

Objective: Sketch the graph of a general function using transformations

Concept

Transformations of the graph of $f(x)$ to obtain the graph of

$$g(x) = a \cdot f(x - h) + k \text{ or } g(x) = f\left(\frac{1}{b}(x - h)\right) + k$$

If $a < 0$	the graph of the function will have an x-axis reflection
If $ a > 1$	the graph of the function will have a vertical stretch by a factor of a
If $ a < 1$	the graph of the function will have a vertical compression by a factor of a
If $b < 0$	the graph of the function will have a y-axis reflection
If $ b > 1$	the graph of the function will have a horizontal stretch by a factor of b
If $ b < 1$	the graph of the function will have a horizontal compression by a factor of b
If $h > 0$	the graph of the function is translated h units right
If $h < 0$	the graph of the function is translated h units left
If $k > 0$	the graph of the function is translated k units up
If $k < 0$	the graph of the function is translated k units down



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Graphing a General Function
Using a Parent Graph and Transformations

1. Identify the points of the parent graph to be transformed. **Include endpoints, maximums, minimums, and intercepts.**
2. **Identify the transformations** that will take place from the parameters.
3. **Perform any reflection, stretch, and/or compression.** **Then perform any translations.**
4. **Sketch the curve of the new function.**



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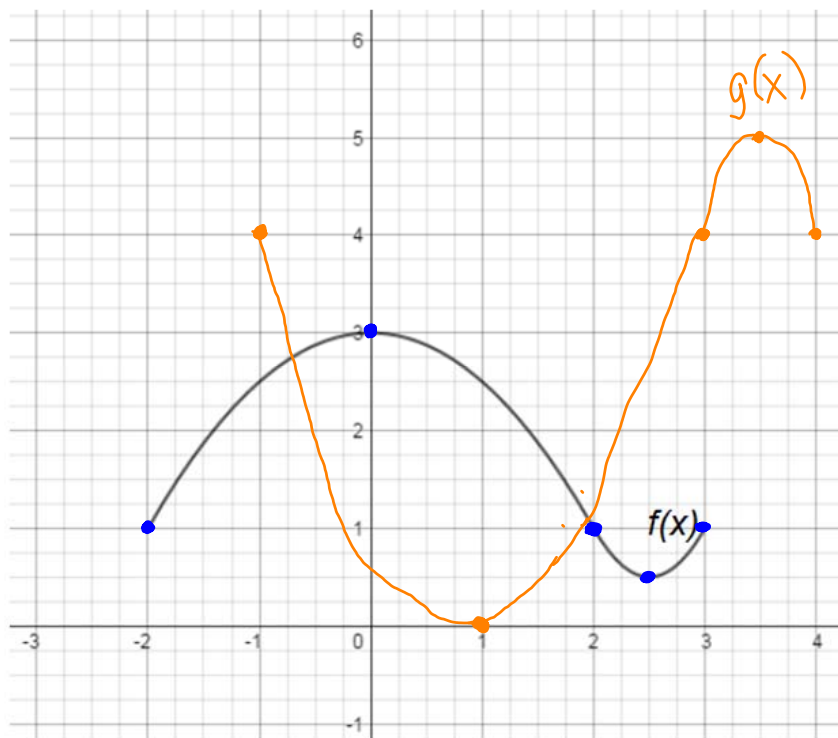
Ex) Given $f(x)$, graph $g(x) = -2f(x-1) + 6$ ^k

$a = -2$
x-axis refl.

