

5-8: Graphing Absolute Value Functions

Eye Opener

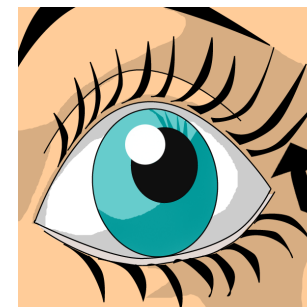
Find each absolute value.

$|2 - 7|$

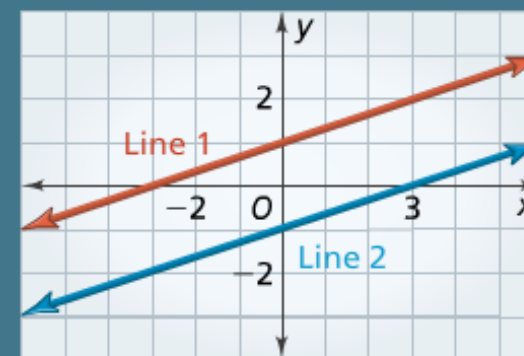
$|7 - 7|$

$|56 - 38|$

$|-24 + 12|$



Write the equations of Line 1 and Line 2. How can you transform the equation of Line 1 into the equation of Line 2? How can you slide Line 1 in the coordinate plane so that it becomes Line 2? Explain.



Essential Understanding

An absolute value function has a V-shaped graph that opens up or down. The parent function of all absolute value functions is $y = |x|$.

The complete formula is $y = a|x - b| + c$

A translation is a shift of a graph horizontally, vertically or both. The result is a graph of the same size and shape, but in a different position.

You can quickly graph absolute value functions by shifting the graph of $y = |x|$



Absolute Value

$$y = a |x - b| + c$$

What are the functions of "x" & "y"?

What does "a" do? 

What does "b" do?  vertex

What does "c" do?  vertex

What is (b,c)? *vertex*

How do you find the y-intercept? What is it? *(0, y)*

How do you find the x-intercepts? What are they?

(x, 0) *0, 1, or 2 intercepts*



Explore various
absolute value
equations & graphs
using the graphing
calculator

In the equation $y = 3|x - 4| + 5$ see if you can find the following without the use of a calculator, then check yourself with the calculator:

Which way will the graph open?

UP

Is the graph wider or narrower than $y = |x|$?

$A=3$

Find the x-intercepts?

let $y = 0$

None

What is the line of symmetry?

$x = 4$

What is the vertex?

$(4, 5)$

Handwritten work for the absolute value function $y = 3|x - 4| + 5$. The work shows the equation $0 = 3|x - 4| + 5$ being simplified to $-\frac{5}{3} = |x - 4|$, demonstrating that there are no x-intercepts. The vertex $(4, 5)$ is also noted.

In the equation $y = \frac{1}{2}|x + 3| - 4$ see if you can find the following without the use of a calculator, then check yourself with the calculator:

Which way will the graph open?

up

Is the graph wider or narrower than $y = |x|$?

What are the x-intercepts?

2 x-intercepts (x, 0)

What is the line of symmetry?

$x = -3$

What is the vertex?

$-3, -4$

$$0 = \frac{1}{2}|x+3| - 4$$

$$4 = \frac{1}{2}|x+3|$$

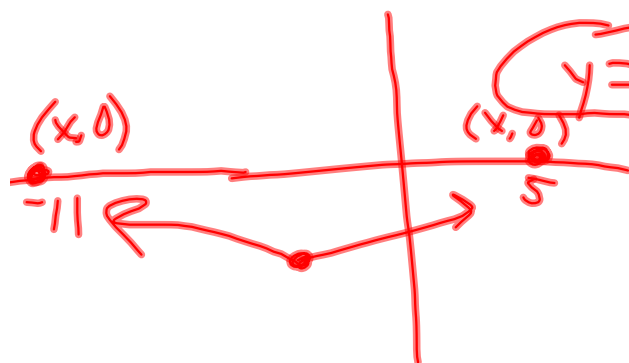
$$8 = |x+3|$$

$$8 = x+3$$

$$x = 5$$

$$-8 = x+3$$

$$-11 = x$$



$$y = a|x - b| + c$$

$$y = \frac{1}{2}|x + 3| - 4$$

$$y = \frac{1}{2}|x - (-3)| - 4$$

$$(-3, -4)$$

In the equation $y = -3|x - 5| + 2$ see if you can find the following without the use of a calculator, then check yourself with the calculator:

Which way will the graph open?

