Transformations of Functions

Let $y = f(x)$ be a function and $c > 0$ be a constant. Then the table below describes how the graphs of various transformed functions can be obtained from the graph of $y = f(x)$.

Transformed function	**Effect of transformation on graph of** $y = f(x)$	
$y = f(x) + c$	Vertical shift c units upward	
$y = f(x) - c$	Vertical shift c units downward	
$y = f(x - c)$	Horizontal shift c units to the right	
$y = f(x + c)$	Horizontal shift c units to the left	
$y = -f(x)$	Reflection about the x-axis	
$y = f(-x)$	Reflection about the y-axis	
$y = cf(x)$	Vertical stretch if $c > 1$; Vertical shrink if $0 < c < 1$	
$y = f(cx)$	Horizontal shrink if $c > 1$; Horizontal stretch if $0 < c < 1$	

Note: $f(x + c) = f(x - (-c))$ and $f(x) - c = f(x) + (-c)$