

PreCalculus

Sec. 1.6

Transformations of Graphs

Horizontal & Vertical Shifts

Given the graph of $f(x)$

$y = f(x + c)$ moves the graph to the **left** c units.

$y = f(x - c)$ moves the graph to the **right** c units.

$y = f(x) + c$ moves the graph **upward** c units.

$y = f(x) - c$ moves the graph **downward** c units.

Stretching and Shrinking Graphs

Given the graph of $f(x)$:

$y = c f(x)$ **stretches** the graph vertically if $c > 1$ and
shrinks vertically if $0 < c < 1$

(multiply each of its y -values by c)

$y = f(cx)$ **shrinks** the graph horizontally if $c > 1$ and
stretches horizontally if $0 < c < 1$

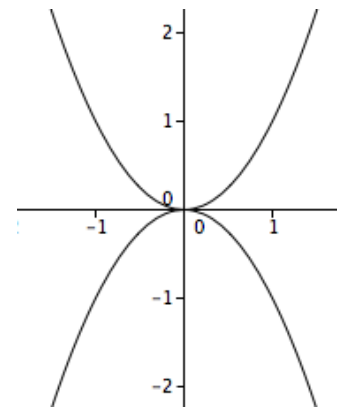
(divide each of its x -values by c)

Reflection Over the x-Axis

Given the graph of $f(x)$

$y = -f(x)$ **reflects** the graph over the x -axis.

(all the y -values change their sign)

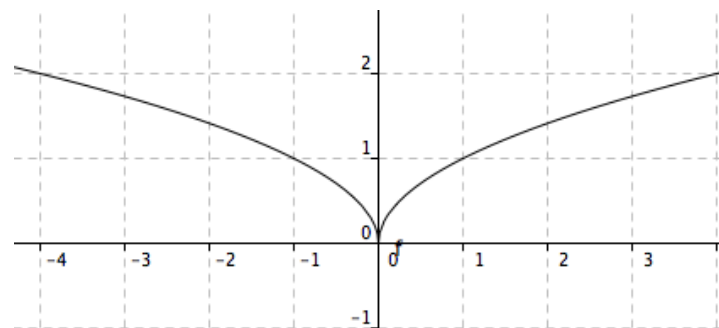


Reflection Over the y-Axis

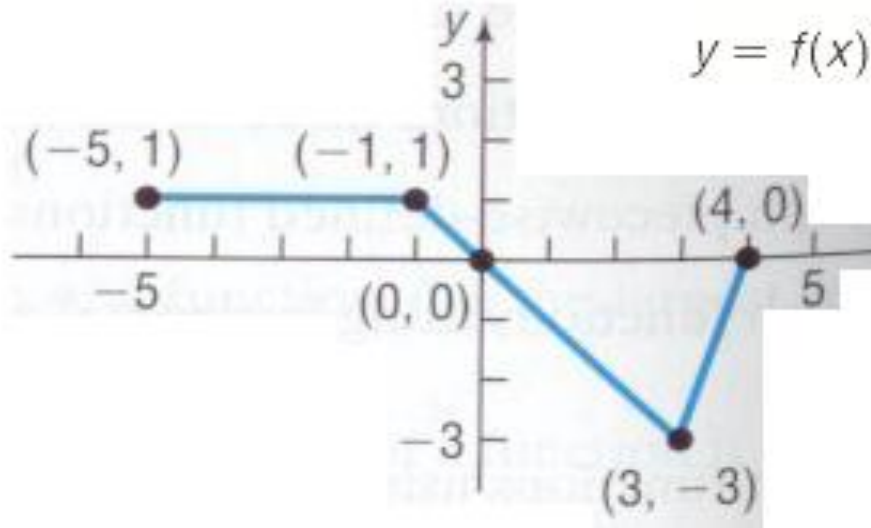
Given the graph of $f(x)$

$y = f(-x)$ **reflects** the graph over the y -axis.

(all the x -values change their sign)



