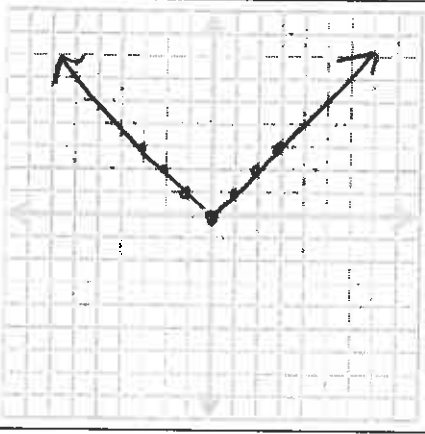


**13.2: Transformations of Absolute Value Functions**  
**Horizontal and Vertical Shifts**

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

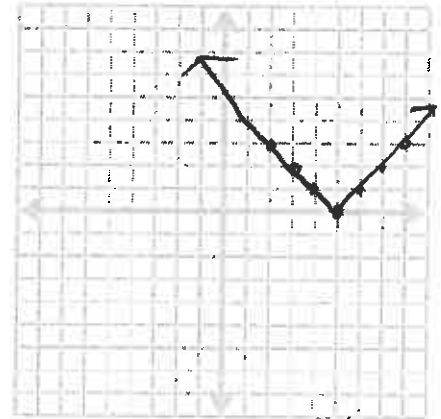
Are there any y-values that are not possible? Values less than 0

The Range is  $y \geq 0$

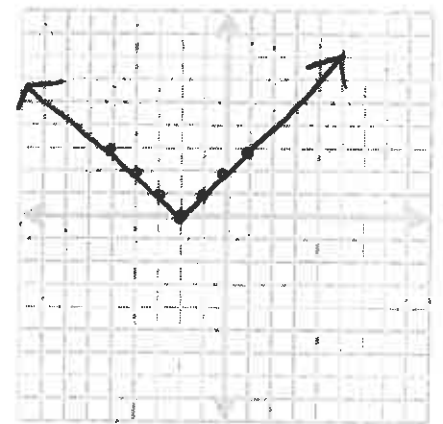
In the function  $y = a|x - h| + k$ , we observed that "h" caused a horizontal shift to the parent function. A horizontal shift affects the x values of the parent function table only.

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

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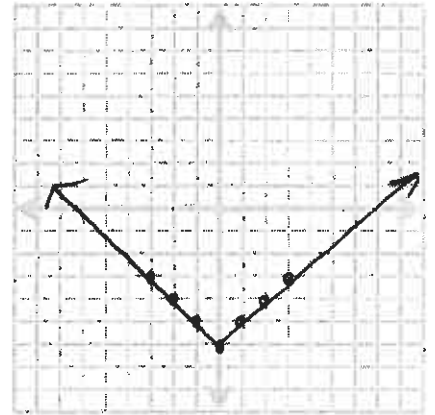


<p>2. <math>f(x) =  x + 2 </math></p> <p>Transformation to parent function:  <u>Shift left 2 units</u></p> <p>Domain: <u>All Real Numbers</u></p>	<p>Parent:</p> <table border="1" style="margin: auto;"> <tr><th>x</th><th>y</th></tr> <tr><td>-3</td><td>3</td></tr> <tr><td>-2</td><td>2</td></tr> <tr><td>-1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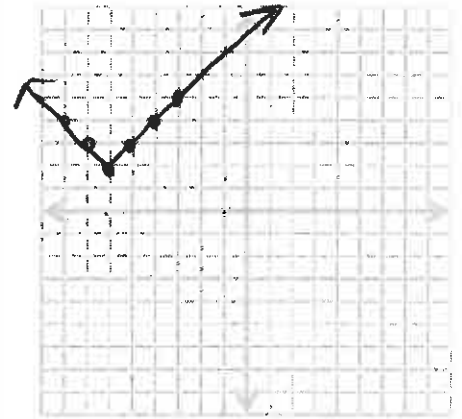


In the function  $y = a|x-h|+k$ , we observed that "k" caused a vertical shift to the parent function. A vertical shift affects the y values of the parent function table only.

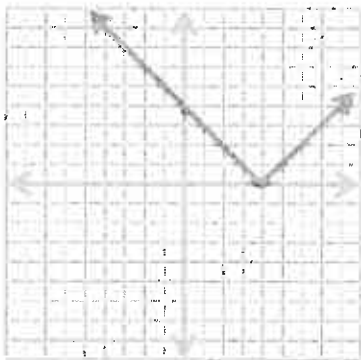
3. $f(x) =  x  - 6$ Transformation to parent function: Shift down 6 units	Parent: $y =  x $	$f(x) =  x  - 6$		
	x	y	x	y
	-3	3	-3	-3
	-2	2	-2	-4
	-1	1	-1	-5
	0	0	0	-6
	1	1	1	-5
	2	2	2	-4
	3	3	3	-3
Domain: All Real Numbers	Range: $y \geq -6$			



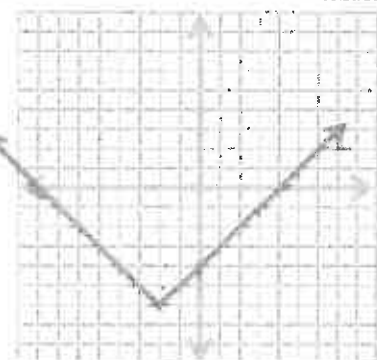
4. $f(x) =  x+6  + 2$ Transformation to parent function: Shift left six Shift up 2	Parent: $y =  x $	$f(x) =  x+6  + 2$		
	x	y	x	y
	-3	3	-9	5
	-2	2	-8	4
	-1	1	-7	3
	0	0	-6	2
	1	1	-5	3
	2	2	-4	4
	3	3	-3	5
Domain: All Real Numbers	Range: $y \geq 2$			



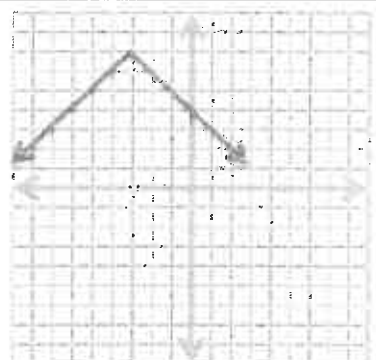
Determine the vertex, domain, and range of each function. Then, write an equation for the function.

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:  $f(x) = |x+3| + 7$