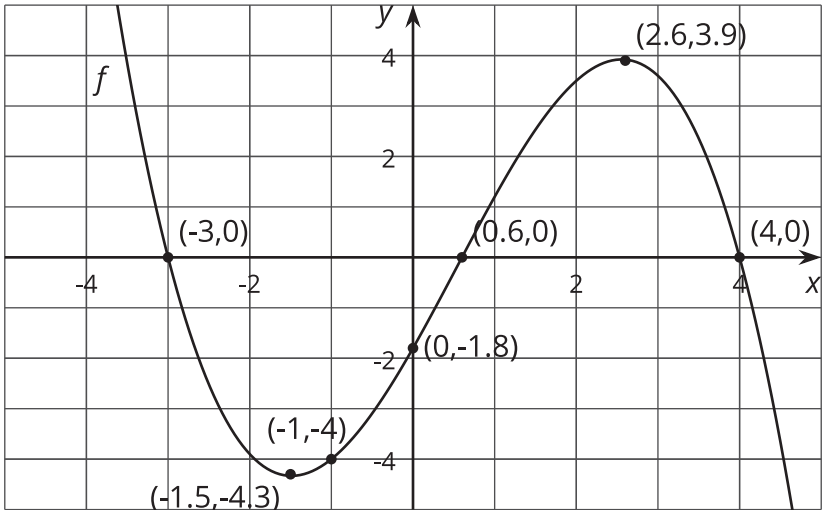
$x$	$f(x)$	$g(x) = -f(x)$
-3	0	
-1.5	-4.3	
-1	-4	
0	-1.8	
0.6	0	
2.6	3.9	
4	0	

- 1. Let  $g$  be the function defined by  $g(x) = -f(x)$ . Complete the table.
- 2. Sketch the graph of  $g$  on the same axes as the graph of  $f$  but in a different color.
- 3. Describe how to transform the graph of  $f$  into the graph of  $g$ . Explain how the equation produces this transformation.

4.3

Reflecting Across a Different Way

Here is another copy of the graph of  $f$  from the earlier activity. This time, let  $h$  be the function defined by  $h(x) = f(-x)$ .



- 1. Use the definition of  $h$  to find  $h(0)$ . Does your answer agree with your prediction?
- 2. What does your prediction tell you about  $h(-0.6)$ ? Does your answer agree with the definition of  $h$ ?

3. Complete the tables. The values for  $x$  will not be the same for the two tables.

$x$	$f(x)$
-3	0
-1.5	-4.3
-1	-4
0	-1.8
0.6	0
2.6	3.9
4	0

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



4. Sketch the graph of  $h$  on the same axes as the graph of  $f$  but in a different color.
5. Describe what happened to the graph of  $f$  to transform it into the graph of  $h$ . Explain how the equation produces this transformation.



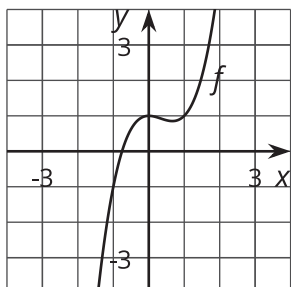
### Are you ready for more?

1. Describe how the graph of  $h$  relates to the graph of  $g$  defined in the earlier activity.
2. Write an equation relating  $h$  and  $g$ .

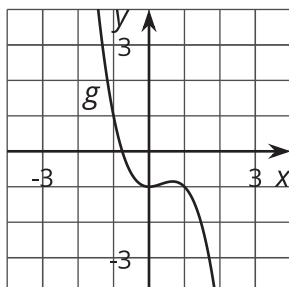
## Lesson 4 Summary

Here are graphs of the functions  $f$ ,  $g$ , and  $h$ , where  $g(x) = -f(x)$  and  $h(x) = f(-x)$ . How do these equations match the transformation we see from  $f$  to  $g$  and from  $f$  to  $h$ ?

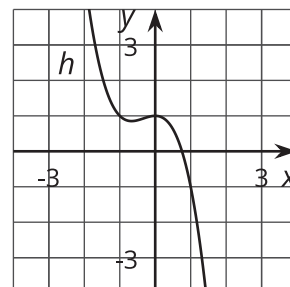
$f(x)$



$g(x) = -f(x)$



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



Considering first the equation  $g(x) = -f(x)$ , we know that for the same input  $x$ , the value of  $g(x)$  will be the opposite of the value of  $f(x)$ . For example, since  $f(0) = 1$ , we know that  $g(0) = -f(0) = -1$ . We can see this relationship in the graphs where  $g$  is the reflection of  $f$  across the  $x$ -axis.

Looking at  $h(x) = f(-x)$ , this equation tells us that the two functions have the same output for opposite inputs. For example, 1 and -1 are opposites, so  $h(1) = f(-1)$  (and  $h(-1) = f(1)$  is also true!). We can see this relationship in the graphs where  $h$  is the reflection of  $f$  across the  $y$ -axis.