$|a| = |-2| = 2 \geq 1$
vert. stretch

$h = 1$ right

$k = 6$ up



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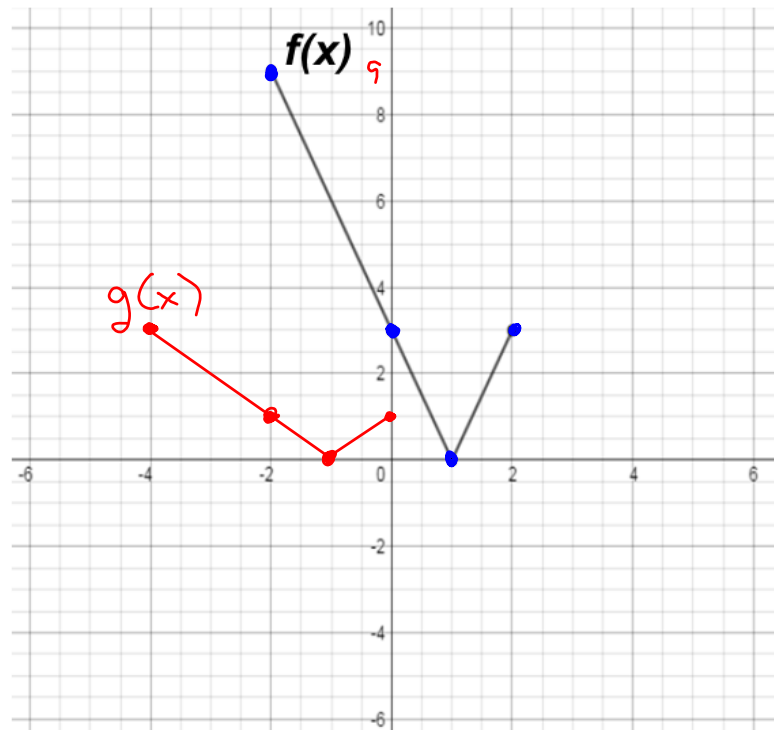
Ex) Given $f(x)$, graph $g(x) = \frac{1}{3}f(x+2)$
 a $opp = h$

$a = \frac{1}{3}$ no refl.

$|a| = |\frac{1}{3}| = \frac{1}{3} < 1$

vert. comp.

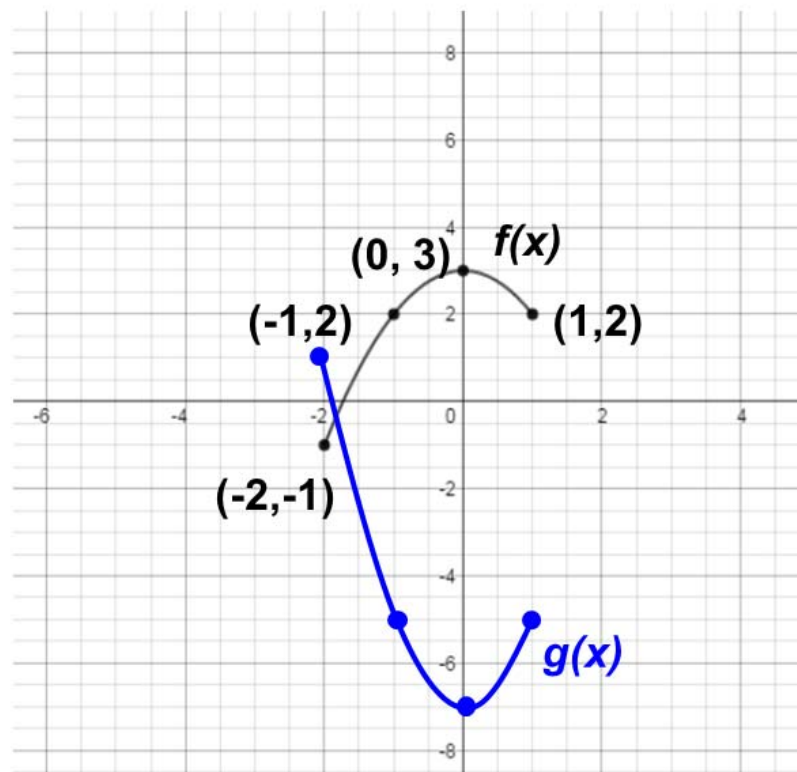
$h = -2$ left



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Practice) Given $f(x)$, graph $g(x) = -2f(x) - 1$

