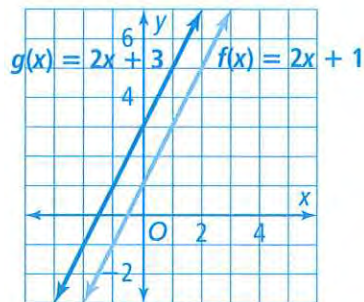


3-3

Transforming
Linear Functions

CRITIQUE & EXPLAIN

Avery states that the graph of g is the same as the graph of f with every point shifted vertically. Cindy states that the graph of g is the same as the graph of f with every point shifted horizontally.



- A. Give an argument to support Avery's statement.
- B. Give an argument to support Cindy's statement.
- C. **Look for Relationships** What do you know about linear equations that might support either of their statements? © MP.7

HABITS OF MIND

Generalize Would the same arguments apply to the equations of other pairs of parallel lines? © MP.8

**EXAMPLE 1** **Try It!** Vertical Translations of Linear Functions

1. Let $f(x) = -4x$.
 - a. How does the graph of $g(x) = -4x - 3$ compare with the graph of f ?

- b. How does the graph of $g(x) = -4x + 1.5$ compare with the graph of f ?

EXAMPLE 2 **Try It!** Horizontal Translations of Linear Functions

2. Let $f(x) = 3x + 7$.
 - a. How does the graph of $g(x) = 3(x - 4) + 7$ compare with the graph of f ?

- b. How does the graph of $g(x) = 3(x + 9.5) + 7$ compare with the graph of f ?

HABITS OF MIND

Use Appropriate Tools How does looking at a table of values help you understand translations? © MP5



Try It! Stretches and Compressions of Linear Functions

3. Let $f(x) = x - 2$.

a. How does the graph of $g(x) = 0.25(x - 2)$ compare with the graph of f ?

b. How does the graph of $g(x) = 0.5x - 2$ compare with the graph of f ?

HABITS OF MIND

Reason How does the relationship between the elements of the domain and the elements of the range relate to transformations of the function? Explain. © MP.2

Do You UNDERSTAND?

1. **ESSENTIAL QUESTION** How does modifying the input or the output of a linear function rule transform its graph?

2. **Vocabulary** Why is the addition or subtraction of k to the output of a function considered a *translation*?

3. **Error Analysis** The addition or subtraction of a number to a linear a function always moves the line up or down. Describe the error with this reasoning. © MP.3

4. **Use Structure** Why does multiplying the input of a linear function change only the slope while multiplying the output changes both the slope and the y -intercept? © MP.7

Do You KNOW HOW?

Given $f(x) = 4x + 1$, describe how the graph of g compares with the graph of f .

5. $g(x) = 4(x + 3) + 1$

6. $g(x) = (4x + 1) + 3$

Given $f(x) = x + 2$, setting $k = 4$ affects the slope and y -intercept of the graph of g compared to the graph of f .

7. $g(x) = 4(x + 2)$

8. $g(x) = (4x) + 2$

9. The minimum wage for employees of a company is modeled by the function $f(x) = 7.25$. The company decided to offer a signing bonus of \$75. How does adding this amount affect a graph of an employee's earnings?