↓ Down

Is the graph wider or narrower than $y = |x|$?

What are the x-intercepts?

$(\frac{4}{3}, 0)$ $(\frac{5}{3}, 0)$ 2

What is the line of symmetry?

$x = 5$

What is the vertex?

$(5, 2)$

what grad is it in?
1st

$$\begin{aligned}
 0 &= -3|x - 5| + 2 \\
 -2 & \quad \quad \quad -2 \\
 \hline
 -2 &= -3|x - 5| \\
 \frac{-2}{-3} &= \frac{-3|x - 5|}{-3} \\
 \frac{2}{3} &= |x - 5| \\
 x - 5 &= \pm \frac{2}{3} \\
 \frac{x - 5}{+5} & \quad \quad \quad \frac{+2/3}{+5} \\
 \hline
 (4 \frac{1}{3}) & \quad \quad \quad (5 \frac{2}{3}) \\
 x &= 5 \pm \frac{2}{3}
 \end{aligned}$$

$$y = a|x-b| + c$$

- 1) open up $3|x|: y$
- 2) open down $-3|x|=y$
- 3) vertex of $(-2, 4)$ $y = |x+2| + 4$
- 4) flatter than $y = |x|$ $x = \frac{1}{2}|x|$
- 5) line of symmetry of #3 $x = -2$

What is the equation of the graph below?

Identify the vertex $(0, 2)$

Identify a 2nd point on the graph.

