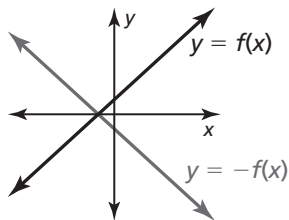## 1.2 Notetaking with Vocabulary (continued)
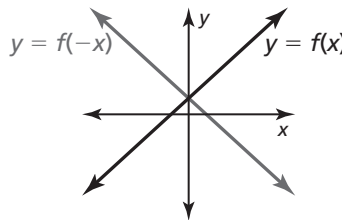
Reflections in the *x*-axis

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

Multiplying the **outputs** by −1 changes their signs.

Reflections in the *y*-axis

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


Multiplying the **inputs** by −1 changes their signs.

Notes:

Horizontal Stretches and Shrinks

The graph of $y = f(ax)$ is a horizontal stretch or shrink by a factor of $\dfrac{1}{a}$ of the graph of $y = f(x)$, where $a > 0$ and $a \neq 1$.

Multiplying the **inputs** by a before evaluating the function stretches the graph horizontally (away from the *y*-axis) when $0 < a < 1$, and shrinks the graph horizontally (toward the *y*-axis) when $a > 1$.
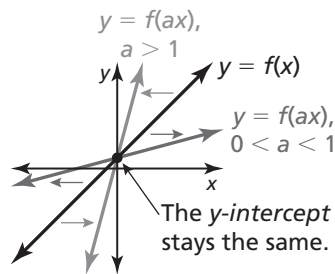
Notes:

1.2 Notetaking with Vocabulary (continued)

Vertical Stretches and Shrinks

The graph of $y = a \bullet f(x)$ is a vertical stretch or shrink by a factor of a of the graph of $y = f(x)$, where $a > 0$ and $a \neq 1$.

Multiplying the **outputs** by a stretches the graph vertically (away from the x-axis) when $a > 1$, and shrinks the graph vertically (toward the x-axis) when $0 < a < 1$.

y = a · f(x), a > 1
y = f(x)
y = a · f(x), 0 < a < 1
The x-intercept stays the same.
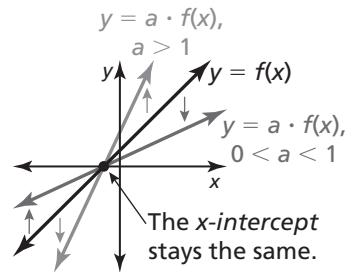
Notes:

Extra Practice

In Exercises 1–9, write a function *g* whose graph represents the indicated transformation of the graph of *f*. Use a graphing calculator to check your answer.

1. $f(x) = \left|\frac{1}{3}x\right|$; translation 2 units to the left

2. $f(x) = -|x + 9| - 1$; translation 6 units down

3. $f(x) = -2x + 2$; translation 7 units down