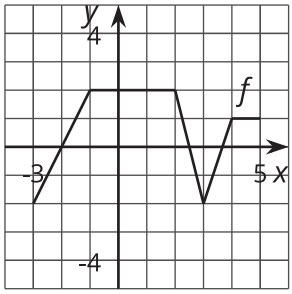
Unit 5, Lesson 4

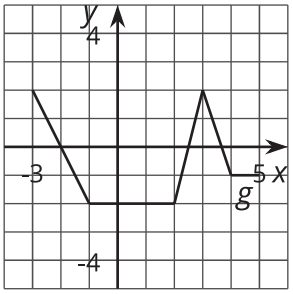
# Reflecting Functions

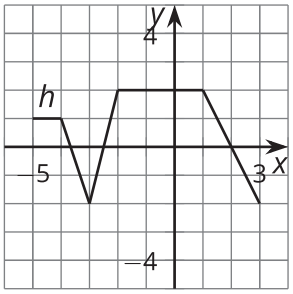
Let's reflect some graphs.

## 4.1 Notice and Wonder: Reflections

What do you notice? What do you wonder?

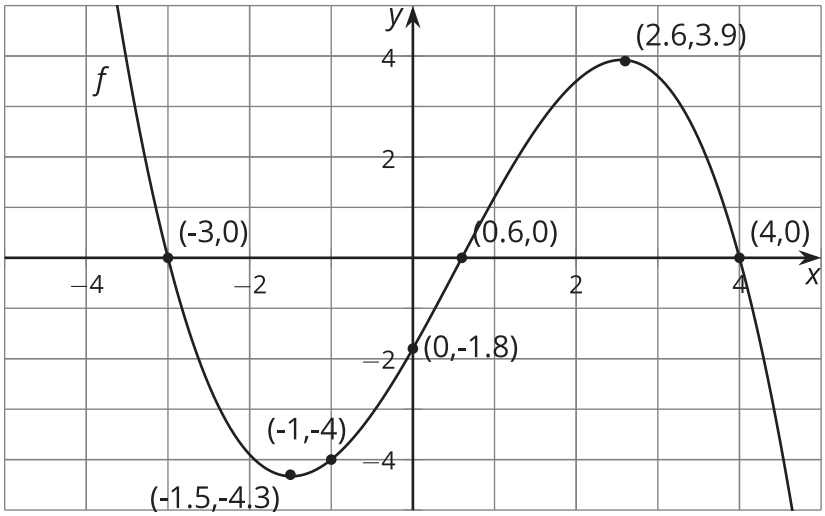


# 4.2 Reflecting Across

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

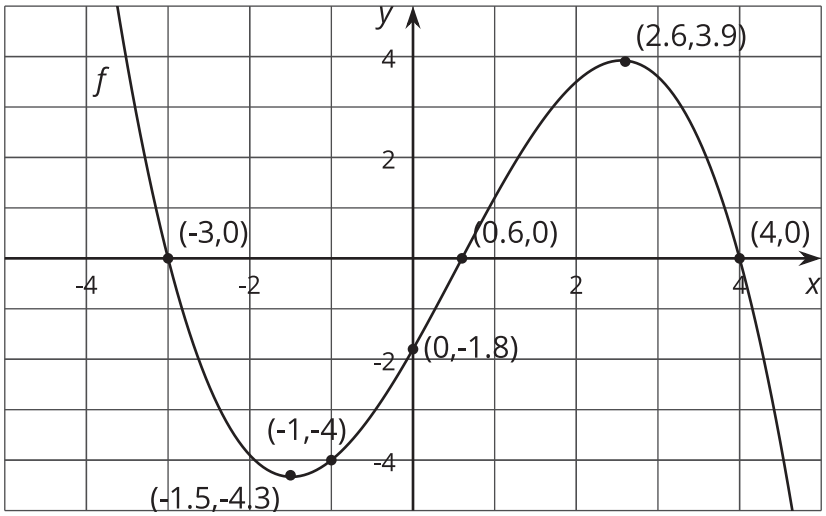



| $x$ | $f(x)$ | $g(x) = -f(x)$ |
|---|---|---|
| -3 | 0 | |
| -1.5 | -4.3 | |
| -1 | -4 | |
| 0 | -1.8 | |
| 0.6 | 0 | |
| 2.6 | 3.9 | |
| 4 | 0 | |

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 $h(x) = f(\text{-}x)$.




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 $h(\text{-}0.6)$? 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 |

| $x$ | $h(x) = f(\text{-}x)$ |
|---|---|
| | |
| | |
| | |
| | |
| | |
| | |
| | |

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?

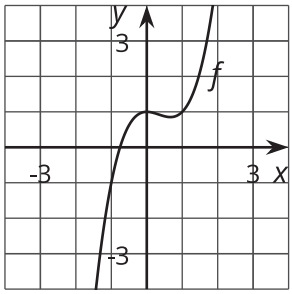
1. Describe how the graph of $h$ relates to the graph of $g$ defined in the earlier activity.

2. Write an equation relating $h$ and $g$.

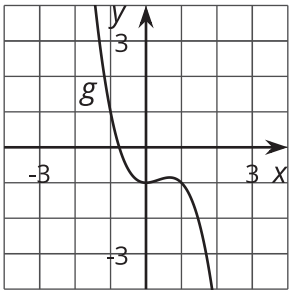
## Lesson 4 Summary

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 $h$?

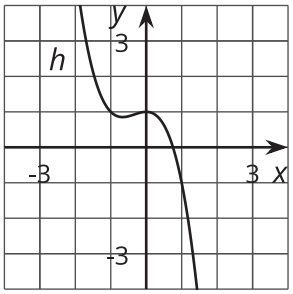
$f(x)$




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




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




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.