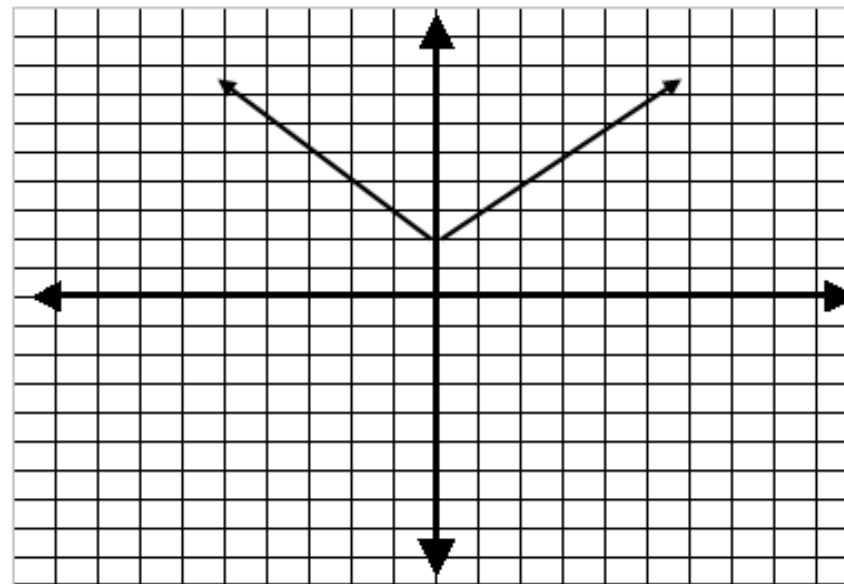
Count off the slope. $a = +1$

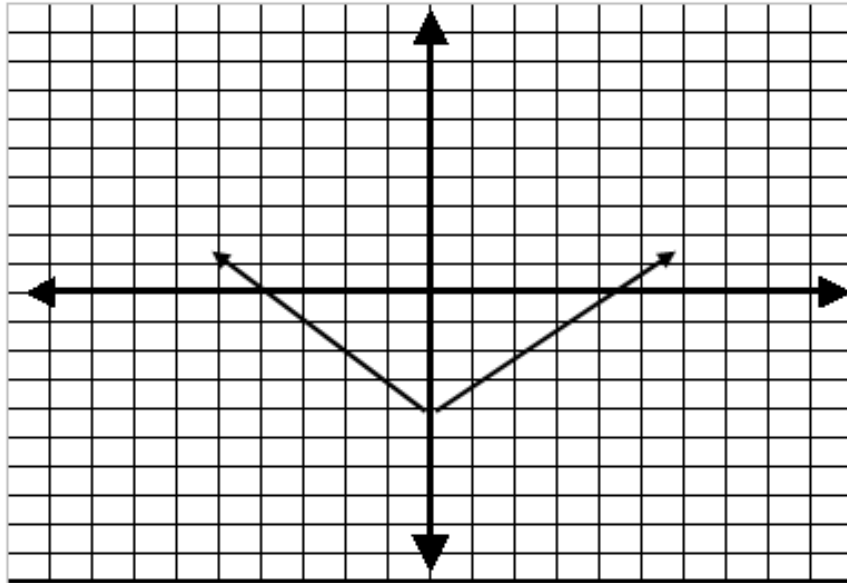
What is the sign of the slope?