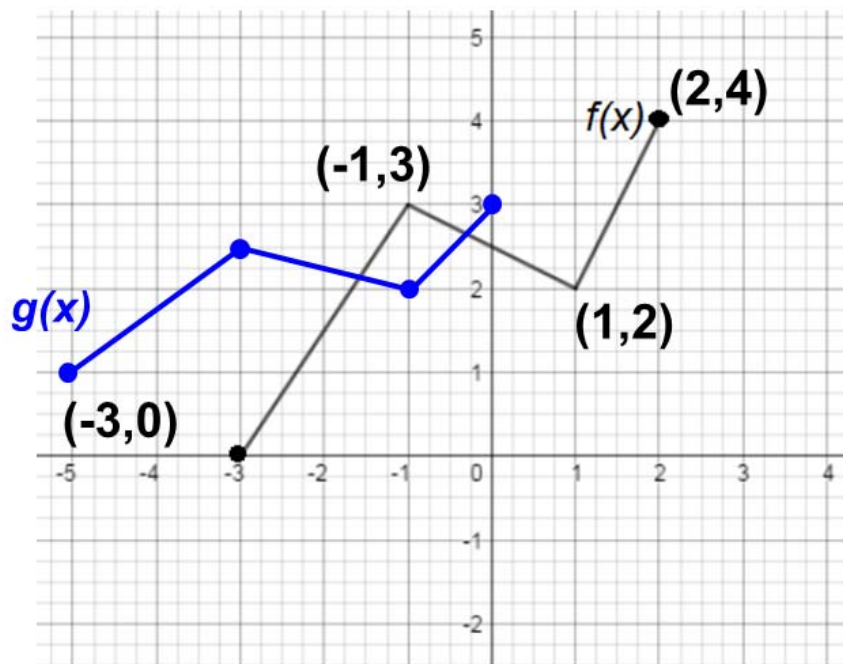
$$a = -2, \quad k = -1$$



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Practice) Given $f(x)$, graph $g(x) = \frac{1}{2}f(x + 2) + 1$

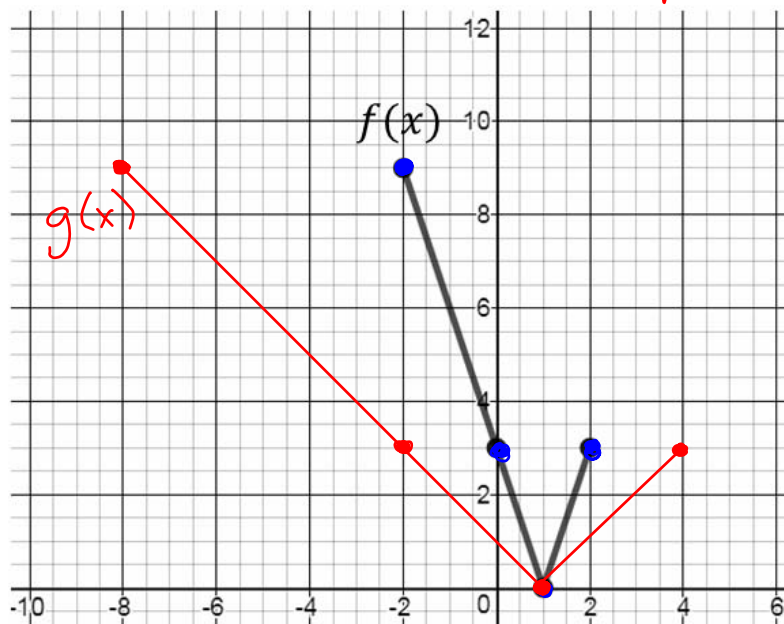
$$a = \frac{1}{2}, \quad h = -2, \quad k = 1$$



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Ex) Given $f(x)$, graph $g(x) = f\left(\frac{1}{3}(x+2)\right)$ ^{opp = h} $h = -2$ left
 $\frac{1}{b} = \frac{1}{3}$

