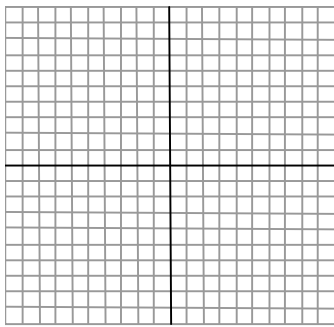


$$f(x) = a(b(x - h)) + k$$

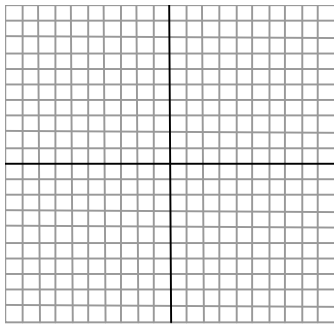
Translations

- The shape and size of the parent graph stay the same.
- The entire graph just changes position.
- Translations are also known as “shifts” and can occur horizontally or vertically.

Graph the following functions using your graphing calculator. Then, complete the tables and sketch each graph on the provided coordinate plane.

$f(x) = x$ <table style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th style="border-right: 1px solid black; padding: 5px;">x</th> <th style="padding: 5px;">$f(x)$</th> </tr> </thead> <tbody> <tr><td style="border-right: 1px solid black; padding: 5px;">-2</td><td style="padding: 5px;"></td></tr> <tr><td style="border-right: 1px solid black; padding: 5px;">-1</td><td style="padding: 5px;"></td></tr> <tr><td style="border-right: 1px solid black; padding: 5px;">0</td><td style="padding: 5px;"></td></tr> <tr><td style="border-right: 1px solid black; padding: 5px;">1</td><td style="padding: 5px;"></td></tr> <tr><td style="border-right: 1px solid black; padding: 5px;">2</td><td style="padding: 5px;"></td></tr> </tbody> </table>	x	$f(x)$	-2		-1		0		1		2		$g(x) = f(x) + 4$ $g(x) =$ <table style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th style="border-right: 1px solid black; padding: 5px;">x</th> <th style="padding: 5px;">$g(x)$</th> </tr> </thead> <tbody> <tr><td style="border-right: 1px solid black; padding: 5px;">-2</td><td style="padding: 5px;"></td></tr> <tr><td style="border-right: 1px solid black; padding: 5px;">-1</td><td style="padding: 5px;"></td></tr> <tr><td style="border-right: 1px solid black; padding: 5px;">0</td><td style="padding: 5px;"></td></tr> <tr><td style="border-right: 1px solid black; padding: 5px;">1</td><td style="padding: 5px;"></td></tr> <tr><td style="border-right: 1px solid black; padding: 5px;">2</td><td style="padding: 5px;"></td></tr> </tbody> </table>	x	$g(x)$	-2		-1		0		1		2		$h(x) = f(x) - 1$ $h(x) =$ <table style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th style="border-right: 1px solid black; padding: 5px;">x</th> <th style="padding: 5px;">$h(x)$</th> </tr> </thead> <tbody> <tr><td style="border-right: 1px solid black; padding: 5px;">-2</td><td style="padding: 5px;"></td></tr> <tr><td style="border-right: 1px solid black; padding: 5px;">-1</td><td style="padding: 5px;"></td></tr> <tr><td style="border-right: 1px solid black; padding: 5px;">0</td><td style="padding: 5px;"></td></tr> <tr><td style="border-right: 1px solid black; padding: 5px;">1</td><td style="padding: 5px;"></td></tr> <tr><td style="border-right: 1px solid black; padding: 5px;">2</td><td style="padding: 5px;"></td></tr> </tbody> </table>	x	$h(x)$	-2		-1		0		1		2		
x	$f(x)$																																						
-2																																							
-1																																							
0																																							
1																																							
2																																							
x	$g(x)$																																						
-2																																							
-1																																							
0																																							
1																																							
2																																							
x	$h(x)$																																						
-2																																							
-1																																							
0																																							
1																																							
2																																							

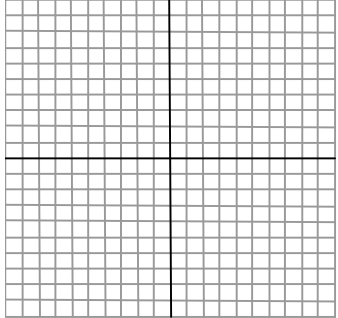
Graph the following functions using your graphing calculator. Then, complete the tables and sketch each graph on the provided coordinate plane.

