

Honors Advanced Algebra

Special Functions (Absolute Value)

Date: 9/10

Target 1A. Graph, transform and identify key features of absolute value functions



Absolute Value Function:

Graphing the Absolute Value Function

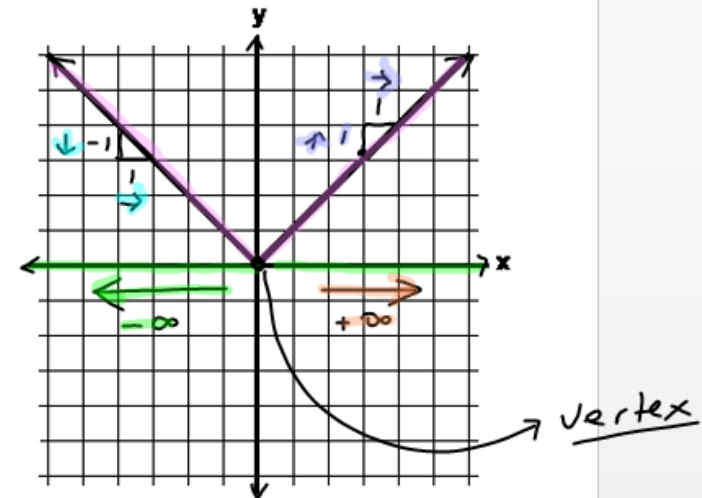
The graph of the absolute value function $f(x) = |x|$ is similar to the graph of $f(x) = x$ except that the "negative" half of the graph is reflected over the x-axis.

Here is the graph of $f(x) = |x|$. (See right)

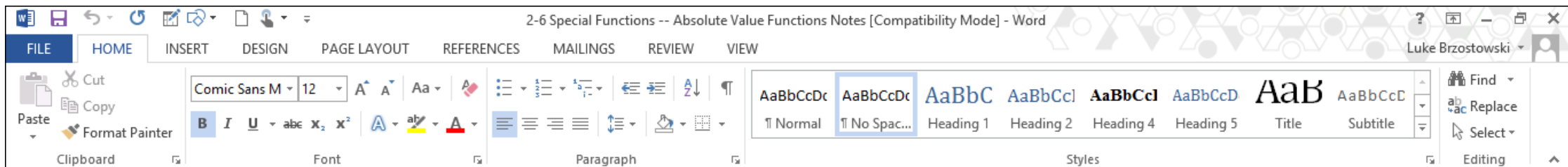
What's the slope of the function where $x > 0$? Positive $\frac{1}{1} \rightarrow$

What's the slope of the function where $x < 0$? Negative $\frac{-1}{1} \downarrow$

Where is the vertex? (h, k)
 $(0, 0)$



Recall Slope intercept form:
 $y = mx + b$
 ↓
 slope
 $\frac{\Delta y}{\Delta x} = \frac{\text{RISE}}{\text{RUN}}$
 ↓
 change in "x"



We can translate, stretch, shrink, and reflect the graph.

$f(x) = a|x-h| + k$
 ← Take opposite of h
 ← "like" slope
 (h, k) vertex

1. $f(x) = 2|x - 1| - 4$

Vertex? (1, -4)

Slope to right of vertex? $\frac{1}{1}$ (with green arrows)

Slope to left of vertex? $-\frac{1}{1}$ (with blue arrows) =

Domain and Range? D: $(-\infty, \infty) = \mathbb{R}$ = all real numbers

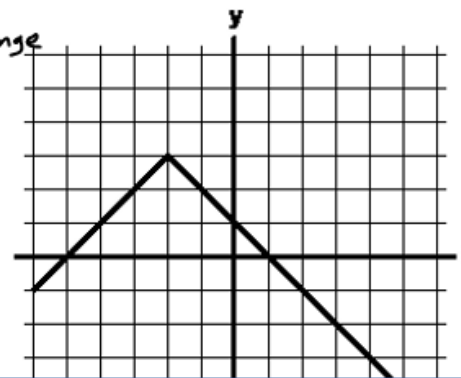
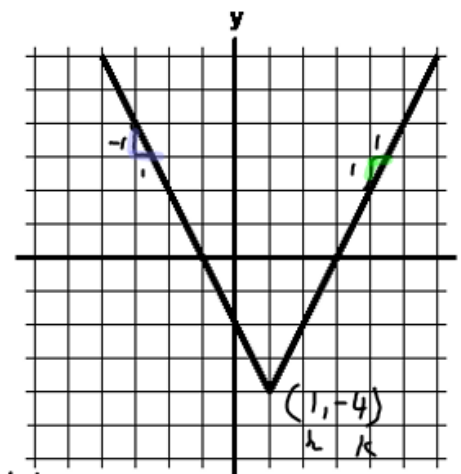
All x-values All y-values R: $[-4, +\infty)$ → parenth. means not included
 ↳ bracket means # included in range

2. $f(x) = -|x + 2| + 3$

Vertex?