$b = 3$ no refl. $|b| = |3| = 3 \geq 1$
 horiz. stretch



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Ex) Given $f(x)$, graph $g(x) = f(-2(x-1)) + 1$ k
 $\frac{1}{b}$ opp = h

$$\frac{1}{b} = -2 = \frac{-2}{1}$$

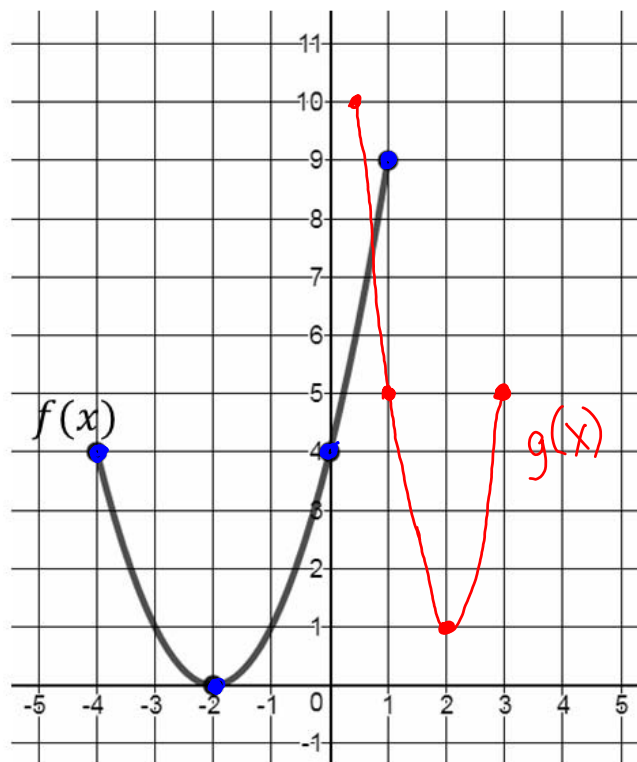
$$b = -\frac{1}{2} \quad \text{y-axis refl.}$$

$$|b| = \left|-\frac{1}{2}\right| = \frac{1}{2} \leq 1$$

horiz. comp.

$h = 1$ right

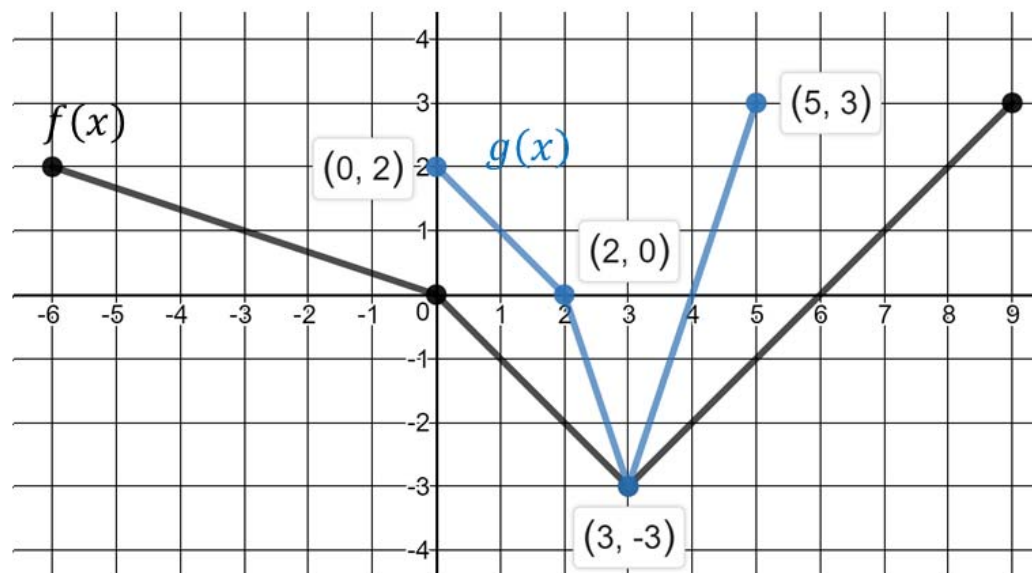
$k = 1$ up



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Practice) Given $f(x)$, graph $g(x) = f(3(x - 2))$