$+$

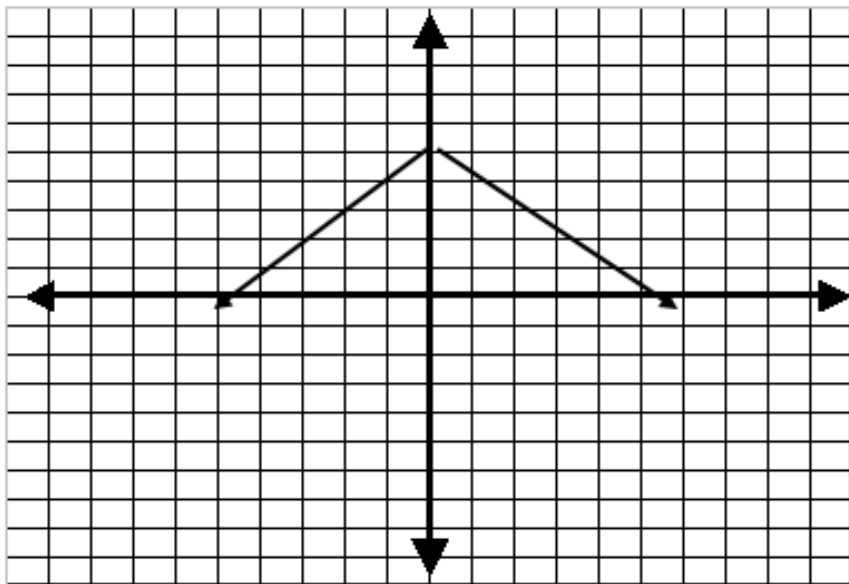
Write the equation

$$y = |x|^{+0} + 2$$

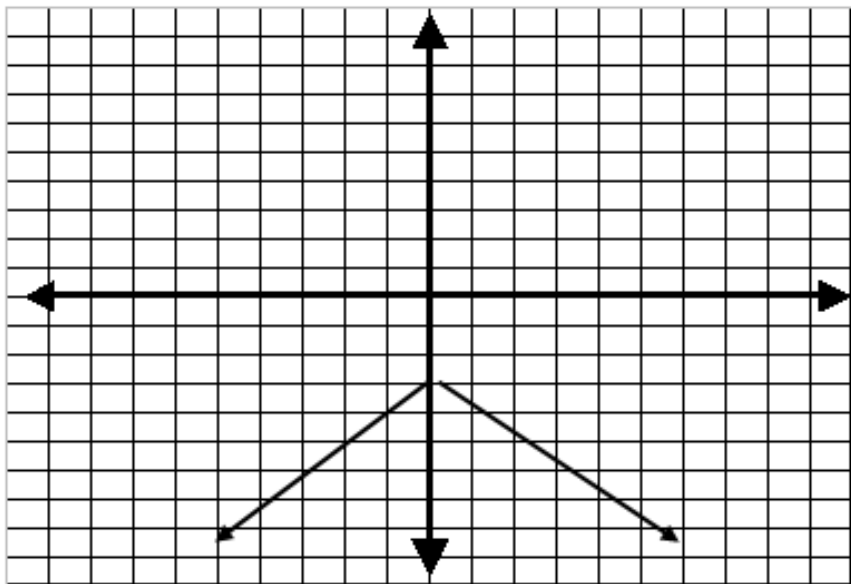




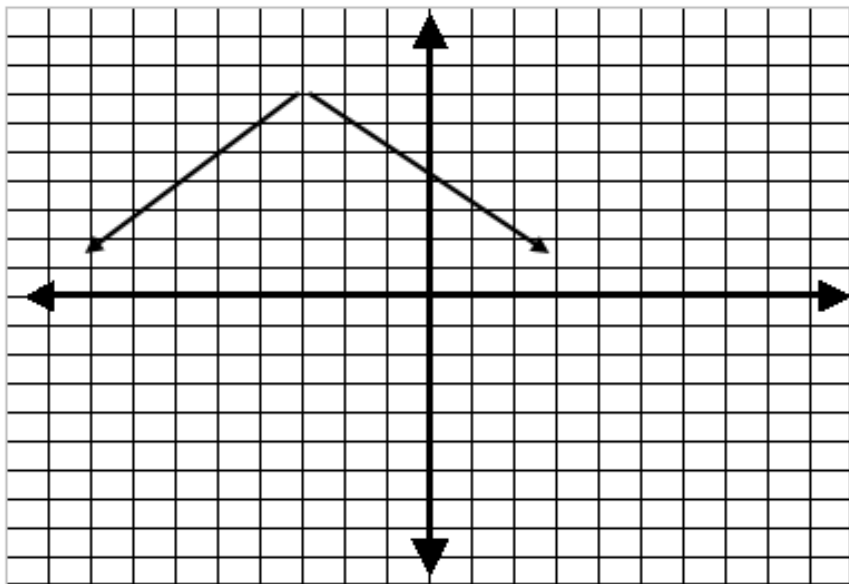
$$y = |x| - 4$$



