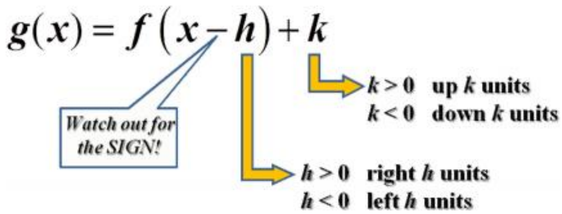
Translations

- When a constant is <u>added</u> or <u>subtracted</u> from a parent function, the result would be a translation horizontally or vertically.
- Let $g(x)$ be the indicated transformation of $f(x)$ at (h, k).



Ex. 1) Let $g(x)$ be the indicated transformation of $f(x)$. Write the rule for $g(x)$.

a) $f(x) = 2x + 3$; vertical translation 4 units up.

Rule:

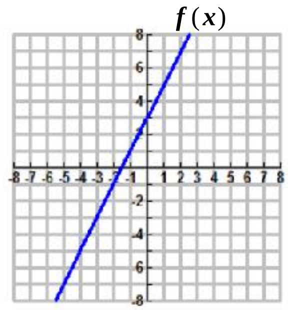
x ì *same*

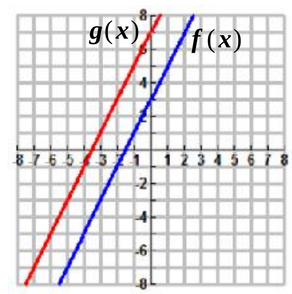
y ì *y* + 4

$g(x) = f(x) + 4$

$g(x) = (2x + 3) + 4$

$g(x) = 2x + 7$

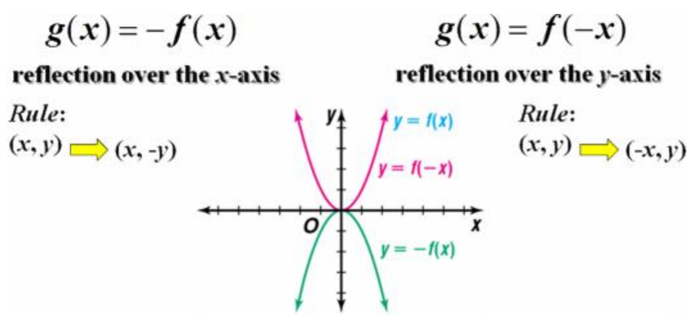




Reflections

- Flips a figure over a line called the *axis* (or *line*) *of symmetry*.
- Let $g(x)$ be the indicated transformation of $f(x)$.

	Reflections over the *x*-axis	Reflections over the *y*-axis
Rule	*x* ì *same*	*x* ì -*x*
	y ì -*y*	*y* ì *same*
As a point	(*x*, -*y*)	(-*x*, *y*)



Ex. 2) Let $g(x)$ be the indicated transformation of $f(x)$. Write the rule for $g(x)$.

x	f(x)
−1	0
0	2
1	4

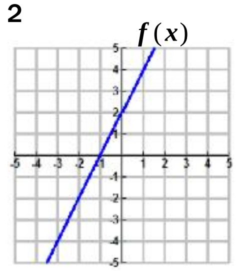
a) linear function defined in the table; reflection across y-axis.

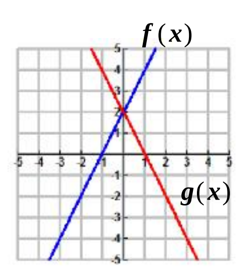
- Find the slope: $m = \dfrac{2-0}{0-(-1)} = 2$
- Find the equation in slope-intercept form. Using (0, 2), $b = 2$

  $f(x) = 2x + 2$
- Write the rule for $g(x)$. Reflecting $f(x)$ across the y-axis replaces each x with $-x$.

