

# Graphing Absolute Value Functions

General Form:

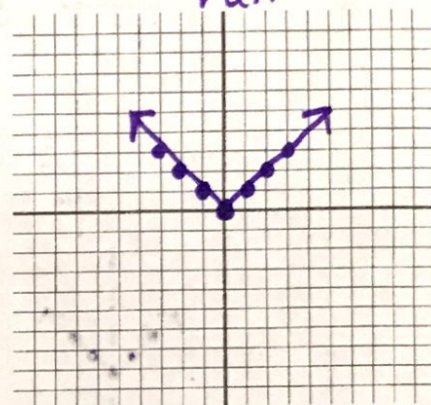
$$y = a|x-h| + k$$

Characteristics:

1. Graph is V-shaped
2. Vertex  $(h, k)$  \* opposite sign for h
3. "a" acts as the slope of right side.  $\frac{\text{rise}}{\text{run}}$

Graph the Parent Absolute Value Function:  $f(x) = |x|$

x	y	ordered pair:
0	0	$(0, 0)$
-1	1	$(-1, 1)$
1	1	$(1, 1)$
-2	2	$(-2, 2)$
2	2	$(2, 2)$
-3	3	$(-3, 3)$
3	3	$(3, 3)$



## Graph Transformations

What effect does each one have on the parent graph?

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

Sign in front of "a" determines if graph opens up (+) or opens down (-)

Determines if graph is wider  $0 < a < 1$  or skinnier  $a > 1$

Moves graph left (+) or right (-)

Moves graph up (+) or down (-)

This means the NEW vertex of the transformed function is  $(h, k)$

Determine the vertex (opposite of h, k) of the following functions.

State whether the graph will open up or down. ("a" positive or negative)

1)  $y = 2|x-2| + 3$   
h      k

V:  $(2, 3)$  opens up

2)  $y = 0|x+5| - 6$

V:  $(-5, -6)$  opens down

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

V:  $(-2, 0)$  opens down

4)  $y = 1/3|x| + 5$

V:  $(0, 5)$  opens up

5)  $y = |x|$

V:  $(0, 0)$  opens up

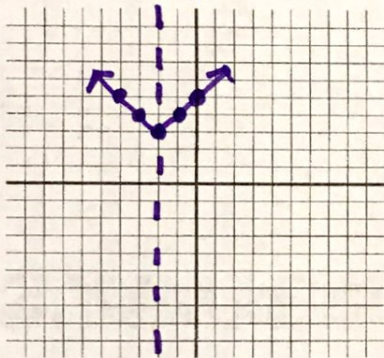
↑ opposite sign

Steps for graphing absolute value functions:

- 1) Find & plot vertex  $(h, k)$
- 2) Find & sketch axis of symmetry  $x = h$
- 3) Use "a" as the slope to find the next 2 points to the right of A.O.S.  $a = \frac{\text{rise}}{\text{run}}$
- 4) Using symmetry, plot 2 additional points on the left of the A.O.S. & then connect points.

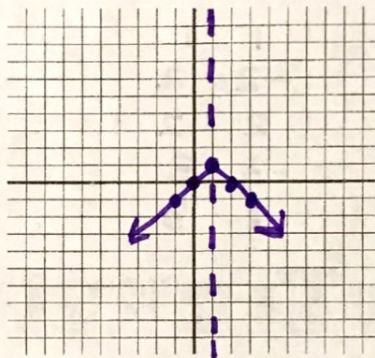
ex 1:  $y = |x + 2| + 3$

Vertex:  $(-2, 3)$   
Slope:  $\frac{1}{1}$



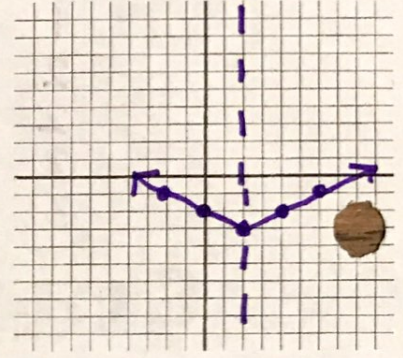
ex 2:  $y = -|x - 1| + 1$

Vertex:  $(1, 1)$   
Slope:  $-\frac{1}{1}$



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

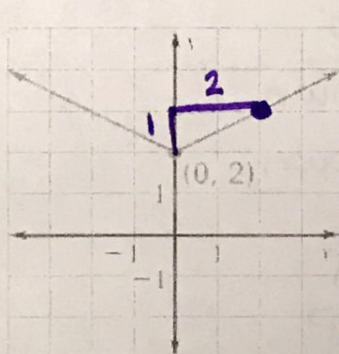
Vertex:  $(2, -3)$   
Slope:  $\frac{1}{2}$



Steps for writing an equation when given an absolute value graph.

- 1) Identify vertex  $(h, k)$
- 2) Determine if "a" is positive or negative by seeing if it's facing up or down.
- 3) Find a point to right of vertex to find the slope, this is "a".
- 4) Plug into  $y = a|x - h| + k$

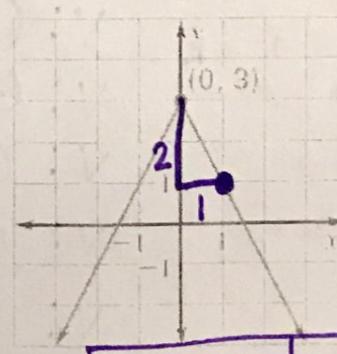
ex 1. Write an equation of the graph shown.



$(h, k): (0, 2)$   
 $a = \frac{1}{2}$

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

ex 2. Write an equation of the graph shown.



$(h, k): (0, 3)$   
 $a = -2$

$y = -2|x| + 3$