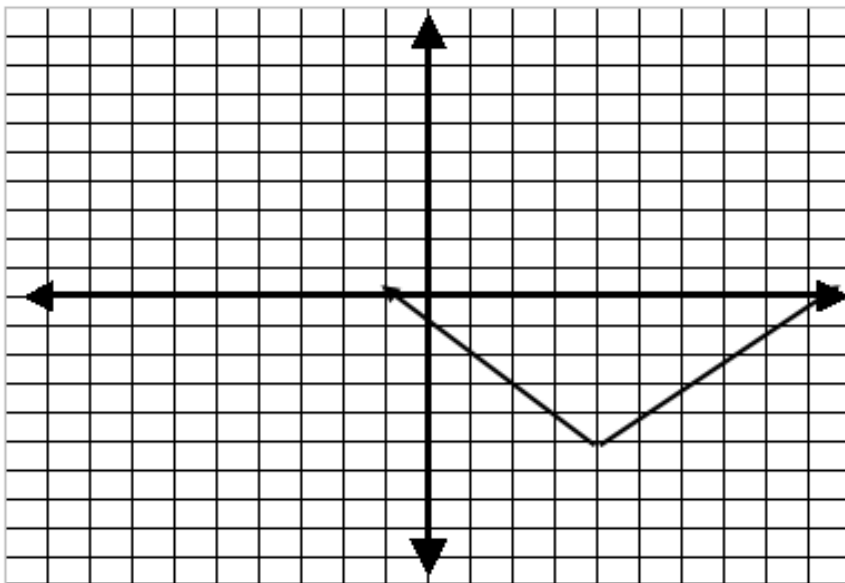
$$y = -|x| + 5$$



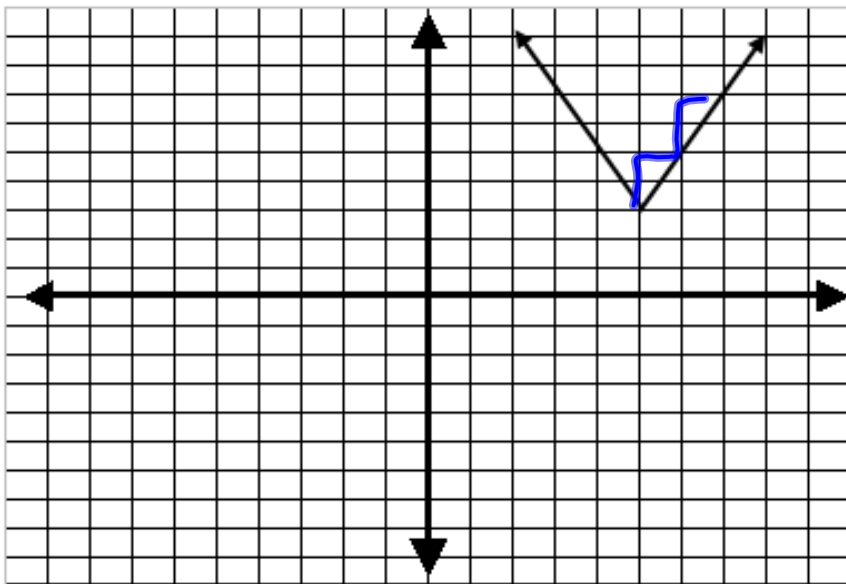
$$y = -|x| - 3$$



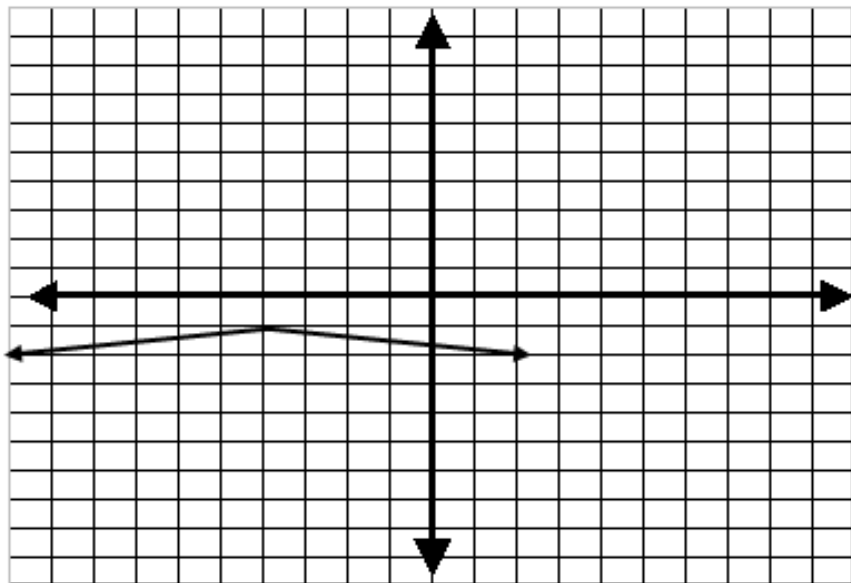
$$y = -|x + 3| + 7$$
$$y = -|x - -3| + 7$$