  $g(x) = 2(-x) + 2$

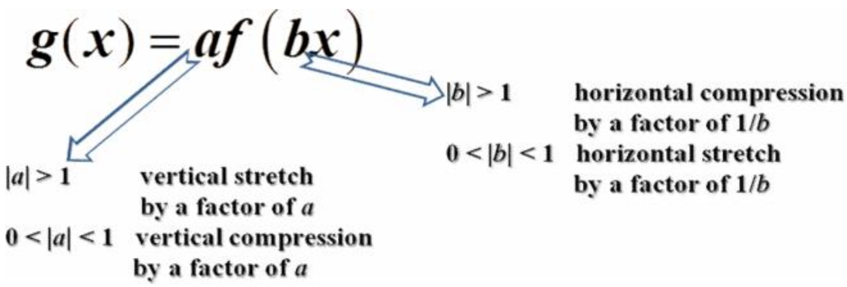
  $g(x) = -2x + 2$





Stretches and Compressions

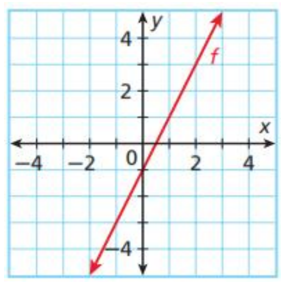
- A transformation that produces an image that is the same shape as the original in which all distances on the coordinate plane are stretch or compressed/shrinked by multiplying either all x-coordinates or all y-coordinates by a factor.
- Let $g(x)$ be the indicated transformation of $f(x)$.

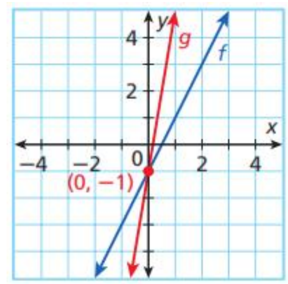


Ex. 3) Let $g(x)$ be a horizontal compression of $f(x) = 2x - 1$ by a factor of $\frac{1}{3}$. Write the rule for $g(x)$, and graph the function .

- Horizontally compressing $f(x)$ by a factor of $\frac{1}{3}$ replaces each x with $\frac{1}{b}(x)$ where $b = \frac{1}{3}$.

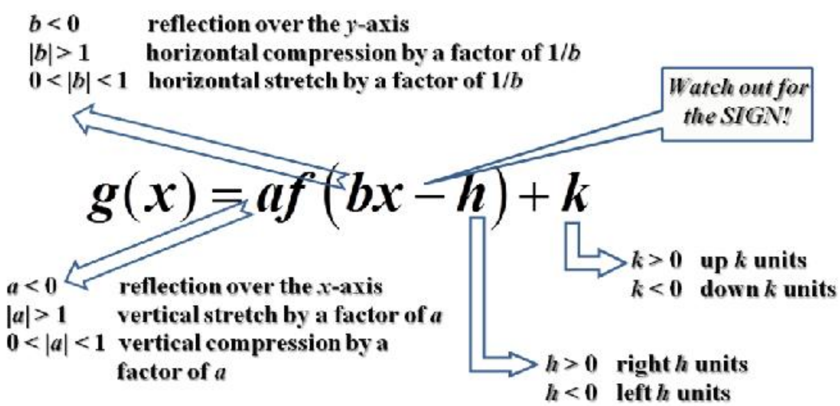
$$g(x) = 2\left(\frac{1}{b}\right)x - 1$$
$$= 2\left(\frac{1}{\frac{1}{3}}\right)x - 1$$
$$= 2(3x) - 1$$
$$g(x) = 6x - 1$$





Summary of Transformations

- Let $g(x)$ be the indicated transformation of $f(x)$ with a and b as factors and translation to (h, k).



Ex. 4) Let $g(x)$ be a vertical shift of $f(x) = x$, down 2 units followed by a vertical stretch by a factor of 5 . Write the rule for $g(x)$.

- Translating $f(x) = x$ down 2 units subtracts 2 from the function.

$$h(x) = f(x) - 2$$
$$h(x) = x - 2$$

- Perform the vertical stretch by a factor of 5

$$g(x) = 5 \cdot h(x)$$
$$g(x) = 5(x - 2)$$
$$g(x) = 5x - 10$$