2.5 Horizontal and Vertical Shifts

Two graphs may look exactly alike in shape, but differ in their positions within the xy-plane.

Adding or subtracting values from a function will shift the graph of the function on the coordinate plane.

If f is a function and c is a positive constant, then the graph of
- y = f(x) + c is the graph of y = f(x) shifted *up* c units
- y = f(x) – c is the graph of y = f(x) shifted *down* c units
- y = f(x + c) is the graph of y = f(x) shifted *left* c units
- y = f(x – c) is the graph of y = f(x) shifted *right* c units

Vertical translations: adding or subtracting after the function (outside the parenthesis)

y = f(x) +3 shifts f(x) up 3 spaces on the y axis
y = f(x) – 2 shifts f(x) down 2 spaces on the y axis

Horizontal translations: adding or subtracting with the function (inside the parenthesis)

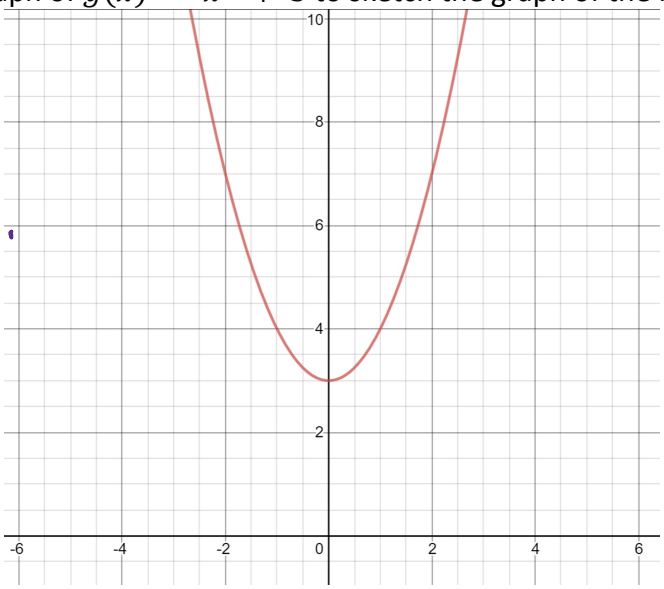
y = f(x+4) shifts the graph of f(x) left 4 spaces on the x axis
y = f(x-3) shifts the graph of f(x) right 3 spaces on the x axis

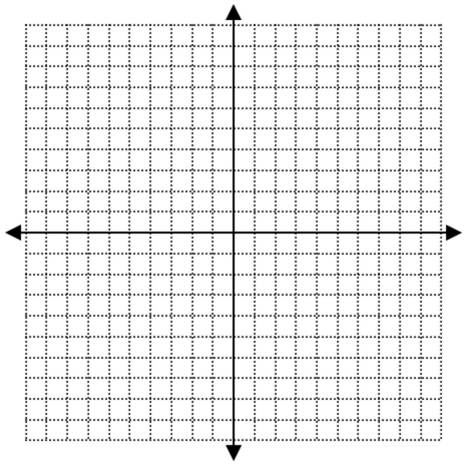
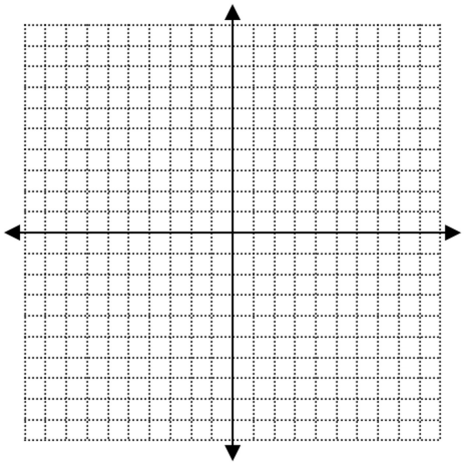
Vertical & Horizontal translation

y = f(x-5) +2 shifts the graph of f(x) up 2 spaces on the y-axis and right 5 on the x-axis.

