Notes: Absolute Value Functions

Graph the following piecewise function:

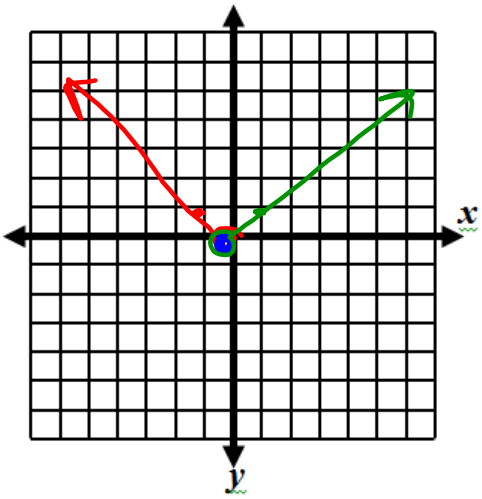
$$f(x)=\begin{cases}-x, & x<0\\ 0, & x=0\\ x, & x>0\end{cases}$$

x	-x
0	0
-1	1

0

x	x
0	0
1	1

0



The general equation of an Absolute Value Function is:

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

Vertex: (h,k)

Let's add this to our Function Toolkit.....

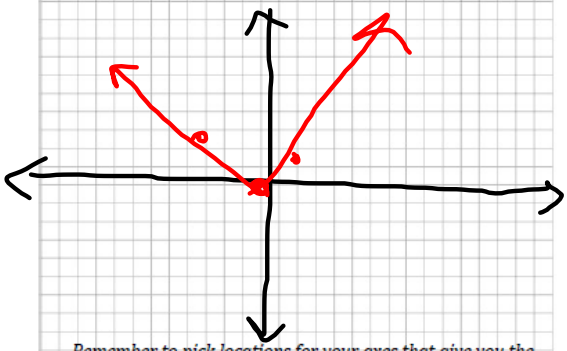
Function: $f(x)=|x|$

Family: Absolute Value Function

Key Points

x	$f(x)$
-3	3
0	0
1	1
585	585

Graph the Axes and the Function



Remember to pick locations for your axes that give you the best picture of your function and then label your axes.

Domain	
Written Description	Interval Notation
all real #s	$(-\infty,\infty)$
Range	
Written Description	Interval Notation
all positive #s and 0 no negative #s	$[0,\infty)$
Intercepts:	$(0,0)$
Symmetry:	y-axis
Why is this a function?	

Write at least one thing that describes this function that will help you remember it.
ex. a description of the shape, where it crosses the x-axis, how it's different from another similar function

Transformations of the Absolute Value Parent Function $f(x) = \|x\|$		
Transformation	***f*(*x*) Notation**	**Examples**
Vertical Translation	$f(x)+k$ $k>0$ shifts ↑ $k<0$ shifts ↓	$g(x)=\|x\|+2$ shifts up 2
Horizontal Translation	$f(x-h)$ $h>0$ shifts → $h<0$ shifts ←	$g(x)=\|x+2\|$ shifts left 2 $h=-2$
Vertical Stretch/Compression	$af(x)$ $\|a\|>1$ vert. stretch $\|a\|<1$ vert. compression	$g(x)=2\|x\|$ vert. stretch by factor of 2
Reflection	$-f(x)$	$g(x)=-\|x\|$ reflection in x-axis

Let $g(x)$ be the indicated transformation(s) of $f(x) = \|x\|$. Write the rule for $g(x)$.		
Vertical translation up three. $g(x)=\|x\|+3$	Vertical compression by a factor of ½ $g(x)=\frac{1}{2}\|x\|$	Horizontal translation to the right 3 and vertical translation up 5. $g(x)=\|x-3\|+5$
Reflection in the *x*-axis. $g(x)=-\|x\|$	Vertical stretch by a factor of 3. $g(x)=3\|x\|$	Reflection in the *x*-axis, horizontal translation to the left 4, and vertical translation up 1. $g(x)=-\|x+4\|+1$

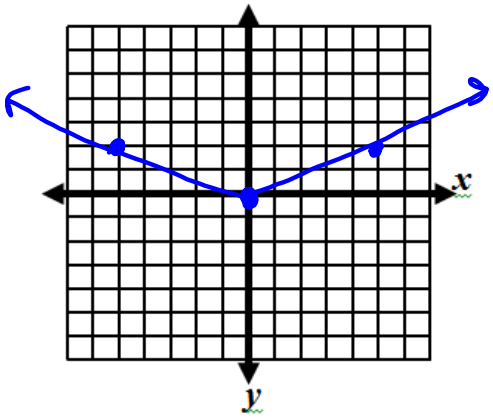
Using the graph of *f*(*x*) = |*x*| as a guide, describe the transformations of each function and identify its domain and range. Then, graph each function.

1. $f(x)=\frac{2}{5}|x|$ Vtx: (0,0)

Transformations:

vertical compression by factor of 2/5

D: $(-\infty,\infty)$ R: $[0,\infty)$

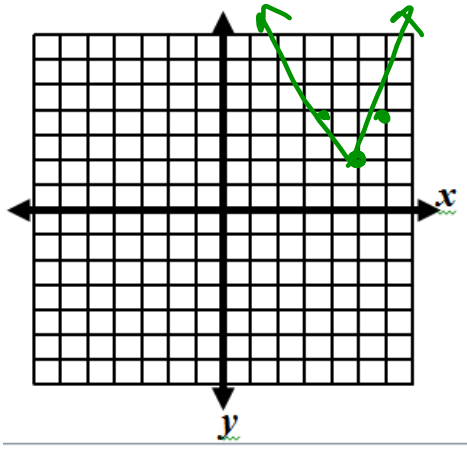


2. $f(x)=2|x-5|+2$ Vtx: (5,2)

Transformations:

up 2
right 5
vert. str by factor of 2

D: $(-\infty,\infty)$ R: $[2,\infty)$



3. $f(x)=-\frac{2}{3}|x|-3$

Transformations:

D: R: