

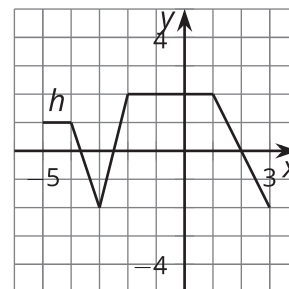
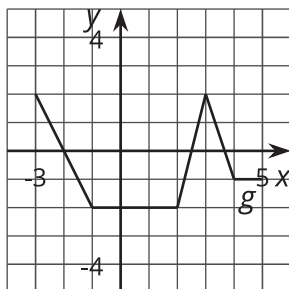
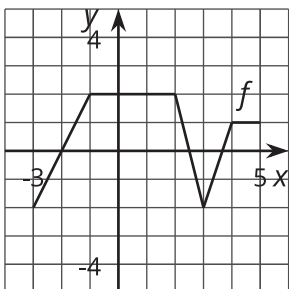


# Reflecting Functions

Let's reflect some graphs.

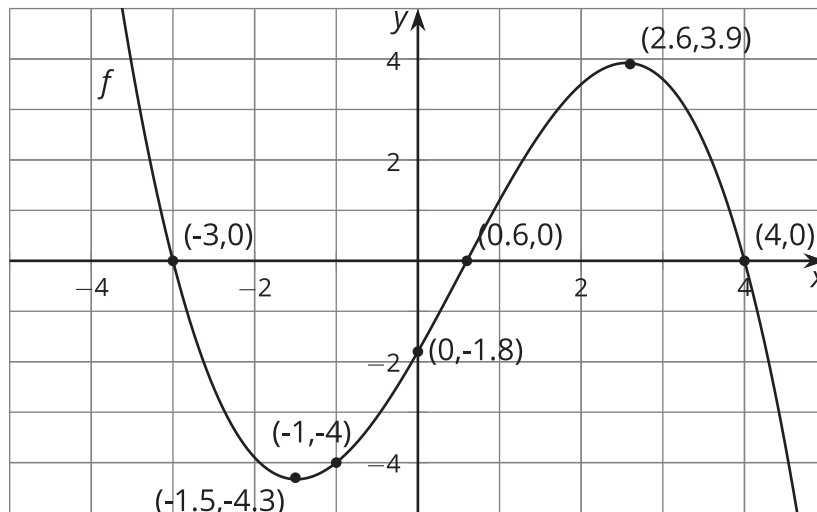
## 4.1 Notice and Wonder: Reflections

What do you notice? What do you wonder?



## 4.2 Reflecting Across

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



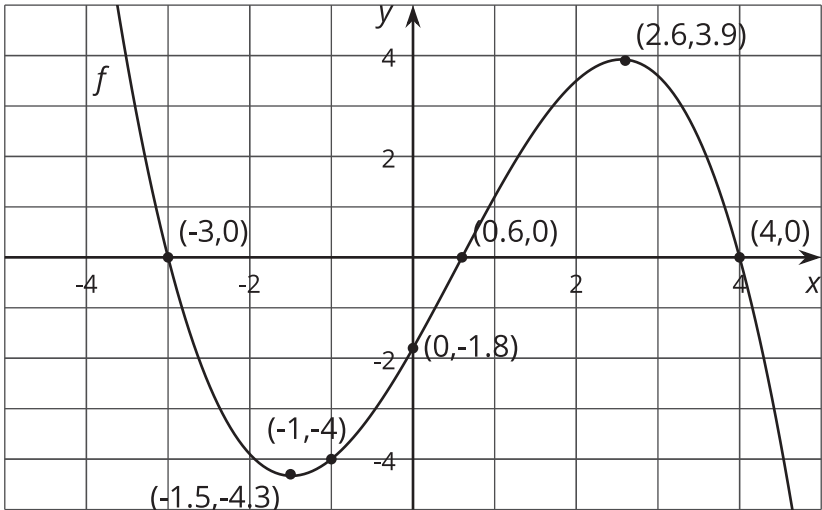
| $x$  | $f(x)$ | $g(x) = -f(x)$ |
|------|--------|----------------|
| -3   | 0      |                |
| -1.5 | -4.3   |                |
| -1   | -4     |                |
| 0    | -1.8   |                |
| 0.6  | 0      |                |
| 2.6  | 3.9    |                |
| 4    | 0      |   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

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.



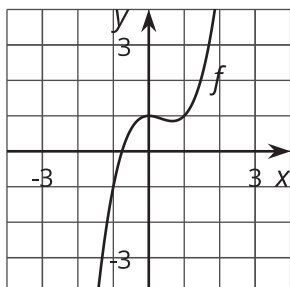
### Are you ready for more?

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  $g$ .

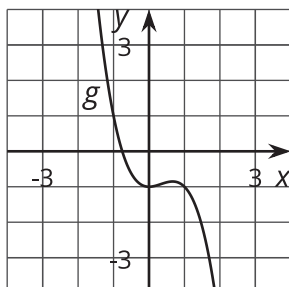
## Lesson 4 Summary

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  $h$ ?

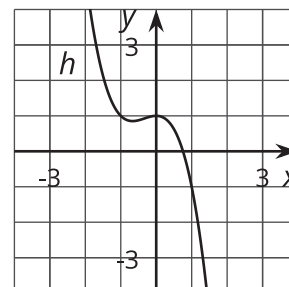
$f(x)$



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



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



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.