

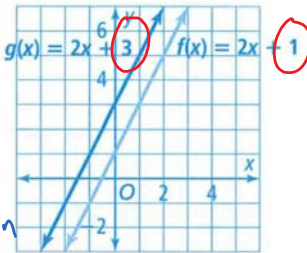
TRANSFORMATIONS

Vertical translation

$y = mx + b$
 $y = 2x + 0$ (y-int)

CRITIQUE & EXPLAIN

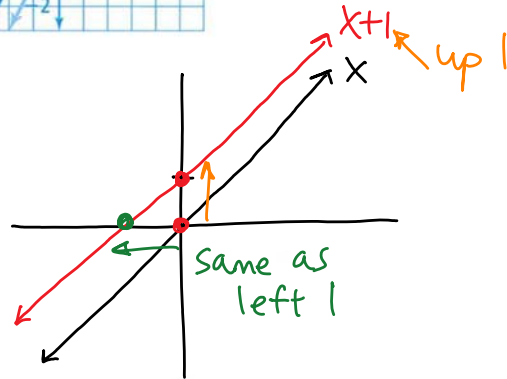
Avery states that the graph of g is the same as the graph of f with every point shifted vertically. Cindy states that the graph of g is the same as the graph of f with every point shifted horizontally.



Shift up/down

3-3 Transforming Linear Functions
PearsonRealize.com

A. Give an argument to support Avery's statement.



B. Give an argument to support Cindy's statement.

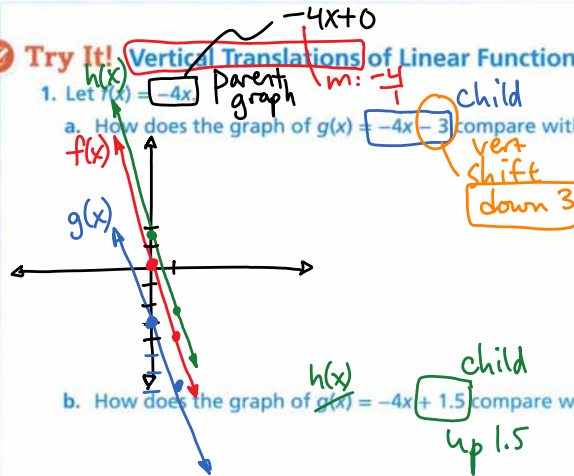
C. Look for Relationships What do you know about linear equations that might support either of their statements? MP.7

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

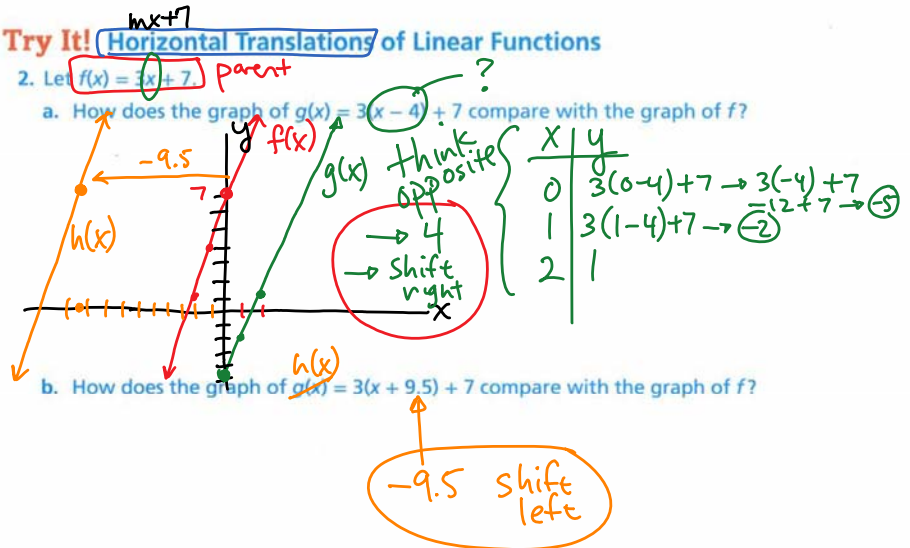
1. Let $f(x) = -4x$.
 a. How does the graph of $g(x) = -4x - 3$ compare with the graph of f ?



- b. How does the graph of $h(x) = -4x + 1.5$ 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 $h(x) = 3(x + 9.5) + 7$ compare with the graph of f ?

HABITS OF MIND

Use Appropriate Tools How does looking at a table of values help you understand translations? **MP.5**

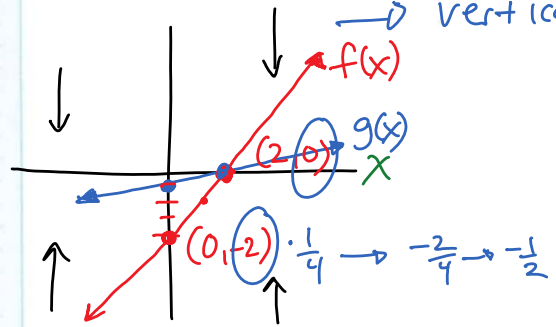
$y = a(bx - h) + k$
 ↑ Vert stretch/compression/reflection
 ← left/right
 ↕ up/down
 aka shrink
 ↑ $a < 0$ neg

Try It! Stretches and Compressions of Linear Functions

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

$a: 0.25 \rightarrow \frac{1}{4}$ 25%

→ vertical shrink



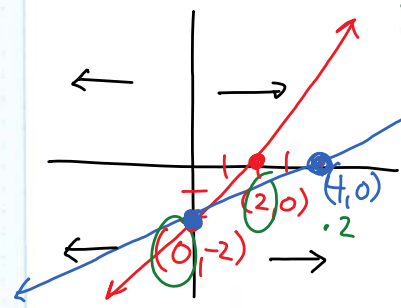
b. How does the graph of $g(x) = 0.5x - 2$ compare with the graph of f ?

affecting x:

$b: \frac{1}{2}$

$\begin{bmatrix} 2 \\ 1 \end{bmatrix}$ horizontal stretch

$a(bx - h) + k$



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

vertex form $y = a(x-h) + k$

↑ left/right ↑ up/down



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? parent

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

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

think opposite: -3 ← shift left 3

6. $g(x) = (4x + 1) - 3$ → shift up 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 .

$a(bx-h)+k$

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

$a > 1$
→ vertical stretch by 4

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

$b = \frac{4}{1} \rightarrow \frac{1}{4}$ → horiz shrink/compression by $\frac{1}{4}$

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