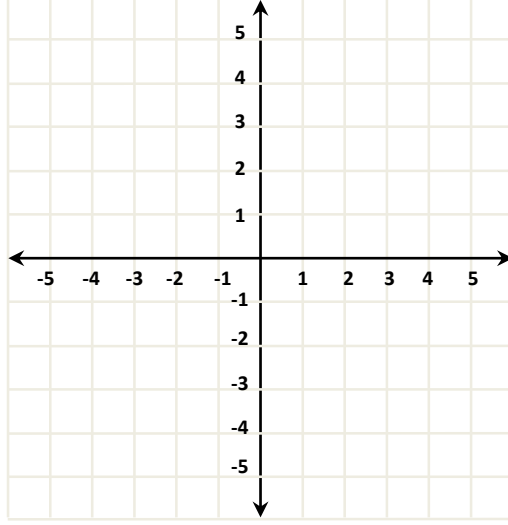
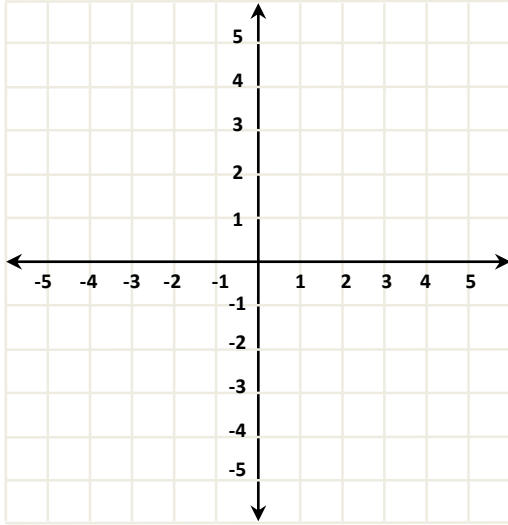
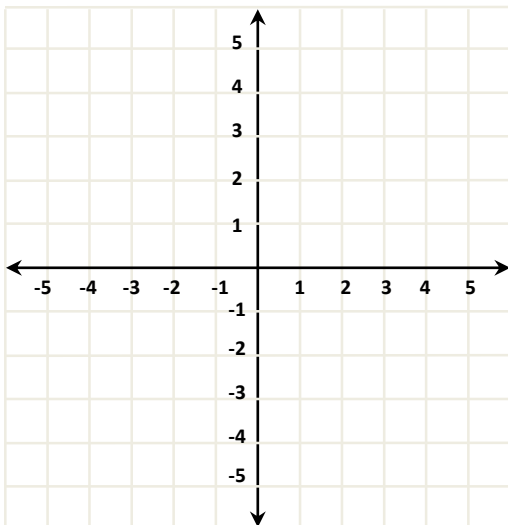
Ex. 1: Sketch the following translations and reflections to the function $f(x)$ shown.



