Graphs of Parabolas and V-shapes
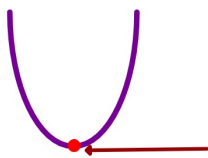
Quadratic Functions

$y = a(x-h)^2 + k$
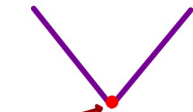
$y = ax^2 + bx + c$

Absolute Value Functions

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

Vertex

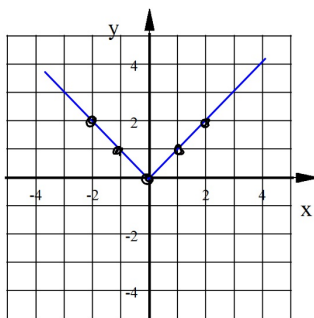| $y = a(x-h)^2 + k$ $y = ax^2 + bx + c$	$y = a|x - h| + k$
opens up $a > 0$	
opens down $a < 0$	

The Parent Function $y = |x|$

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

What is the vertex of the Parent Function?

(0,0)
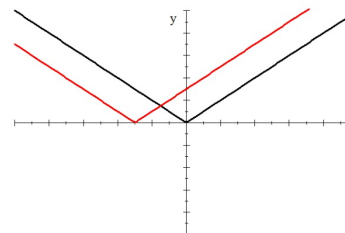
What is the slope of the sides of the Parent Function?

right side: slope = +1

left side: slope = -1

Translations of $y = |x|$ and $y = -|x|$

1. Graph $Y_2 = |x + 3|$ How has this graph moved compared to the parent function?

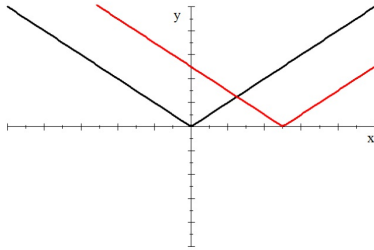moved 3 units left

What are the coordinates of the vertex?

Vertex: (-3,0)

2. Graph $Y_2 = |x - 5|$ How has this graph moved compared to the parent function?

moved 5 units right

What are the coordinates of the vertex?

Vertex: (5,0)

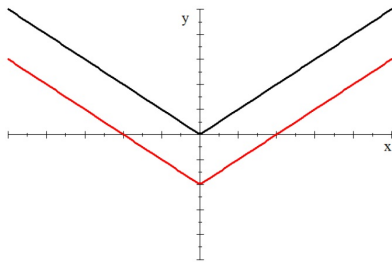3. a) What equation would move the graph of $y = |x|$ 7 units to the left?

$y = |x+7|$

b) What equation would be a translation of $y = |x|$ so that the vertex is $(9,0)$? 9 RT

$y = |x-9|$

4. Graph $Y_2 = |x| - 4$ How has this graph moved compared to the parent function?

moved 4 units down

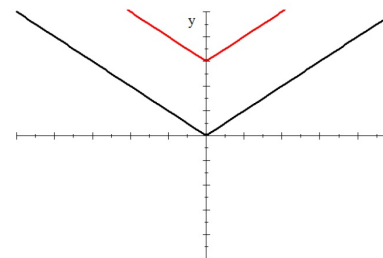What are the coordinates of the vertex?

Vertex: (0,-4)

5. Graph $Y_2 = |x| + 6$ How has this graph moved compared to the parent function?

moved 6 units up

What are the coordinates of the vertex?

Vertex: (0,6)

6. a) What equation would move the graph of $y = |x|$ 2 units up?

$y = |x| + 2$

   b) What equation would be a translation of $y = |x|$ so that the vertex is $(0, -9)$? 9 down

$y = |x| - 9$

Use each description to write the equation of the absolute value function

7. The parent function $y = |x|$ is moved 4 units right and 6 units down.

$y = |x - 4| - 6$

8. The parent function $y = -|x|$ is moved 8 units up and 10 units left.

$y = -|x + 10| + 8$

9. The parent function $y = -|x|$ and the vertex is $(-7, -5)$ 7 Left 5 down

$y = -|x + 7| - 5$

10. Describe the translations of the parent function $y = |x|$
that each equation represents and state the coordinates of the vertex.

a. $y = |x - 8| + 7$

Description:
8 RIGHT
7 up

Vertex:
$(8, 7)$

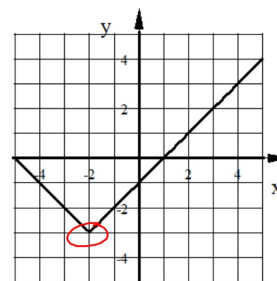b. $y = |x + 10| - 9$

Description:
10 Left
9 down

Vertex:
$(-10, -9)$

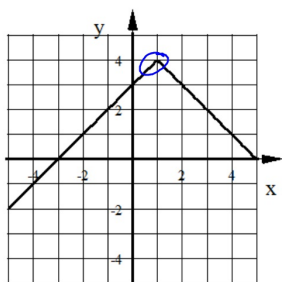11. The graph below is a translation of $y = |x|$.
Write the equation of this function.

