Warm-Up...

Given that (-2 , 5) is a point on the graph of $y = f(x)$, determine the coordinates of this point once the following transformations are applied...

(1) $y = 3f(x)$

$(x, y) \to (x, 3y)$

$(-2, 5) \to (-2, 15)$

(2) $y = f\left(-\frac{1}{3}x\right)$

$(x, y) \to (-3x, y)$

$(-2, 5) \to (6, 5)$

(3) $y = 4f\left[\frac{1}{2}(x + 5)\right] - 3$ $(-9, 17)$

$(x, y) \to (2x - 5, 4y - 3)$

$(-2, 5) \to (2(-2) - 5, 4(5) - 3)$

$\to (-9, 17)$

(4) $y - 5 = -2f(-2x + 6)$ $(4, -5)$

$y = -2f[-2(x - 3)] + 5$

$(x, y) \to \left(-\frac{1}{2}x + 3, -2y + 5\right)$

$(-2, 5) \to \left(-\frac{1}{2}(-2) + 3, -2(5) + 5\right)$

$\to (4, -5)$

Summary of Transformations…

Transformations of the graphs of functions	
$f(x)+c$	shift $f(x)$ up c units
$f(x)-c$	shift $f(x)$ down c units
$f(x+c)$	shift $f(x)$ left c units
$f(x-c)$	shift $f(x)$ right c units
$f(-x)$	reflect $f(x)$ about the y-axis
$-f(x)$	reflect $f(x)$ about the x-axis
$cf(x)$	When $0 < c < 1$ – vertical shrinking of $f(x)$ When $c > 1$ – vertical stretching of $f(x)$ **Multiply the y values by c**
$f(cx)$	When $0 < c < 1$ – horizontal stretching of $f(x)$ When $c > 1$ – horizontal shrinking of $f(x)$ **Divide the x values by c**

$$y = f(x) \longrightarrow y = af\left(b\left(x-c\right)\right)+d$$

Mapping Rule: $(x, y) \rightarrow \left(\frac{1}{b}x + c, ay + d\right)$

Important note for sketching...

Transformations should be applied in following order:

1. Reflections
2. Stretches
3. Translations

Remember....RST

The function $y = f(x)$ is transformed to the function $g(x) = -3f(4x - 16) - 10$. Copy and complete the following statements by filling in the blanks.

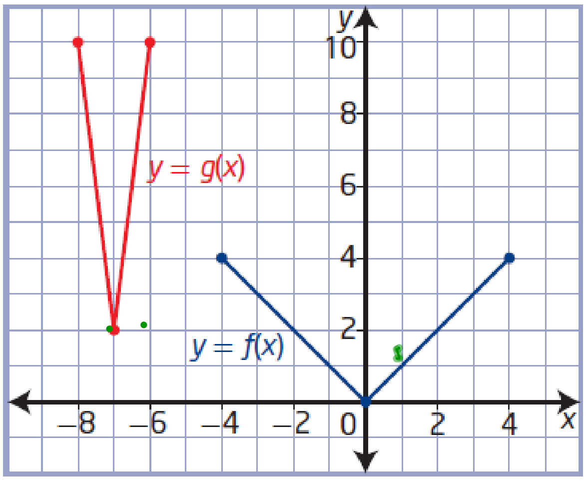
$4(x-4)$

The function $f(x)$ is transformed to the function $g(x)$ by a horizontal stretch about the **a** (x-axis) by a factor of **b** ($\frac{1}{4}$). It is vertically stretched about the **c** (y-axis) by a factor of **d** (3). It is reflected in the **e** (x-axis), and then translated **f** (4) units to the right and **g** (10) units down.

