Honors Advanced Algebra
Special Functions (Absolute Value)

Date: 9/10

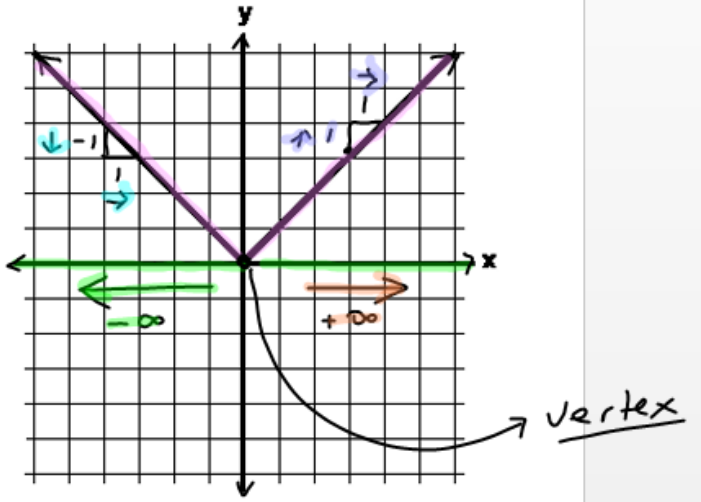
Target 1A. Graph, transform and identify key features of absolute value functions

Absolute Value Function:
Graphing the Absolute Value Function

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

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 $\frac{1}{1}$↑→

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

Where is the vertex? $\overset{h\ k}{(0,0)}$

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

$f(x) = a|x-h|+k$ → Take opposite of h

"like" slope

(h, k) vertex

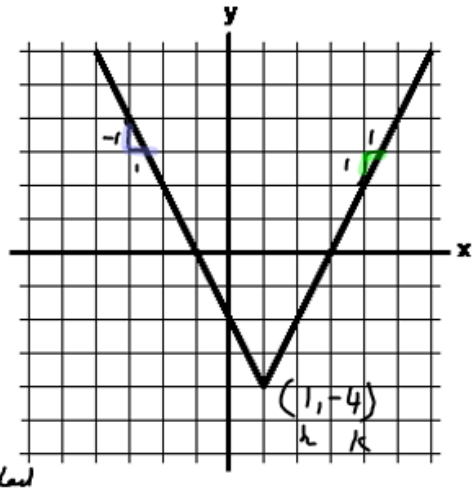
1. $f(x) = 2|x-1|-4$

h k

Vertex? (1, −4)

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

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



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

All x-values

All y-values R: $[-4, +\infty)$ → parenth. means not included

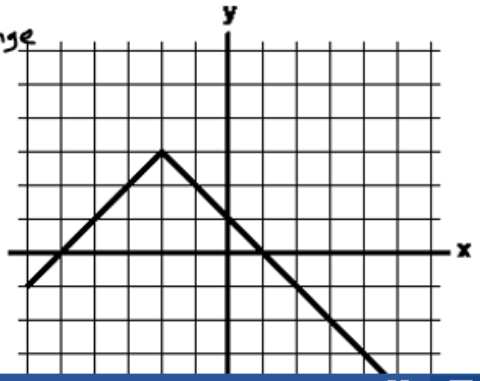
↳ Bracket means # included in range

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

Vertex?

Slope to right of vertex?

Slope to left of vertex?



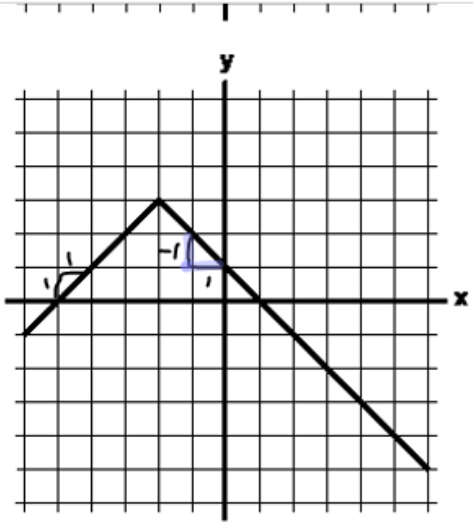
2. $f(x) = -|x + 2| + 3$ (h = −2, k = 3)

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

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

a: RISE/RUN

$-a$: RISE/RUN

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

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

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

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

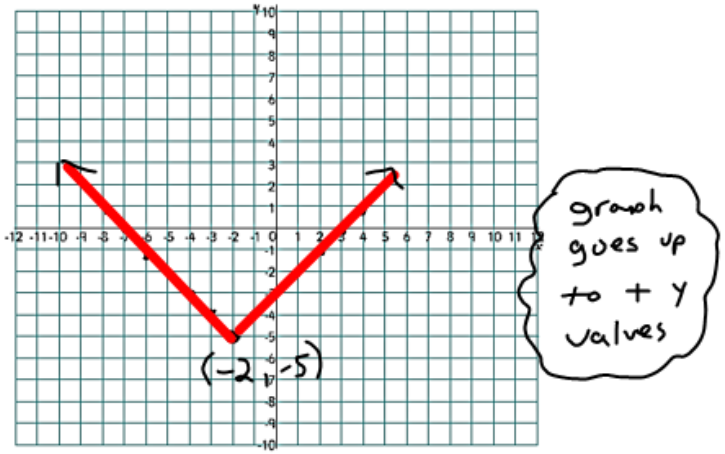
1. $f(x) = |x + 2| - 5$

a = 1
points ↑ b/c a is positive

1 ↑ / 1 → vertex = (−2, −5)

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

Recall: x-values y-values

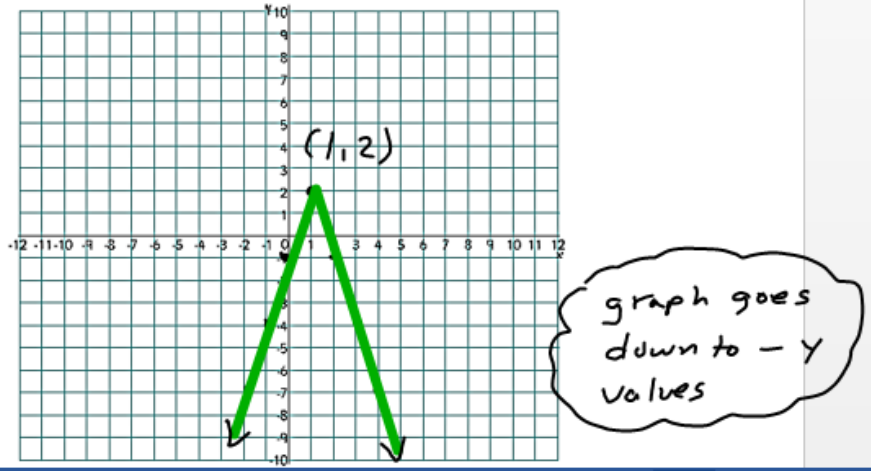


2. $f(x) = -3|x - 1| + 2$

a = −3
points ↓ b/c a is negative

−3 ↓ / 1 → vertex = (1, 2)

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



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

① $f(x) = a|x-h|+k$

Vertex : $(1,-3)$ (h, 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 : $(-4,-1)$ (h, k)

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

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

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