$$y = |x - 4| - 5$$



$$y = 2|x - 5| + 3$$



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

Translate the graph of $y = 2|x - 5| + 3$ up 4 units on the y-axis

$$y = 2|x - 5| + 7$$

Down 6 units on the y-axis

$$y = 2|x - 5| - 3$$

$$\text{vertex} = (5, 3)$$

→ 7

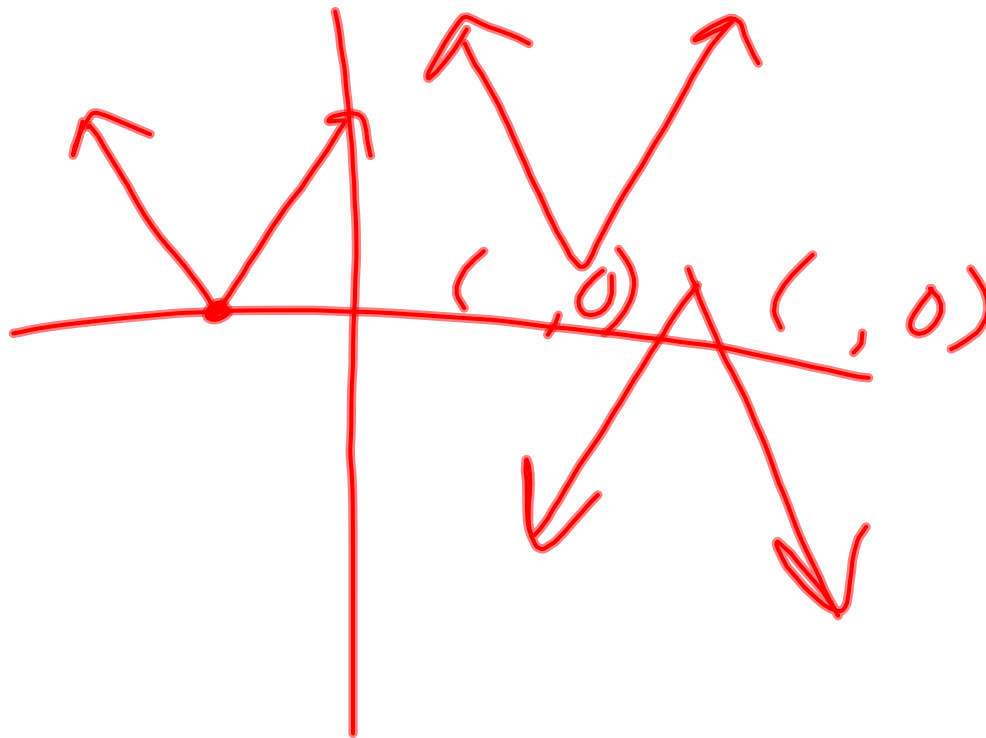
$$\text{new vertex} = (12, 3)$$

Over 7 units to the right

$$y = 2|x - 12| + 3$$

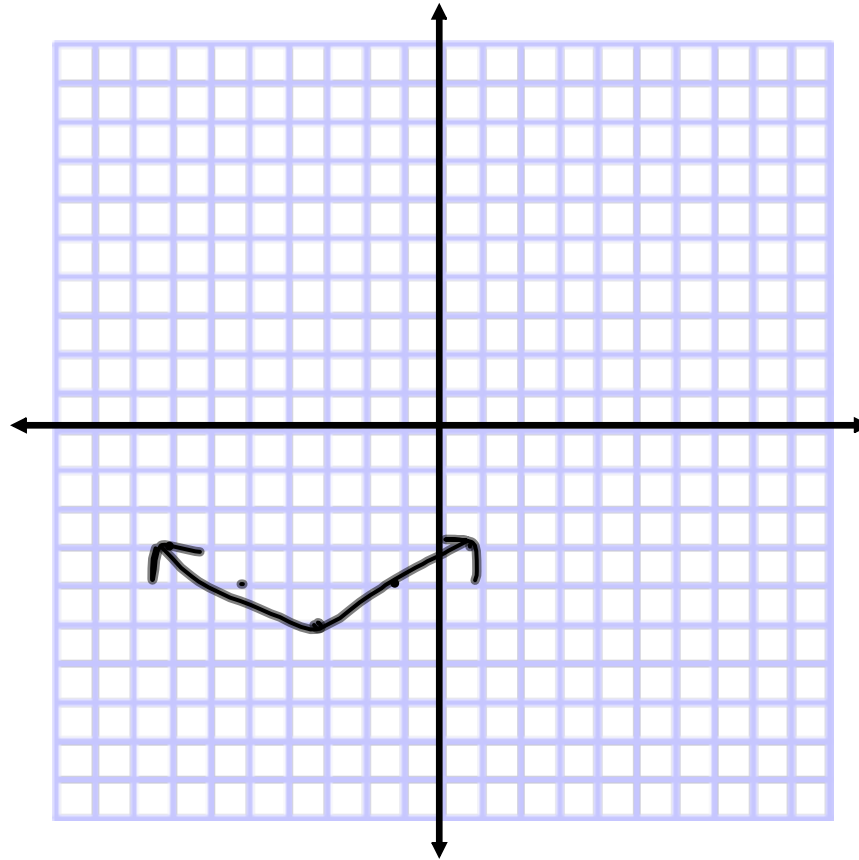
Over 9 units to the left.

