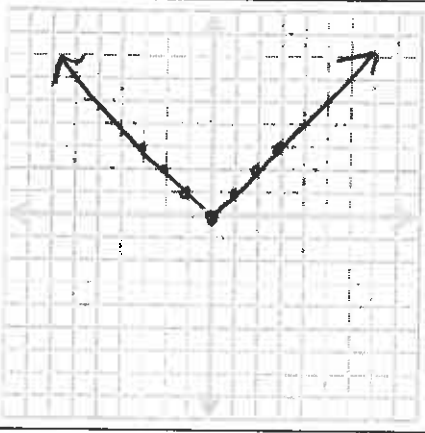


13.2: Transformations of Absolute Value Functions
Horizontal and Vertical Shifts

Recall the Parent Function, $y = |x|$:

x	y
-3	3
-2	2
-1	1
0	0
1	1
2	2
3	3



What is the vertex? $(0,0)$

Is there any value that cannot be plugged in for x because they would give us non-real undefined output?

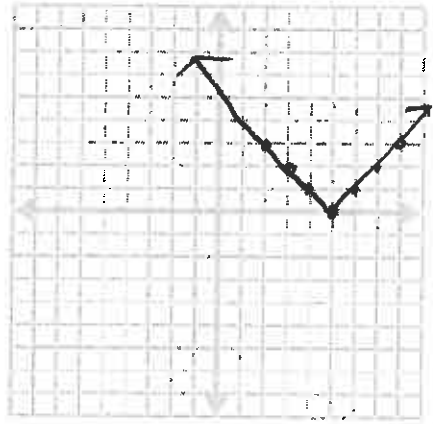
The Domain is All Real Numbers

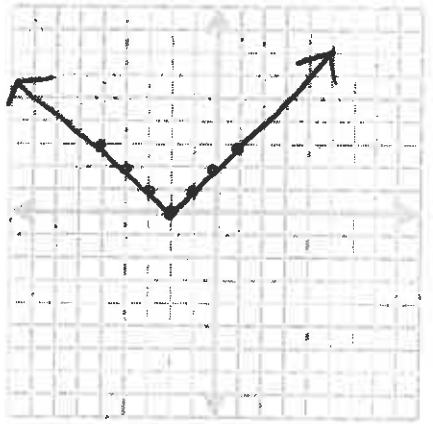
Are there any y-values that are not possible? Values less than 0

The Range is $y \geq 0$

In the function $y = a|x - h| + k$, we observed that "h" caused a horizontal shift to the parent function. A horizontal shift affects the x values of the parent function table only.

Graph each of the following by describing the transformation and creating the parent and transformed tables of values.

<p>1. $f(x) = x - 5$</p> <p>Transformation to parent function: <u>Shift right 5 units</u></p> <p>Domain: <u>All Real Numbers</u></p>	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th colspan="2">Parent:</th> <th colspan="2">$f(x) = x - 5$</th> </tr> <tr> <th>x</th><th>y</th><th>x+5</th><th>y</th></tr> <tr><td>-3</td><td>3</td><td>2</td><td>3</td></tr> <tr><td>-2</td><td>2</td><td>3</td><td>2</td></tr> <tr><td>-1</td><td>1</td><td>4</td><td>1</td></tr> <tr><td>0</td><td>0</td><td>5</td><td>0</td></tr> <tr><td>1</td><td>1</td><td>6</td><td>1</td></tr> <tr><td>2</td><td>2</td><td>7</td><td>2</td></tr> <tr><td>3</td><td>3</td><td>8</td><td>3</td></tr> </table> <p>Range: <u>$y \geq 0$</u></p>	Parent:		$f(x) = x - 5 $		x	y	x+5	y	-3	3	2	3	-2	2	3	2	-1	1	4	1	0	0	5	0	1	1	6	1	2	2	7	2	3	3	8	3	
Parent:		$f(x) = x - 5 $																																				
x	y	x+5	y																																			
-3	3	2	3																																			
-2	2	3	2																																			
-1	1	4	1																																			
0	0	5	0																																			
1	1	6	1																																			
2	2	7	2																																			
3	3	8	3																																			

