

3.6 Transforming Linear Functions

Bellwork

1. Simplify: $\frac{(2x^3y^{-2})^4}{32x^8y^{-3}}$

$$\frac{2^4 x^{12} y^{-8}}{32 x^8 y^{-3}} = \frac{16x^{12} y^3}{32x^8 y^8}$$

$$= \frac{x^4}{2y^5}$$

2. Find the slope of the line that passes through (5, -8) and (-1, 4).

$$-6 \left(\begin{array}{r|l} 5 & -8 \\ -1 & 4 \end{array} \right) + 12$$

$$m = \frac{12}{-6}$$

3. Write in slope-intercept form:

$$y + 2 = \frac{1}{2}(x - 6)$$

$$y + 2 = \frac{1}{2}x - 3$$

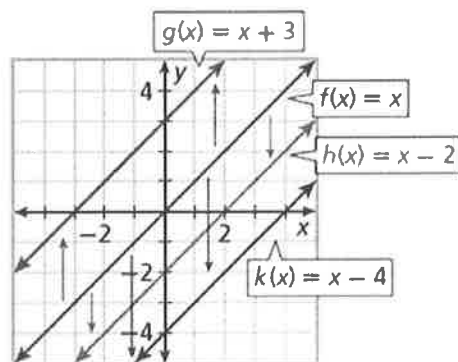
$$y = \frac{1}{2}x - 5$$

$$m = -2$$

A family of functions is a set of functions whose graphs have basic characteristics in common.

A parent function is the most basic function in a family. For linear functions, the parent function is $f(x) = x$.

A transformation is a change in position or size of a figure.

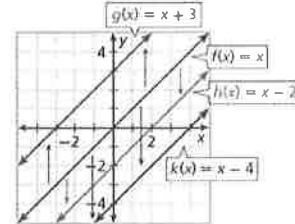


Linear Transformations - translations (vertical)

In the function $f(x) = mx + b$:

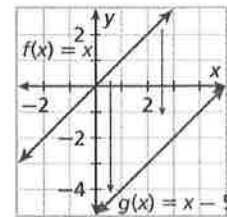
- * If b increases, the graph is translated up

The blue line is translated
3 units up to the red line



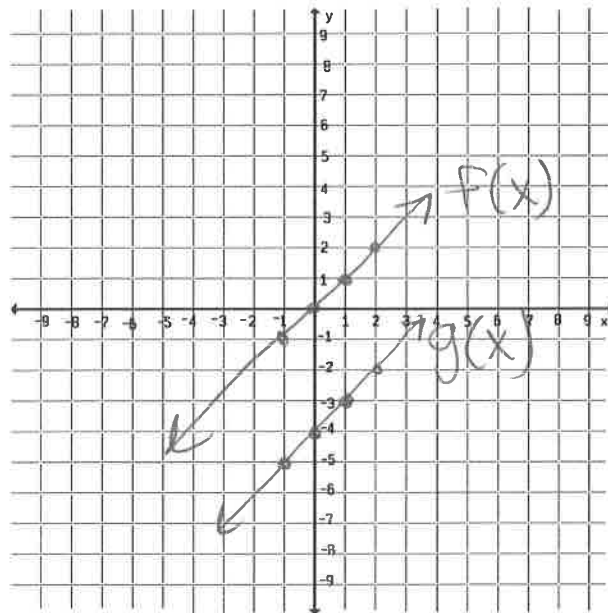
- * If b decreases, the graph is translated down