Slope to right of vertex?

Slope to left of vertex?



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Domain and Range:

$$2. f(x) = -|x + 2| + 3$$

Vertex? $(-2, 3)$

Slope to right of vertex? $-\frac{1}{1}$

Slope to left of vertex? $\frac{1}{1}$

Domain and Range?

D: $(-\infty, \infty)$ Always same domain... For ever "v" shaped graph

R: $(-\infty, 3]$ Will change from problem to problem

In general, the graph of the absolute value function $f(x) = a|x - h| + k$ is a "v" with vertex

slope $m =$ on the right side of the vertex and slope $m =$ on the

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In general, the graph of the absolute value function $f(x) = a|x - h| + k$ is a "v" with vertex (h, k) , slope $m = \frac{\text{RISE}}{\text{RUN}} = a$ on the right side of the vertex and slope $m = \frac{\text{RISE}}{\text{RUN}} = -a$ on the left side of the vertex.

Practice: Graph the following absolute value functions and state the domain and range.

- $f(x) = |x + 2| - 5$
- $f(x) = -3|x - 1| + 2$

PAGE 1 OF 2 197 WORDS 130%

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Practice: Graph the following absolute value functions and state the domain and range.

$$a = 1$$

points \uparrow b/c a is positive

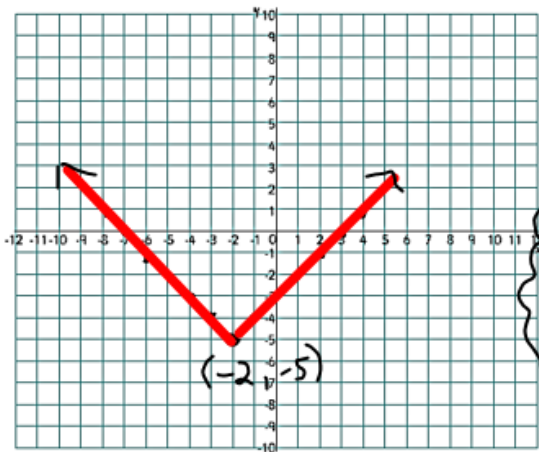


1. $f(x) = |x + 2| - 5$

$$\frac{1 \uparrow}{1 \rightarrow} \text{vertex} = (-2, -5)$$

$$D: (-\infty, \infty) \quad R: (-5, \infty)$$

Recall: x -values y -values



graph goes up to + y values

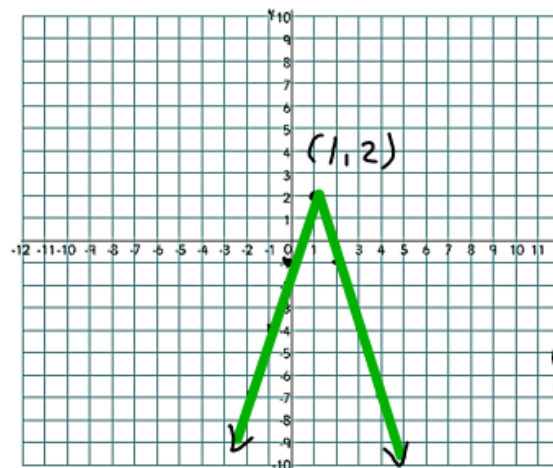
2. $f(x) = -3|x - 1| + 2$

$$\frac{-3 \downarrow}{1 \rightarrow} \text{vertex} = (1, 2)$$

$$D: (-\infty, \infty) \quad R: (-\infty, 2]$$

$$a = -3$$

points \downarrow b/c a is negative



graph goes down to - y values

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3. Write an equation for the following graphs. Then state the domain and range of each.

① $f(x) = a|x-h|+k$

Vertex : $(1, -3)$
 $\quad \quad \quad h \quad k$

Slope = $m = \frac{3 \uparrow}{1 \rightarrow} = 3$

$f(x) = 3|x-1| + (-3) = 3|x-1| - 3$ ✓

D: $(-\infty, \infty)$ R: $[-3, \infty)$

② $f(x) = a|x-h|+k$

Vertex : $(-4, -1)$
 $\quad \quad \quad h \quad k$

Slope = $m = \frac{-3 \downarrow}{1 \rightarrow} = -3$

$f(x) = -3|x-(-4)| + (-1) = -3|x+4| - 1$ ✓

D: $(-\infty, \infty)$ R: $(-\infty, -1]$

