

Chapter 1
Linear Functions

Section 1-2
Transformations of Linear and Absolute Value Functions

Communicate Your Answer

4. How do the graphs of $y = f(x) + k$, $y = f(x - h)$, and $y = -f(x)$ compare to the graph of the parent function f ?
5. Compare the graph of each function to the graph of its parent function f . Use a graphing calculator to verify your answers are correct.
- | | | |
|-----------------------|-----------------------|--------------------|
| a. $y = \sqrt{x} - 4$ | b. $y = \sqrt{x + 4}$ | c. $y = -\sqrt{x}$ |
| d. $y = x^2 + 1$ | e. $y = (x - 1)^2$ | f. $y = -x^2$ |

EXAMPLE 1 Writing Translations of Functions

Let $f(x) = 2x + 1$.

- a. Write a function g whose graph is a translation 3 units down of the graph of f .
- b. Write a function h whose graph is a translation 2 units to the left of the graph of f .

EXAMPLE 2 Writing Reflections of Functions

Let $f(x) = |x + 3| + 1$.

- a. Write a function g whose graph is a reflection in the x -axis of the graph of f .
- b. Write a function h whose graph is a reflection in the y -axis of the graph of f .

Write a function g whose graph represents the indicated transformation of the graph of f . Use a graphing calculator to check your answer.

- ▶ 1. $f(x) = 3x$; translation 5 units up
- ▶ 2. $f(x) = |x| - 3$; translation 4 units to the right
- ▶ 3. $f(x) = -|x + 2| - 1$; reflection in the x -axis
- ▶ 4. $f(x) = \frac{1}{2}x + 1$; reflection in the y -axis

EXAMPLE 3 Writing Stretches and Shrinks of Functions

Let $f(x) = |x - 3| - 5$. Write (a) a function g whose graph is a horizontal shrink of the graph of f by a factor of $\frac{1}{3}$, and (b) a function h whose graph is a vertical stretch of the graph of f by a factor of 2.

Write a function g whose graph represents the indicated transformation of the graph of f . Use a graphing calculator to check your answer.

- ▶ 5. $f(x) = 4x + 2$; horizontal stretch by a factor of 2
- ▶ 6. $f(x) = |x| - 3$; vertical shrink by a factor of $\frac{1}{3}$

EXAMPLE 4 Combining Transformations

Let the graph of g be a vertical shrink by a factor of 0.25 followed by a translation 3 units up of the graph of $f(x) = x$. Write a rule for g .

- ▶ 7. Let the graph of g be a translation 6 units down followed by a reflection in the x -axis of the graph of $f(x) = |x|$. Write a rule for g . Use a graphing calculator to check your answer.