Graphing Absolute Value Functions

EQ: How do you graph absolute value functions? What are their characteristics?

STANDARDS:

MCC9-12.F.IF.7 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. *(Limit to radical and rational functions.)*

MCC9-12.F.IF.7b Graph square root, cube root and piecewise functions, including step functions and absolute value functions.

MCC9-12.F.IF.5 Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.

MCC9-12.F.IF.4 For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities and sketch graphs showing key features given verbal description of the relationship. Key features include: intercepts, intervals where the function is increasing, decreasing, positive or negative; relative maximums and minimums; symmetries; end behaviors; and periodicity.

MCC9-12.F.BF.3 Identify the effect on the graph of replacing f (x) by f(x) + k, kf(x), f(kx) and f(x + k) for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions from them.

Nov 7-1:41 PM

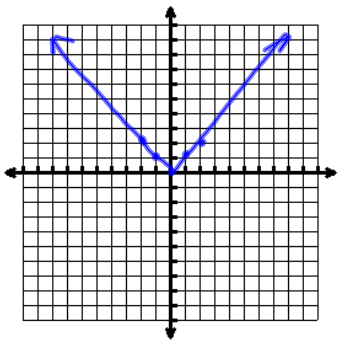
Defining an Absolute Value Function as a Piecewise Function

$$|x| = \begin{cases} x, \text{ if } x > 0 \\ 0, \text{ if } x = 0 \\ -x, \text{ if } x < 0 \end{cases}$$

Mar 25-1:57 PM

Parent Graphs and their Characteristics

Absolute Value $y = |x|$



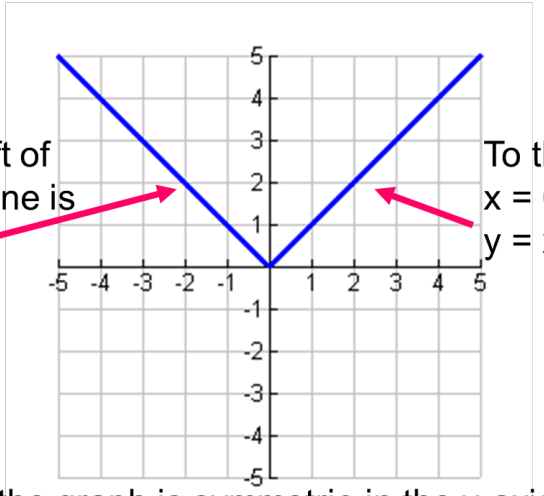
x	y
-2	2
-1	1
0	0
1	1
2	2

Characteristics

Vertex: (0,0)
Axis of symmetry: x=0
Domain: ℝ
Range: [0,∞)
Max: none
Min: (0,0)
Int of Inc: (0,∞)
Int of Dec: (-∞,0)
x-intercept: (0,0)
y-intercept: (0,0)
end behavior: As x→-∞, y→∞
As x→∞, y→∞

Nov 12-10:50 AM

The graph of this piecewise function consists of 2 rays, is V-shaped and opens up.



To the left of x=0 the line is y = -x

To the right of x = 0 the line is y = x

Notice that the graph is symmetric in the y-axis because every point (x,y) on the graph, the point (-x,y) is also on it.

Mar 25-1:58 PM

Standard Forms

$$y = a\left|b\left(x-h\right)\right| + k$$

$$y = a\sqrt[3]{b\left(x-h\right)} + k$$

$$y = a\sqrt{b\left(x-h\right)} + k$$

For all types

-a: reflect over x-axis

a >1: stretch vert.

a <1: shrink vert.

-b: _____

1/b >1: horizontal elongation

1/b <1: horizontal compression

h: horizontal shift

k: vertical shift

Nov 12-11:09 AM

Steps to graphing ALL graph types

1. Get the function in the correct form - make use if there is a "b" that it has been factored out.

2. Give its description of its transformations compared to the parent graph.

3. Write down the parent table.

4. Adjust parent table by multiplying "a" and "1/b"
   Reminder: "a" affects the range (Ys)
   "1/b" affects the domain (Xs)

5. Adjust the new table by add/sub "h" and "k"
   Reminder: pull h (*opposite*) and k (*same*)
   add/sub "h" to x-values
   add/sub "k" to y-values

6. **Plot your points and give the characteristics**

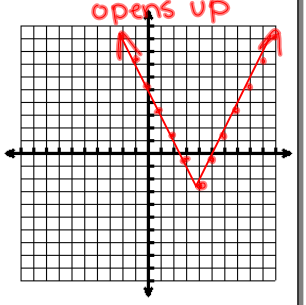
Nov 12-11:17 AM

Graph and give the requested characteristics

1. $f(x) = 2|x-4|-3$ V: (4, -3) m: 2 opens up

x	y

x	y



Characteristics

Vertex: (4, -3) AoS: x = 4

Domain: ℝ Range: [-3, ∞)

Max: — Min: (4, -3)

Int of Inc: (4, ∞) Int of Dec: (-∞, 4)

x-intercept: (3/2, 0) (4½, 0) (2.5, 0) (5.5, 0) y-intercept: (0, 5)

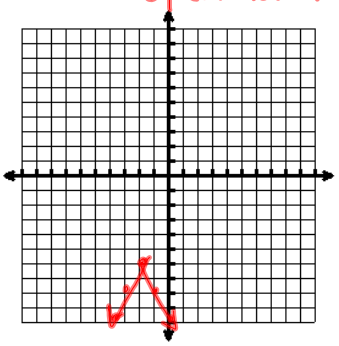
end behavior: As x → -∞, y → ∞; As x → ∞, y → ∞

Nov 12-11:29 AM

2. $f(x) = -|2x+4|-6$ $-|2(x+2)|-6$ vertex: (-2, -6) m = 2 open down

x	y

x	y



Characteristics

Vertex: AoS:

Domain: Range:

Max: Min:

Int of Inc: Int of Dec:

x-intercept: y-intercept

end behavior:

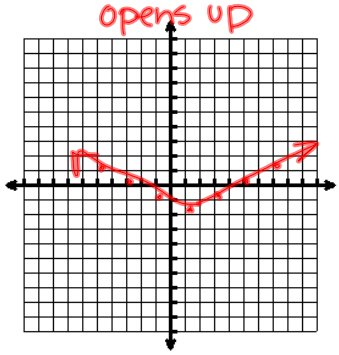
Nov 12-11:29 AM

3. $h(x) = \frac{1}{2}|x-1| - 2$

V: (1, -2)
m = $\frac{1}{2}$
opens up

x	y

x	y



Characteristics

Vertex: AoS:

Domain: Range:

Max: Min:

Int of Inc: Int of Dec:

x-intercept: y-intercept

end behavior:

Nov 12-11:29 AM

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

vertex: (3, 0)

$m = 4 \cdot 2 = 8$

opens up

Mar 26-9:06 AM