$y = |x + 2| - 3$

2 Left 3 down
$(-2, -3)$

12. The graph below is a translation of $y = -|x|$
   Write the equation of this function.
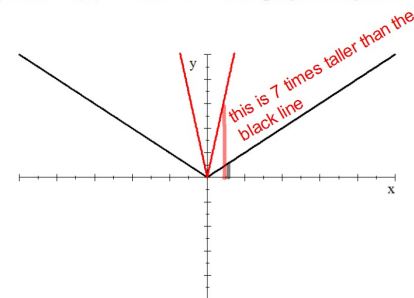

$$y = -|x-1| + 4$$

Vertex is (1,4)

Opens down and graph moved
1 right and 4 up.
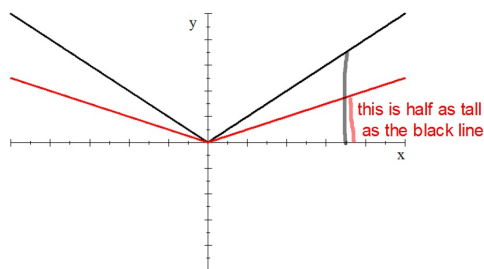

Streches and Shrinks

$y = a|x|$ This equation represents either a strecth (taller) or a shrink (shorter) V-shape.

1. Graph $Y_2 = 7|x|$ How does this graph compare to the parent function $y = |x|$?

this is 7 times taller than the black line

7 x Taller

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2. Graph $Y_2 = \frac{1}{2}|x|$ How does this graph compare to the parent function $y = |x|$?

this is half as tall as the black line

$\frac{1}{2}$ as tall

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3. Write the equation of an absolute value function that is one-fourth as tall as $y = |x|$
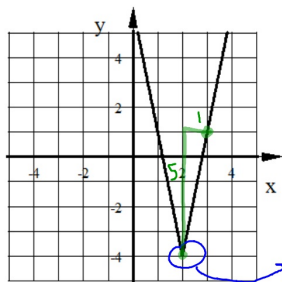
$$Y_2 = \frac{1}{4}|x|$$

4. Write the equation of an absolute value function that is 3 times taller as $y = |x|$ but opens down.

$$y = -3|x|$$

$\boxed{y = a|x| \quad a \text{ also represents the slope of the sides of the absolute value graph.}}$

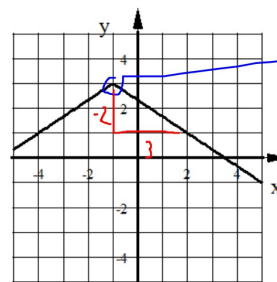5. Write the equation of each absolute value function shown below:

a) EQ:

$$y = ^{+}5 |x - 2| - 4$$

Opens up
Slope of sides = ± 5
moved 2 right and 4 down

$(2, -4)$

b) EQ:

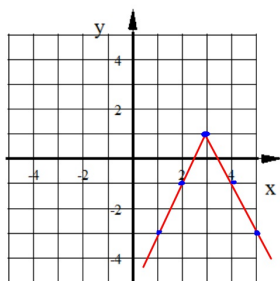Vertex is (-1,3) which means graph moved 1 left and 3 up.

Slope of sides is ± 2/3

Opens down.

$$y = -\frac{2}{3}|x + 1| + 3$$
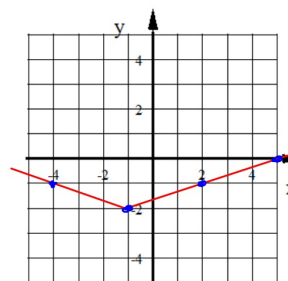
6. Graph each absolute value function.

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

Graph opens down, two times taller (slope of sides = ±2)
graph moved 3 right and 1 up
Vertex (3,1)

b) $y = \frac{1}{3}|x + 1| - 2$

vertex moved 1 left and 2 down (-1,-2)
graph opens up and slope of sides is ± 1/3

Describe all the transformation of y=|x| each equation represents.

1. y = -5|x + 9| - 3

2. y = $\frac{1}{4}$|x - 6| + 11

Opens down
5 times taller (slope of sides = ±5)
moved 9 left and 3 down.

Opens up
1/4 as tall (slope of sides = ±1/4)
moved 6 right and 11 up.

Write the equation of each transformation of y=|x|

1. Translated 12 units up, 7 units left, opens down,
    and is 8 times taller.

$$y = -8|x+7|+12$$

2. Translated 2 units right, 13 units down, is one-third as tall,
    and opens up.

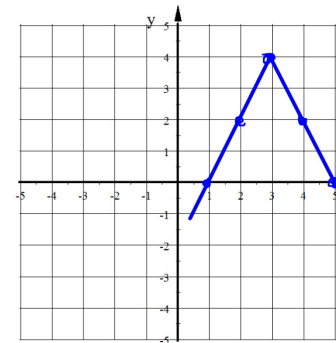$$y = \frac{1}{3}|x-2|-13$$

Absolute Value Equations:

y = a|x - h| + k

Vertex   (h,k)

Slope of the sides: m = ±a

actually the slope is a times the
slope of the parent function:
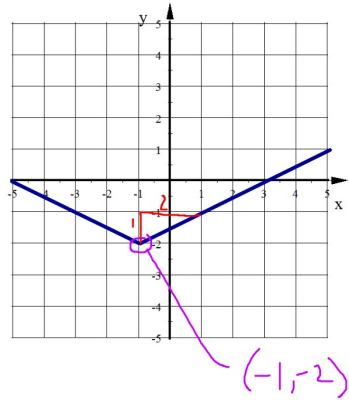(a)(1) = a

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Graph this equation:

y = -2|x - 3| + 4

3 right

4 up

Vertex (3,4)

Opens
down

Slope = 2
(twice as tall)

Write the equation of this graph:

$$y = \frac{1}{2}|x+1| - 2$$

$(-1, -2)$