$f(x) = x^2$ <table style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th style="border-right: 1px solid black; padding: 5px;">x</th> <th style="padding: 5px;">$f(x)$</th> </tr> </thead> <tbody> <tr><td style="border-right: 1px solid black; padding: 5px;">-2</td><td style="padding: 5px;"></td></tr> <tr><td style="border-right: 1px solid black; padding: 5px;">-1</td><td style="padding: 5px;"></td></tr> <tr><td style="border-right: 1px solid black; padding: 5px;">0</td><td style="padding: 5px;"></td></tr> <tr><td style="border-right: 1px solid black; padding: 5px;">1</td><td style="padding: 5px;"></td></tr> <tr><td style="border-right: 1px solid black; padding: 5px;">2</td><td style="padding: 5px;"></td></tr> </tbody> </table>	x	$f(x)$	-2		-1		0		1		2		$g(x) = f(x) + 4$ $g(x) =$ <table style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th style="border-right: 1px solid black; padding: 5px;">x</th> <th style="padding: 5px;">$g(x)$</th> </tr> </thead> <tbody> <tr><td style="border-right: 1px solid black; padding: 5px;">-2</td><td style="padding: 5px;"></td></tr> <tr><td style="border-right: 1px solid black; padding: 5px;">-1</td><td style="padding: 5px;"></td></tr> <tr><td style="border-right: 1px solid black; padding: 5px;">0</td><td style="padding: 5px;"></td></tr> <tr><td style="border-right: 1px solid black; padding: 5px;">1</td><td style="padding: 5px;"></td></tr> <tr><td style="border-right: 1px solid black; padding: 5px;">2</td><td style="padding: 5px;"></td></tr> </tbody> </table>	x	$g(x)$	-2		-1		0		1		2		$h(x) = f(x - 1)$ $h(x) =$ <table style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th style="border-right: 1px solid black; padding: 5px;">x</th> <th style="padding: 5px;">$h(x)$</th> </tr> </thead> <tbody> <tr><td style="border-right: 1px solid black; padding: 5px;"></td><td style="padding: 5px;">4</td></tr> <tr><td style="border-right: 1px solid black; padding: 5px;"></td><td style="padding: 5px;">1</td></tr> <tr><td style="border-right: 1px solid black; padding: 5px;"></td><td style="padding: 5px;">0</td></tr> <tr><td style="border-right: 1px solid black; padding: 5px;"></td><td style="padding: 5px;">1</td></tr> <tr><td style="border-right: 1px solid black; padding: 5px;"></td><td style="padding: 5px;">4</td></tr> </tbody> </table>	x	$h(x)$		4		1		0		1		4	
x	$f(x)$																																						
-2																																							
-1																																							
0																																							
1																																							
2																																							
x	$g(x)$																																						
-2																																							
-1																																							
0																																							
1																																							
2																																							
x	$h(x)$																																						
	4																																						
	1																																						
	0																																						
	1																																						
	4																																						

Reflections

- The shape and size of the parent graph stay the same.
- A reflection is the mirror image of a graph over the x - or y - axis.

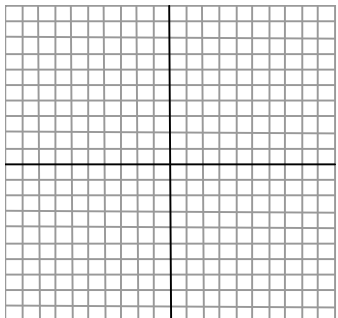
Graph the following functions using your graphing calculator. Then, complete the tables and sketch each graph on the provided coordinate plane.

$f(x) = \sqrt{x}$ <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>x</th> <th>$f(x)$</th> </tr> </thead> <tbody> <tr><td>0</td><td></td></tr> <tr><td>1</td><td></td></tr> <tr><td>4</td><td></td></tr> <tr><td>9</td><td></td></tr> </tbody> </table>	x	$f(x)$	0		1		4		9		$g(x) = -f(x)$ $g(x) =$ <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>x</th> <th>$g(x)$</th> </tr> </thead> <tbody> <tr><td>0</td><td></td></tr> <tr><td>1</td><td></td></tr> <tr><td>4</td><td></td></tr> <tr><td>9</td><td></td></tr> </tbody> </table>	x	$g(x)$	0		1		4		9		$h(x) = f(-x)$ $h(x) =$ <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>x</th> <th>$h(x)$</th> </tr> </thead> <tbody> <tr><td>0</td><td></td></tr> <tr><td>1</td><td></td></tr> <tr><td>2</td><td></td></tr> <tr><td>3</td><td></td></tr> </tbody> </table>	x	$h(x)$	0		1		2		3		
x	$f(x)$																																
0																																	
1																																	
4																																	
9																																	
x	$g(x)$																																
0																																	
1																																	
4																																	
9																																	
x	$h(x)$																																
0																																	
1																																	
2																																	
3																																	

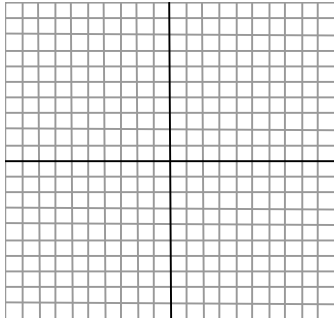
Stretches and Compressions

- Cause a distortion in the shape of the parent graph.
- *Stretch* pulls the graph away from the axes.
- *Compression* pushes the graph towards the axes.

Graph the following functions using your graphing calculator. Then, complete the tables and sketch each graph on the provided coordinate plane.