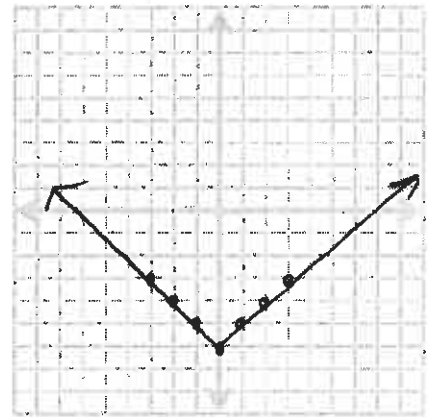
<p>2. $f(x) = x + 2$</p> <p>Transformation to parent function: <u>Shift left 2 units</u></p> <p>Domain: <u>All Real Numbers</u></p>	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th colspan="2">Parent:</th> <th colspan="2">$f(x) = x + 2$</th> </tr> <tr> <th>x</th><th>y</th><th>x-2</th><th>y</th></tr> <tr><td>-3</td><td>3</td><td>-5</td><td>3</td></tr> <tr><td>-2</td><td>2</td><td>-4</td><td>2</td></tr> <tr><td>-1</td><td>1</td><td>-3</td><td>1</td></tr> <tr><td>0</td><td>0</td><td>-2</td><td>0</td></tr> <tr><td>1</td><td>1</td><td>-1</td><td>1</td></tr> <tr><td>2</td><td>2</td><td>0</td><td>2</td></tr> <tr><td>3</td><td>3</td><td>1</td><td>3</td></tr> </table> <p>Range: <u>$y \geq 0$</u></p>	Parent:		$f(x) = x + 2 $		x	y	x-2	y	-3	3	-5	3	-2	2	-4	2	-1	1	-3	1	0	0	-2	0	1	1	-1	1	2	2	0	2	3	3	1	3	
Parent:		$f(x) = x + 2 $																																				
x	y	x-2	y																																			
-3	3	-5	3																																			
-2	2	-4	2																																			
-1	1	-3	1																																			
0	0	-2	0																																			
1	1	-1	1																																			
2	2	0	2																																			
3	3	1	3																																			

In the function $y = a|x-h|+k$, we observed that "k" caused a vertical shift to the parent function. A vertical shift affects the y values of the parent function table only.

3. $f(x) = |x| - 6$
 Transformation to parent function:
 Shift down 6 units

Parent: $y = x $		$f(x) = x - 6$	
x	y	x	y
-3	3	-3	-3
-2	2	-2	-4
-1	1	-1	-5
0	0	0	-6
1	1	1	-5
2	2	2	-4
3	3	3	-3

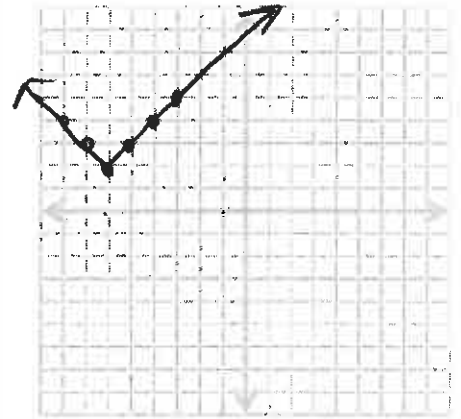
Domain: All Real Numbers Range: $y \geq -6$



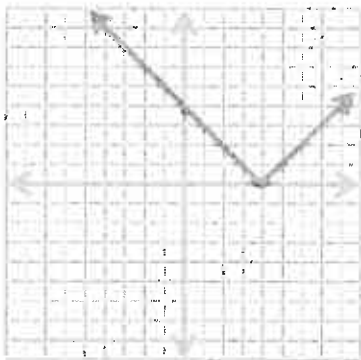
4. $f(x) = |x+6| + 2$
 Transformation to parent function:
 Shift left six
 Shift up 2

Parent: $y = x $		$f(x) = x+6 + 2$	
x	y	x-6	y+2
-3	3	-9	5
-2	2	-8	4
-1	1	-7	3
0	0	-6	2
1	1	-5	3
2	2	-4	4
3	3	-3	5

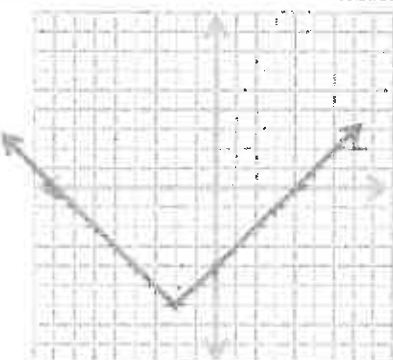
Domain: All Real Numbers Range: $y \geq 2$



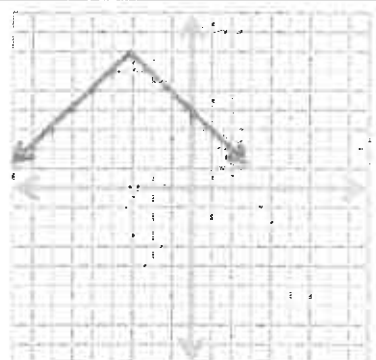
Determine the vertex, domain, and range of each function. Then, write an equation for the function.

5. 

Vertex: (4, 0)
 Domain: All Real Numbers
 Range: $y \geq 0$
 Equation: $f(x) = |x-4|$

6. 

Vertex: (-2, -6)
 Domain: All Real Numbers
 Range: $y \geq -6$
 Equation: $f(x) = |x+2| - 6$

7. 

Vertex: (-3, 7)
 Domain: All Real Numbers
 Range: $y \leq 7$
 Equation: $f(x) = |x+3| + 7$