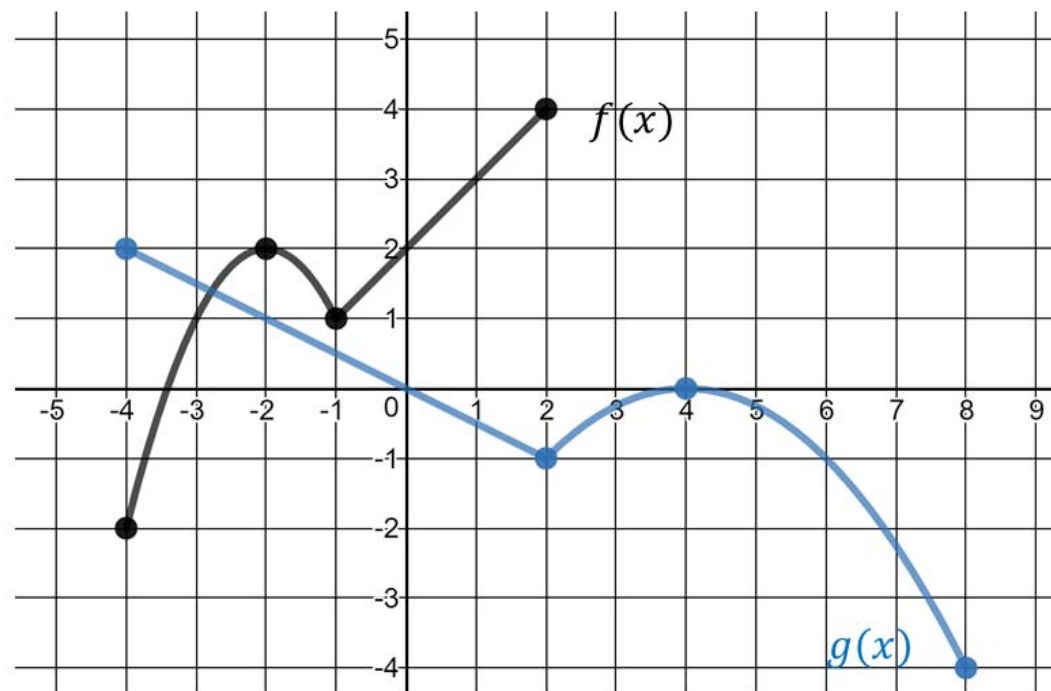
$$\frac{1}{b} = 3 \text{ so } b = \frac{1}{3}, \quad h = 2$$



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Practice) Given $f(x)$, graph $g(x) = f\left(-\frac{1}{2}x\right) - 2$

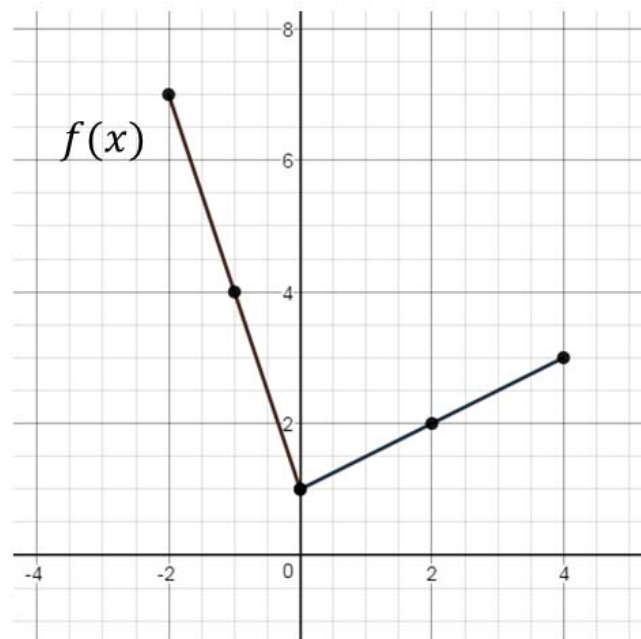
$$\frac{1}{b} = -\frac{1}{2} \text{ so } b = -2, \quad k = -2$$



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Closure

Given the graph of a function $f(x)$, describe how the transformation for $g(x) = f(x - 5)$ would affect $f(x)$.



The function $f(x)$ would be translated 5 units to the right.