$f(x) = x^2$ <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>x</th> <th>$f(x)$</th> </tr> </thead> <tbody> <tr><td>-2</td><td></td></tr> <tr><td>-1</td><td></td></tr> <tr><td>0</td><td></td></tr> <tr><td>1</td><td></td></tr> <tr><td>2</td><td></td></tr> </tbody> </table>	x	$f(x)$	-2		-1		0		1		2		$g(x) = 2f(x)$ $g(x) =$ <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>x</th> <th>$g(x)$</th> </tr> </thead> <tbody> <tr><td>-2</td><td></td></tr> <tr><td>-1</td><td></td></tr> <tr><td>0</td><td></td></tr> <tr><td>1</td><td></td></tr> <tr><td>2</td><td></td></tr> </tbody> </table>	x	$g(x)$	-2		-1		0		1		2		$h(x) = \frac{1}{2}f(x)$ $h(x) =$ <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>x</th> <th>$h(x)$</th> </tr> </thead> <tbody> <tr><td>-2</td><td></td></tr> <tr><td>-1</td><td></td></tr> <tr><td>0</td><td></td></tr> <tr><td>1</td><td></td></tr> <tr><td>2</td><td></td></tr> </tbody> </table>	x	$h(x)$	-2		-1		0		1		2		
x	$f(x)$																																						
-2																																							
-1																																							
0																																							
1																																							
2																																							
x	$g(x)$																																						
-2																																							
-1																																							
0																																							
1																																							
2																																							
x	$h(x)$																																						
-2																																							
-1																																							
0																																							
1																																							
2																																							

Graph the following functions using your graphing calculator. Then, complete the tables and sketch each graph on the provided coordinate plane.

$f(x) = x^2$ <table style="margin-left: auto; margin-right: auto; border-collapse: collapse;"> <thead> <tr> <th style="border-right: 1px solid black; padding: 5px;">x</th> <th style="padding: 5px;">$f(x)$</th> </tr> </thead> <tbody> <tr><td style="border-right: 1px solid black; padding: 5px;">-2</td><td style="padding: 5px;"></td></tr> <tr><td style="border-right: 1px solid black; padding: 5px;">-1</td><td style="padding: 5px;"></td></tr> <tr><td style="border-right: 1px solid black; padding: 5px;">0</td><td style="padding: 5px;"></td></tr> <tr><td style="border-right: 1px solid black; padding: 5px;">1</td><td style="padding: 5px;"></td></tr> <tr><td style="border-right: 1px solid black; padding: 5px;">2</td><td style="padding: 5px;"></td></tr> </tbody> </table>	x	$f(x)$	-2		-1		0		1		2		$g(x) = f(2x)$ $g(x) =$ <table style="margin-left: auto; margin-right: auto; border-collapse: collapse;"> <thead> <tr> <th style="border-right: 1px solid black; padding: 5px;">x</th> <th style="padding: 5px;">$g(x)$</th> </tr> </thead> <tbody> <tr><td style="border-right: 1px solid black; padding: 5px;"></td><td style="padding: 5px;">4</td></tr> <tr><td style="border-right: 1px solid black; padding: 5px;"></td><td style="padding: 5px;">1</td></tr> <tr><td style="border-right: 1px solid black; padding: 5px;"></td><td style="padding: 5px;">0</td></tr> <tr><td style="border-right: 1px solid black; padding: 5px;"></td><td style="padding: 5px;">1</td></tr> <tr><td style="border-right: 1px solid black; padding: 5px;"></td><td style="padding: 5px;">4</td></tr> </tbody> </table>	x	$g(x)$		4		1		0		1		4	$h(x) = f\left(\frac{1}{2}x\right)$ $h(x) =$ <table style="margin-left: auto; margin-right: auto; border-collapse: collapse;"> <thead> <tr> <th style="border-right: 1px solid black; padding: 5px;">x</th> <th style="padding: 5px;">$h(x)$</th> </tr> </thead> <tbody> <tr><td style="border-right: 1px solid black; padding: 5px;"></td><td style="padding: 5px;">4</td></tr> <tr><td style="border-right: 1px solid black; padding: 5px;"></td><td style="padding: 5px;">1</td></tr> <tr><td style="border-right: 1px solid black; padding: 5px;"></td><td style="padding: 5px;">0</td></tr> <tr><td style="border-right: 1px solid black; padding: 5px;"></td><td style="padding: 5px;">1</td></tr> <tr><td style="border-right: 1px solid black; padding: 5px;"></td><td style="padding: 5px;">4</td></tr> </tbody> </table>	x	$h(x)$		4		1		0		1		4	
x	$f(x)$																																						
-2																																							
-1																																							
0																																							
1																																							
2																																							
x	$g(x)$																																						
	4																																						
	1																																						
	0																																						
	1																																						
	4																																						
x	$h(x)$																																						
	4																																						
	1																																						
	0																																						
	1																																						
	4																																						

Summary (to be completed as a class)

INPUT (change in x -values)		OUTPUT (change in y -values)	
$f(x-h)$		$f(x)+k$	
$f(-x)$		$-f(x)$	
$f(bx)$		$af(x)$	