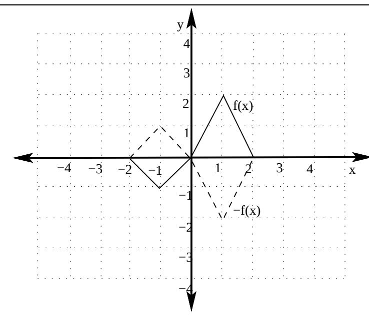
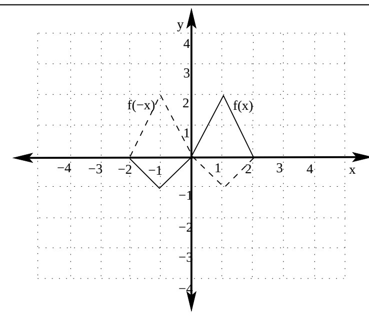
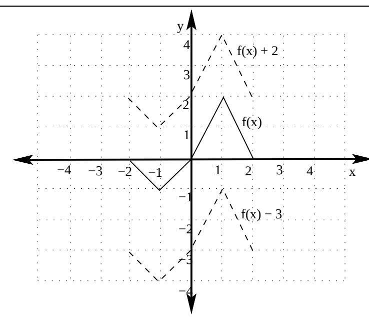
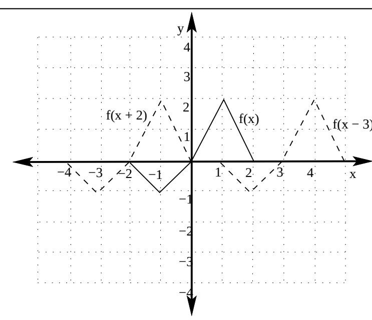
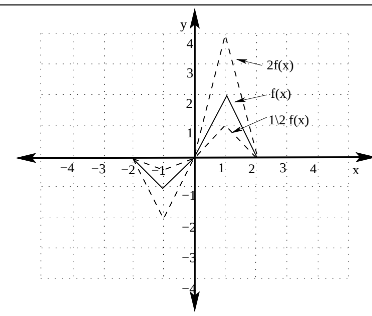
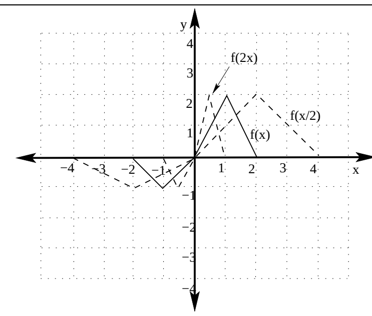
Math 143

Shifts of Functions

The Six Major Types of Shifts

<table>
<tr><th>Equation</th><th>Effect on the graph</th><th>Example:</th></tr>
<tr><td>$y = -f(x)$</td><td>Reflection across the x-axis</td><td>
</td></tr>
<tr><td>$y = f(-x)$</td><td>Reflection across the y-axis</td><td>
</td></tr>
<tr><td>$y = f(x) + c$</td><td>Shifted Up if $c > 0$
Shifted Down if $c < 0$</td><td>
</td></tr>
<tr><td>$y = f(x - c)$</td><td>Shifted Right if $c > 0$
Shifted Left if $c < 0$</td><td>
</td></tr>
</table>

Equation	Effect on the graph	Example:
$y = cf(x)$, $c > 0$	Vertical stretch if $c > 1$ Vertical compression if $0 < c < 1$	
$y = f(cx)$, $c > 0$	Horizontal compression if $c > 1$ Horizontal stretch if $0 < c < 1$	

Note: We will often combine more than one shift together to form one new function.

Example: Given $f(x)$, sketch the graph of $2f(x-1)+3$