a) $f(2x)$

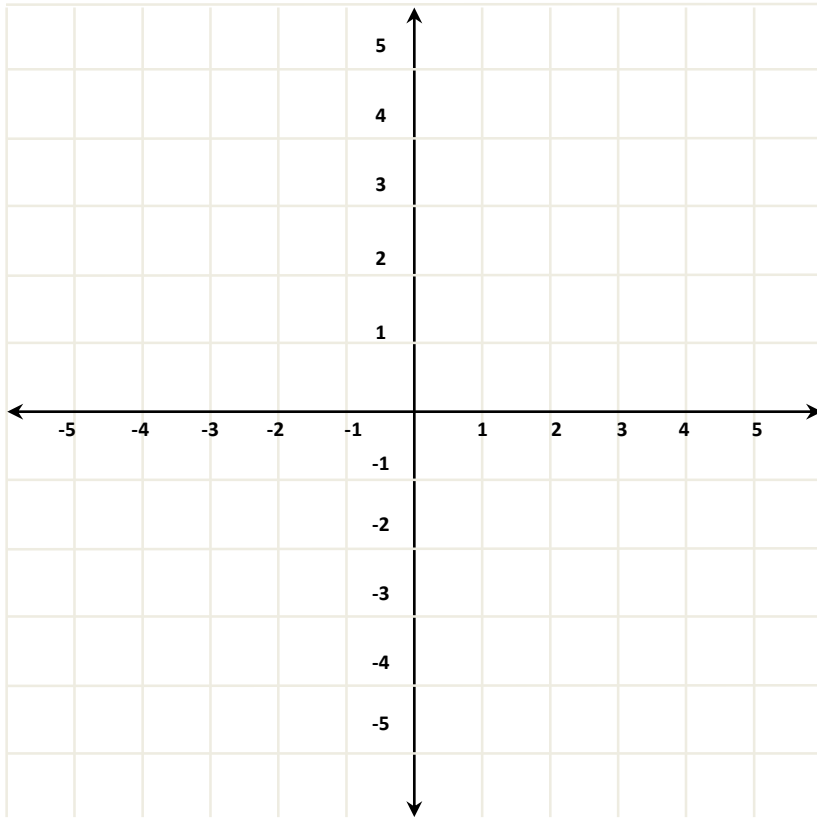
b) $f(-x)$

c) $|f(x)|$



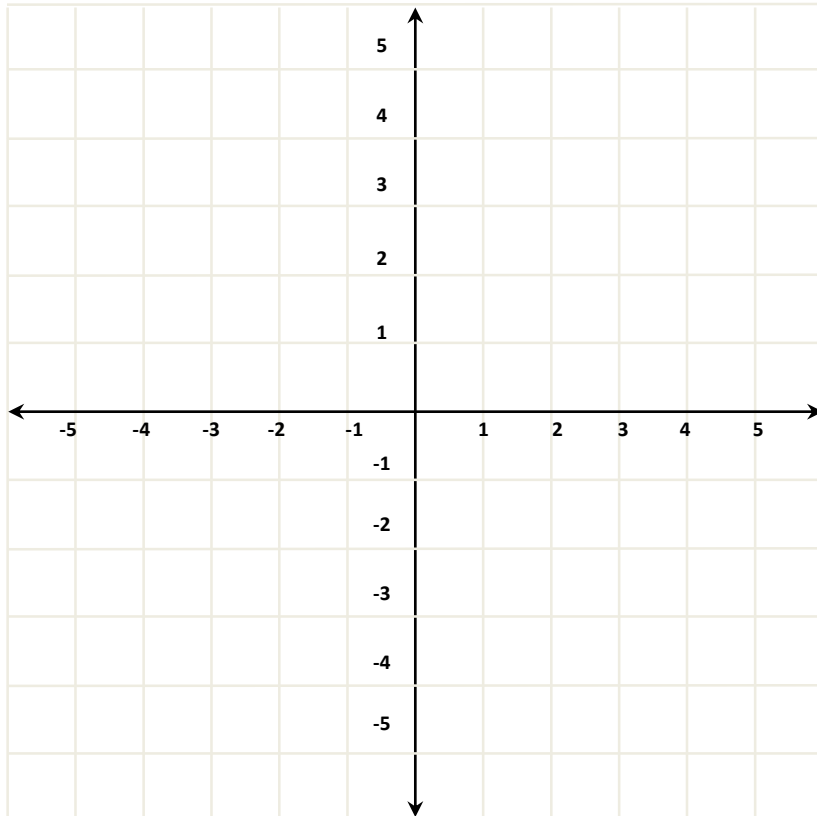
Ex. 2: Sketch the parent function and $h(x)$ on the same rectangular coordinate system. Describe the transformation. State the domain and range in set notation.

$$a) h(x) = -\sqrt{x+2} + 3$$

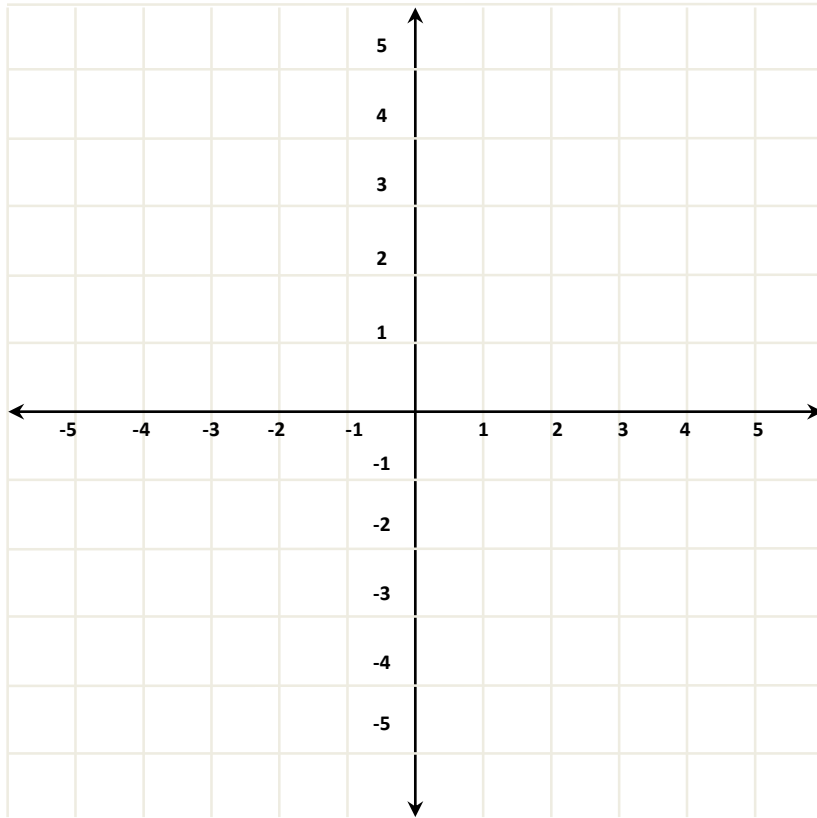


Ex. 3: Sketch the graph of the following functions. State the domain and range in set notation.

