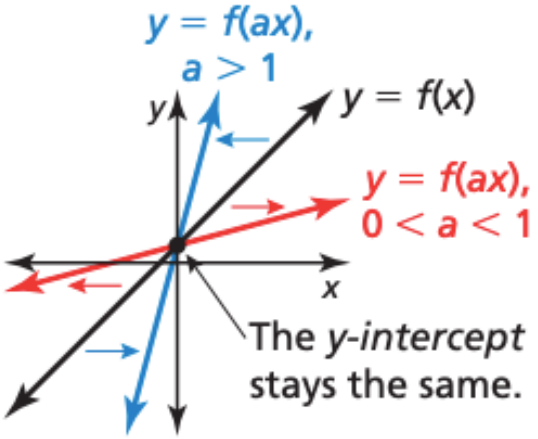
KEY IDEAS

Horizontal Stretches and Shrinks

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

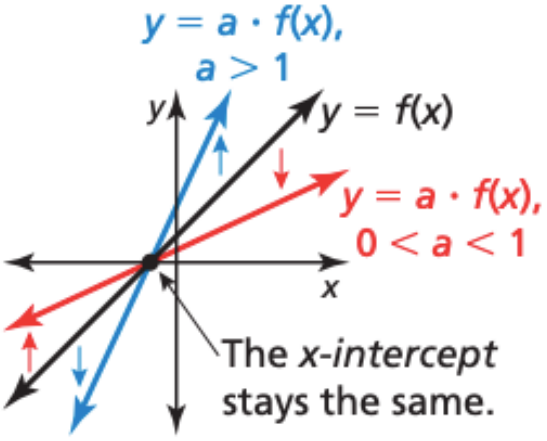
Multiplying the *inputs* by a before evaluating the function stretches the graph horizontally (away from the y-axis) when $0 < a < 1$, and shrinks the graph horizontally (toward the y-axis) when $a > 1$.



Vertical Stretches and Shrinks

The graph of $y = a \cdot f(x)$ 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 $0 < a < 1$.



$f(x) = |x - 3| - 5$; vertical stretch by a factor of 2

$f(x) = |x| - 3$; vertical shrink by a factor of $\frac{1}{3}$

$f(x) = 4x - 2$; vertical shrink by a factor of $\frac{1}{2}$

$f(x) = \frac{1}{3}x + 7$; vertical stretch by a factor of 2

$f(x) = |x - 3| - 5$; horizontal shrink by a factor of $\frac{1}{3}$

$f(x) = |2x| - 6$; horizontal stretch by a factor of 2

$f(x) = 3x + 1$; horizontal shrink by a factor of $\frac{1}{4}$

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.