$$y = 2|x + 4| + 3 \quad \text{new} = (-4, 3)$$

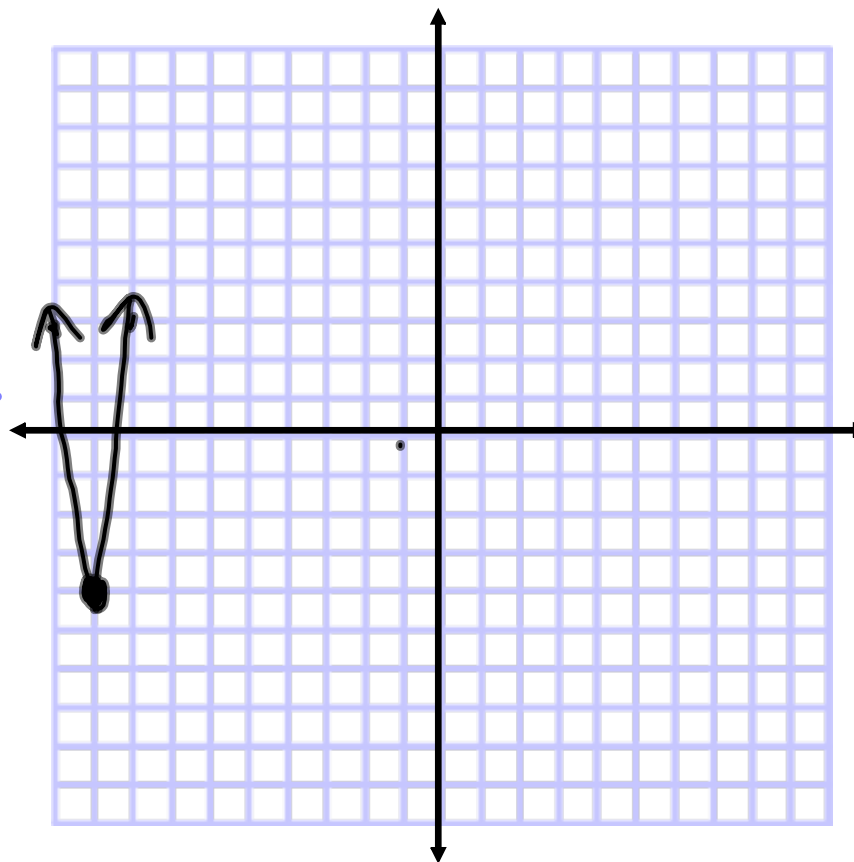


Graph

$$y = \frac{1}{2}|x+3| - 5$$



$$y = 7|x + 18| - 8$$



Eg of abs. value that opens
down, narrower than $y=|x|$
↓ vertex in 4th quad

$$y = -7|x+3| - 4$$

$$y = -69|x-3| - 4$$

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

$$y = -2|x-5| - 3$$

$$y = 4|x-3| - 7$$

$$y = -\frac{3}{2}|x-4| - 3$$

$$y = -3|x-3| - 3$$

$$y = -4|x-2| - 3$$