Write the Equation of a Transformed Function Graph

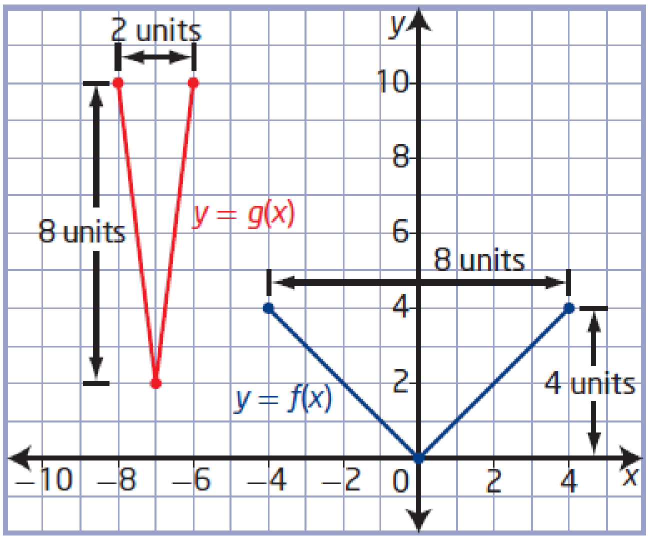
The graph of the function $y = g(x)$ represents a transformation of the graph of $y = f(x)$. Determine the equation of $g(x)$ in the form $y = af(b(x - h)) + k$. Explain your answer.

$g(x) = 8f(x+7) + 2$



Solution

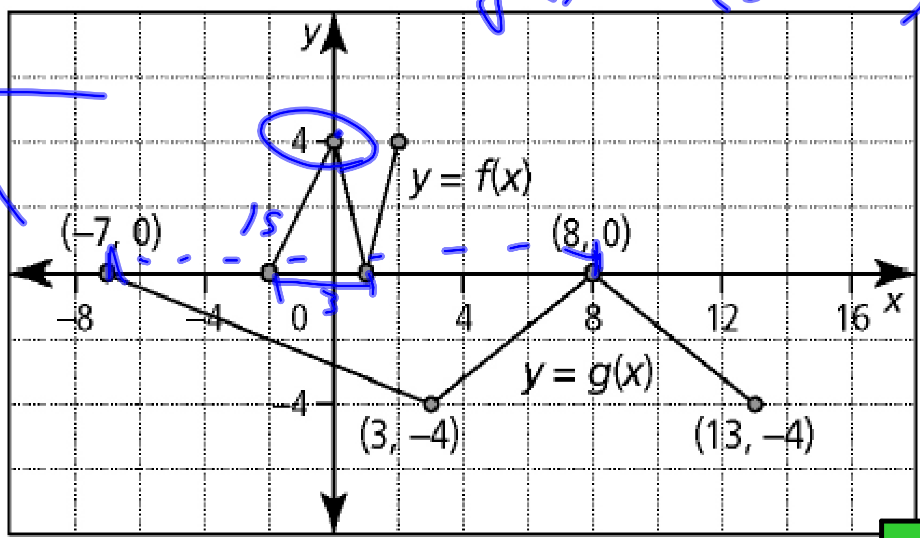
The equation of the transformed function is $g(x) = 2f(4(x + 7)) + 2$.



How could you use the mapping $(x, y) \rightarrow \left(\frac{1}{b}x + h, ay + k\right)$ to verify this equation?

The graph of the function $y = g(x)$ represents a transformation of the graph of $y = f(x)$. Determine the equation of $g(x)$ in the form $y = af(b(x-h)) + k$.

$g(x) = -f\left(\frac{1}{5}(x-3)\right)$



$y = -f\left(\frac{1}{5}(x-3)\right)$

Example...

The graph of the function $y = 2x^2 + x + 1$ is stretched vertically about the x-axis by a factor of 2, stretched horizontally about the y-axis by a factor of $\frac{1}{3}$, and translated 2 units to the right and 4 units down. Write the equation of the transformed function.

Completing the square

$$y = 2\left(x^2 + \frac{1}{2}x + \frac{1}{16}\right) + 1 - \frac{1}{8}$$

x

1/8

×3

×2

$$y = 2\left(x + \frac{1}{4}\right)^2 + \frac{7}{8}$$

−4

$$V\left(-\frac{1}{4}, \frac{7}{8}\right)$$

$$y = 4\left(3\left(x - \frac{7}{4}\right)\right)^2 - \frac{25}{8}$$

Partial Factoring

$y = 2x^2 + x + 1$

$y = x(2x+1) + 1$

$x = 0$ or $x = -\frac{1}{2}$

$x = -\frac{1}{4}$

Practice Problems...

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