This graph represents the
parent function translated
down 5 units



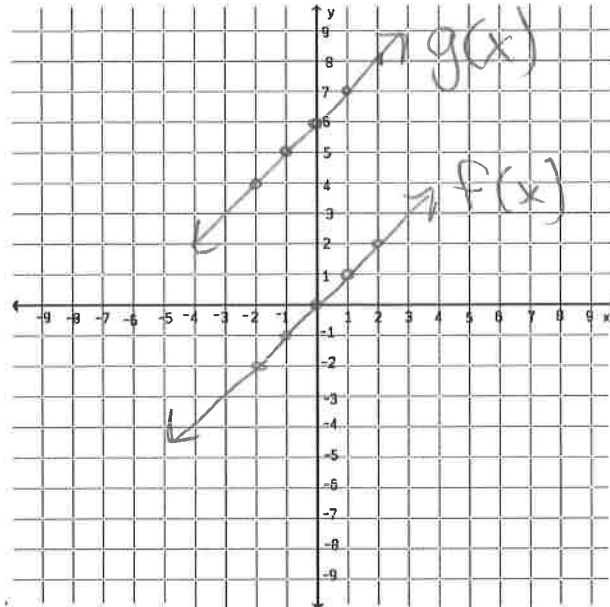
Write an equation that is translated 4 units
down from the parent function $f(x) = x$. Then
graph each.

$$g(x) = x - 4$$



Write an equation that is translated 6 units up from the parent function $f(x) = x$. Then graph each.

$$g(x) = x + 6$$



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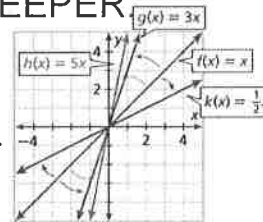
Linear Transformations - vertical stretch/compress

In the function $f(x) = mx + b$:

* If the function is being vertically stretched, it is becoming **STEEPER**

$$m > 1$$

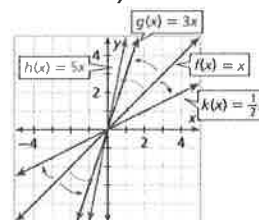
The blue line is being stretched by a factor of 3 to the red line



* If the function is being vertically compressed, it is becoming **LESS STEEP**.

$$0 < m < 1 \text{ (a fraction smaller than 1)}$$

The blue line is being compressed by a factor of $1/2$ to the purple line



Write an equation to represent the transformation on $f(x) = x$. Then identify the steepness compared to the parent function.

1. Vertically stretched by a factor of 3

$$g(x) = 3x \quad \text{more steep than } f(x)$$

2. Vertically compressed by a factor of $\frac{2}{3}$

$$g(x) = \frac{2}{3}x \quad \text{less steep}$$

3. Vertically stretched by a factor 9

$$g(x) = 9x \quad \text{more steep}$$

4. compress by a factor of $\frac{6}{7}$

$$g(x) = \frac{6}{7}x \quad \text{less steep}$$

Write an equation to represent the transformation on $f(x) = x$. Interpret your results.

1. down 6, vertically compressed by a factor of $\frac{1}{6}$.

$$g(x) = \frac{1}{6}x - 6$$

2. up 3, vertically stretched by a factor 4.

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

3. up 1, vertically compressed by a factor of $\frac{1}{3}$

$$g(x) = \frac{1}{3}x + 1$$

Linear Transformations - reflection

In the function $f(x) = mx + b$:

* If the function is reflected in the y-axis, the slope is opposite

$$f(x) = 2x - 5$$

$$g(x) = -2x - 5$$

Write an equation for the transformation on $f(x) = x$.

1. up 9, vertically stretched by a factor of 7, and reflected in the y-axis

$$g(x) = -7x + 9$$

2. down 1, vertically compressed by a factor of $-2/5$, reflected in the y-axis

$$g(x) = -\left(-\frac{2}{5}\right)x - 1$$

$$g(x) = \frac{2}{5}x - 1$$

Explain the transformation of each equation from the parent function $h(x) = x$.

1. $f(x) = 1/2x + 6$

vertically compressed

up 6

2. $3x - 2y = 8$

$$\begin{array}{r} -3x \qquad -3x \\ \hline -2y = -3x + 8 \\ \hline \frac{-2y}{-2} = \frac{-3x + 8}{-2} \end{array}$$

$$y = \frac{3}{2}x - 4$$

vert. stretch
down 4

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

reflected

up 2

Homework

Transformation WS