Example 1

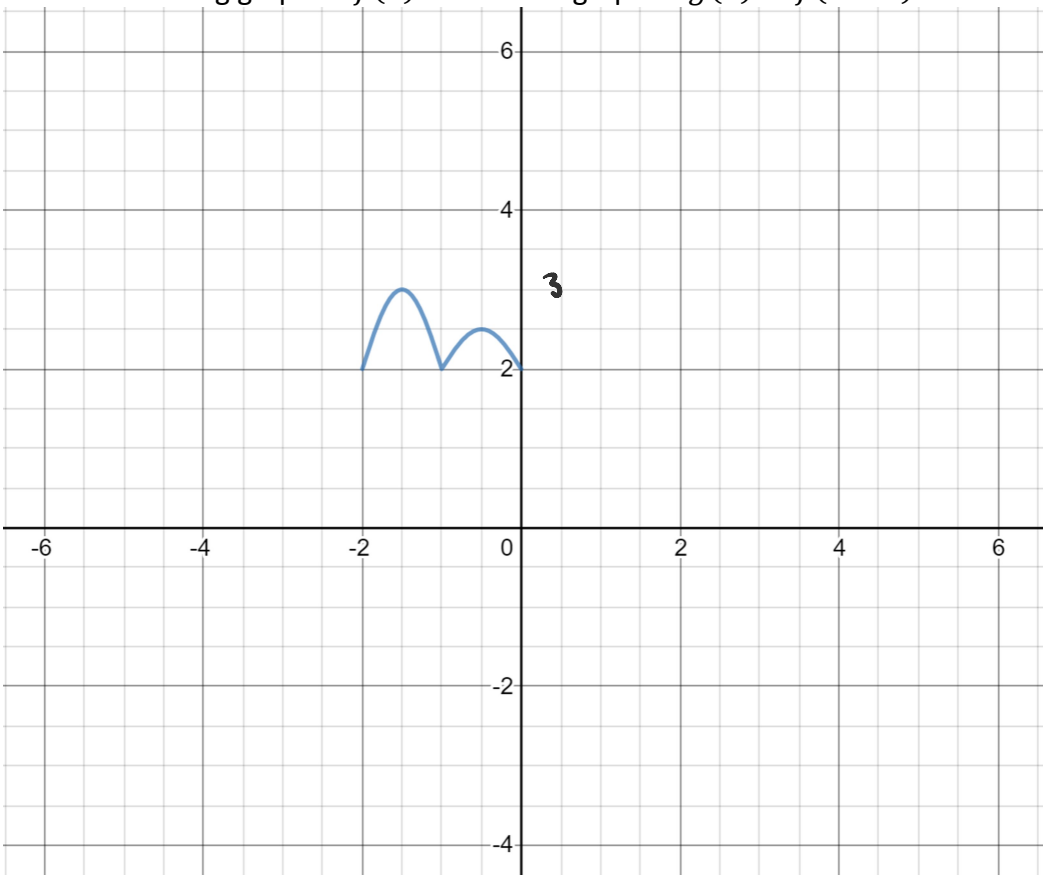
Use the graph of $g(x) = x^2 + 3$ to sketch the graph of the following functions



a) $h(x) = g(x) - 2$	b) $f(x) = g(x - 2)$
	

Problem 1

Use the following graph of $f(x)$ to sketch a graph of $g(x) = f(x + 3) - 2$



Example 2

If $f\ (5) = -2, f\ (2) = 7$, and $f\ (-3) = -14$

Find the coordinates for $h(x) = f(x) + 5$ and $g(x) = f(\ x - 2\ )$ for each function value

$f(x)$	$(5, -2)$	$(2,7)$	$(-3, -14)$

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

Problem 2

If $g(1) = -3, g(2) = 8, g(-2) = -12$, find the coordinates for $f(x) = g(x) - 3$ and $h(x) = g(x + 5)$