

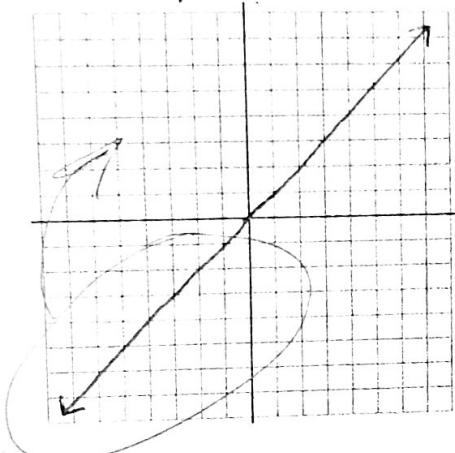
## 8.1 Graphing Transformations

### Absolute Value Equations

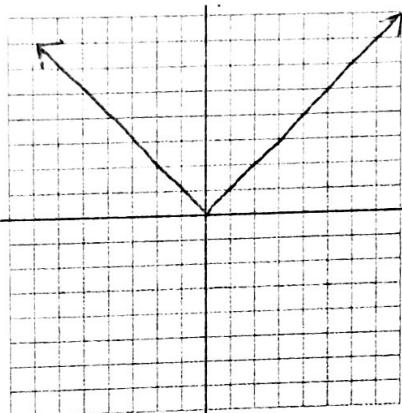
What does an absolute value function do? Makes values positive (distance from 0)

Let's see what that looks like on a graph:

$$y = x$$



$$y = |x|$$



Parent Graph of  $y = |x|$

Vertex at  $(0, 0)$

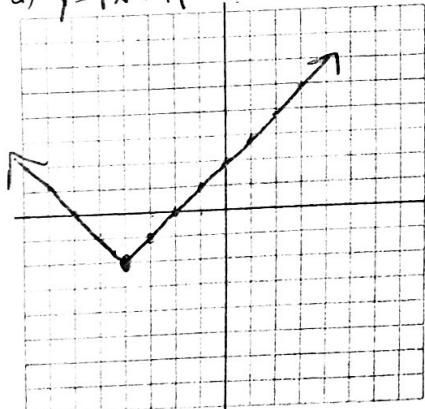
$$y = x \text{ for } x > 0$$

$$y = -x \text{ for } x < 0$$

aka slope of 1 in  
both directions

1) Graph each equation below:

a)  $y = |x+4| - 2$



Vertex:  $(-4, -2)$

Max/min value:  $-2$

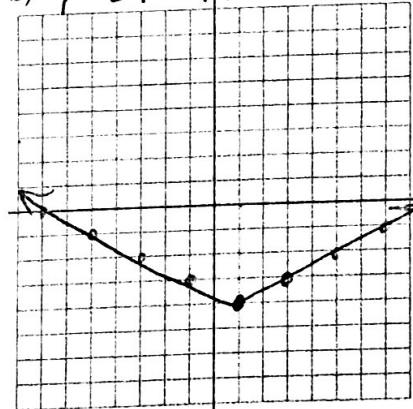
Domain:  $(-\infty, \infty)$

Range:  $[-2, \infty)$

Transformations

Horizontal shift left 4  
Vertical shift down 2

b)  $y = \frac{1}{2}|x-1| - 4$



Vertex:  $(1, -4)$

Max/min value:  $-4$

Domain:  $(-\infty, \infty)$

Range:  $[-4, \infty)$

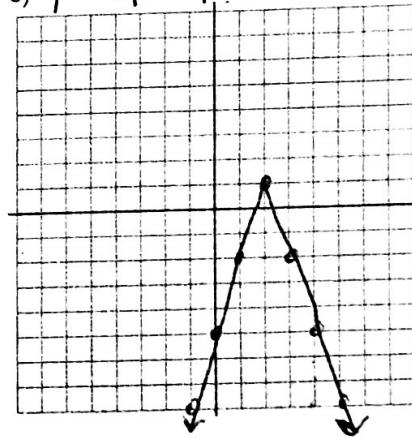
Transformations

Vertical compression  
of  $\frac{1}{2}$   
or

Vertical compression by  
factor of  $\frac{1}{2}$

Horizontal shift right 1  
Vertical shift down 4

c)  $y = -3|x-2| + 1$



Vertex:  $(2, 1)$

Max/min value:  $1$

Domain:  $(-\infty, \infty)$

Range:  $(-\infty, 1]$

Transformations

Reflection over x-axis  
Vertical stretch by factor of 3  
Horizontal shift right 2  
Vertical shift up 1

Begin by graphing each quadratic equation below:

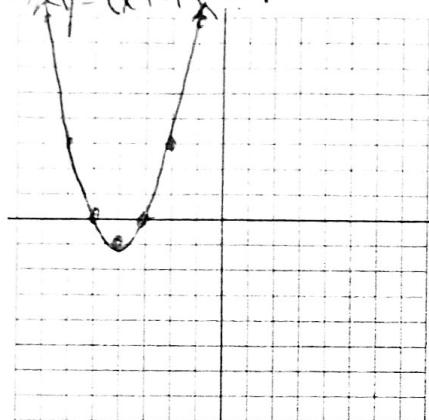
$$a=1$$

$$1a=1$$

$$3a=3$$

$$5a=5$$

a)  $y = (x+4)^2 - 1$



Vertex:  $(-4, -1)$

Max/min value:  $-1$

Domain:  $(-\infty, \infty)$

Range:  $[-1, \infty)$

#### Transformations

Horizontal shift left 4

Vertical shift down 1

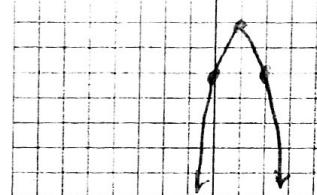
b)  $y = -2(x-1)^2 - 1$

$$a=-2$$

$$1a=-2$$

$$3a=-6$$

$$5a=-10$$



Vertex:  $(1, -1)$

Max/min value:  $-1$

Domain:  $(-\infty, \infty)$

Range:  $(-\infty, -1]$

#### Transformations

Reflection over x-axis

Vertical stretch by factor of 2

Horizontal shift right 1

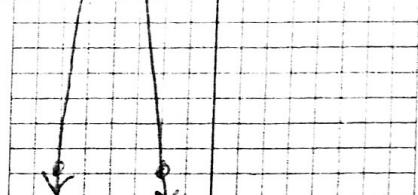
Vertical shift down 1

c)  $y = -3(x+4)^2 + 5$

$$a=-3$$

$$1a=-3$$

$$3a=-9$$



Vertex:  $(-4, 5)$

Max/min value:  $5$

Domain:  $(-\infty, \infty)$

Range:  $(-\infty, 5]$

#### Transformations

Reflection over x-axis

Vertical stretch by factor of 3

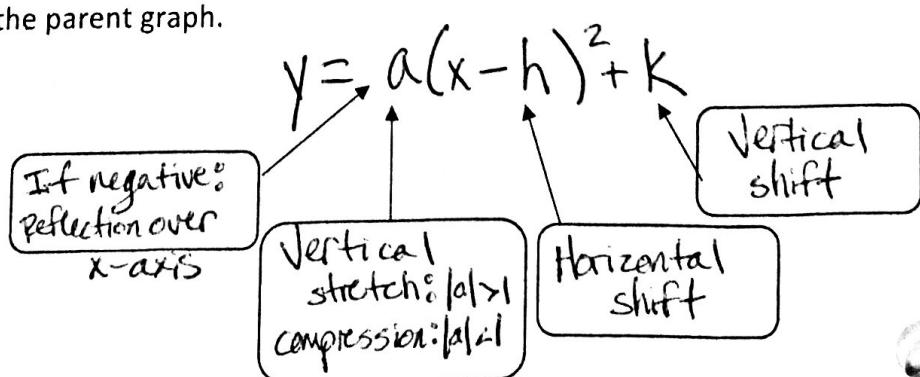
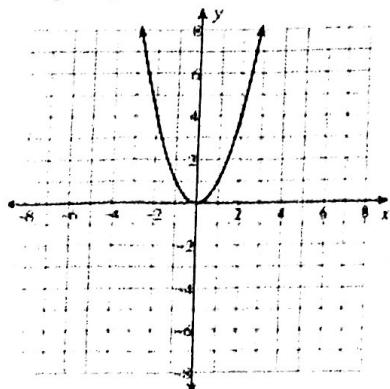
Horizontal shift left 4

Vertical shift up 5

Each of the above equations is in vertex form. This form is the most convenient form to graph from since you can easily pick out the starting point of the graph, aka the vertex.

Turns out that **any** kind of equation (linear, quadratic, absolute value, square root, etc.) can be written in this kind of format where it gives you the starting point of your graph. We call it transformational form.

A **transformation** is a description of how the graph has changed from the parent graph. Recall that the parent graph of a quadratic is (shown below). In transformational form, we can see how an equation has changed (aka transformed) from the parent graph.



Here is what an absolute value equation looks like in transformational form:

$$y = a|x-h|+k$$

If negative, reflection over  $x$ -axis  
Vertical stretch:  $|a| > 1$   
Compression:  $|a| < 1$

Vertical shift

Horizontal shift

3) Identify each parent graph and any transformations associated with each equation.

a.  $y = 4|x| + 5$

Vertical stretch by factor of 4  
Vertical shift up 5

b.  $y = -\frac{2}{3}(x-7)^2$

Reflection over  $x$ -axis  
Vertical compression of  $\frac{2}{3}$   
Horizontal shift right 7

4) Write the equation based on the transformations.

- a. Parent function:  $y = |x|$   
Reflection over the  $x$ -axis  
Vertical compression of  $1/3$   
Vertical shift up 1

$$y = -\frac{1}{3}|x| + 1$$

$$y = 4(x+3)^2$$

4) Write the equation each graph in transformational form.