$$a) f(x) = \left[\frac{1}{4}x \right]$$

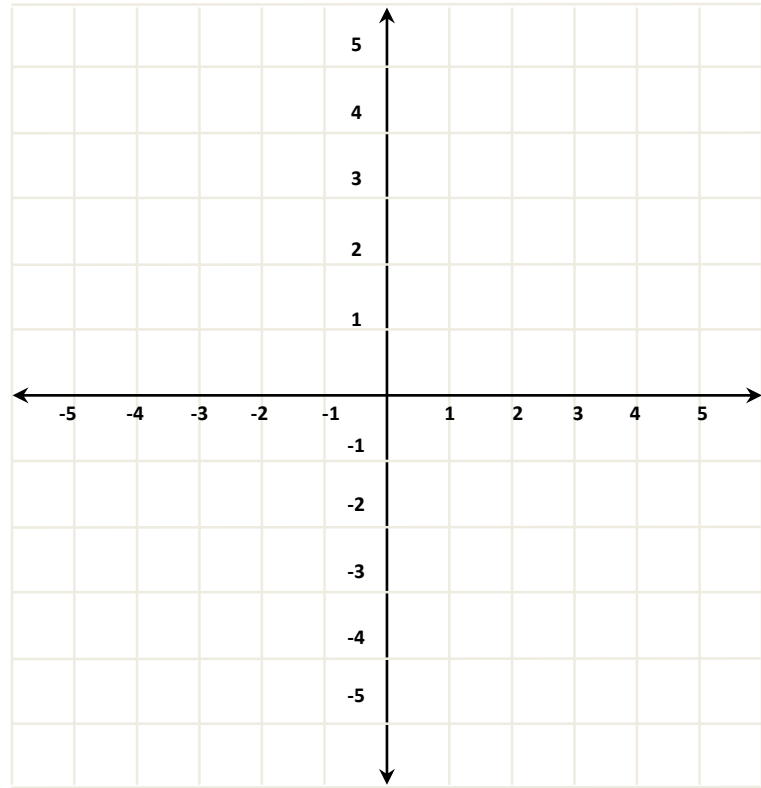


$$b) \quad g(x) = 2[x] + 1$$

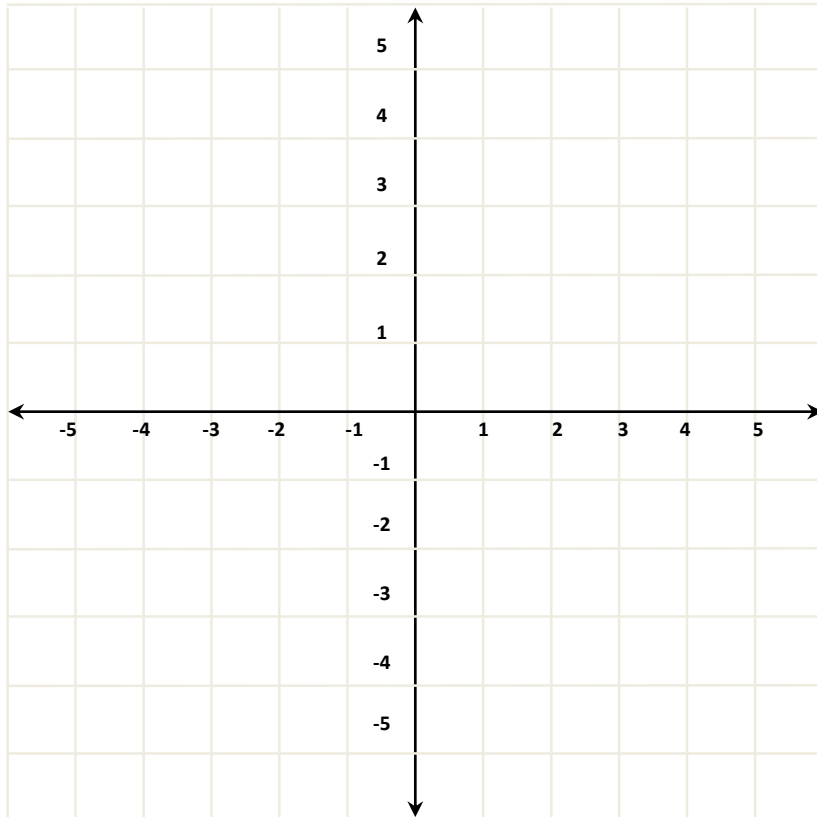


c) $p(x) = x^2 + 6x + 4$

Use $\left(\frac{-b}{2a}, f\left(\frac{-b}{2a}\right) \right)$



d) $f(x) = 3 - |x - 4|$



Ex. 4: Use function notation to write $g(x)$ in terms of the parent function $f(x)$.

$$a) g(x) = \frac{1}{2}|x - 2| - 3$$

$$b) g(x) = -\sqrt{x + 1} - 6$$