Study Guide

Graph Absolute Value
03/21/2012

Graph Absolute Value

The absolute value of a real number is the distance the real number, x, is from 0 on a number line. The absolute value of a real number is denoted by placing the real number within two vertical lines: $|x|$. In other words, $|-5|$ (read: *the absolute value of - 5*) is 5 because - 5 is 5 units from 0 on a number line.

There are two major principles of absolute value:

1. The absolute value of a negative or positive number is always a **positive** number.
2. The absolute value of 0 is 0.

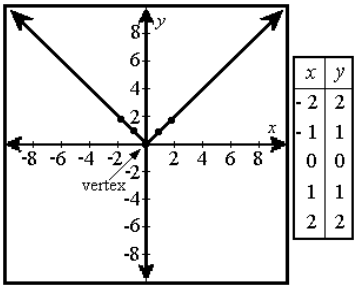
Graphs of Absolute Value Functions:

The standard form for an absolute value function ($y = a|bx + c| + d$) is needed to compare graphs of absolute value functions with the graph of $y = |x|$.

- a determines whether the graph opens up or opens down
- b determines how wide open the graph is
- c determines whether the graph shifts to the right or the left
- d determines whether the graph shifts upward or downward

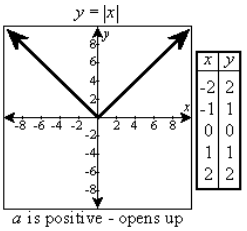
When determining the shifts, it is helpful to use the vertex of the graph as the point of reference. In this skill, the absolute value equations are given in the form where a is equal to 1 or - 1 and d changes. The variables b and c do not affect the equations in this skill.

When comparing graphs of absolute value functions, start with the graph of $y = |x|$, which is shown below.



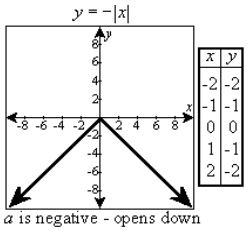
x	y
-2	2
-1	1
0	0
1	1
2	2

Then, determine how the given equation alters this graph. When a is positive, the graph opens up, and when a is negative, the graph opens down.



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

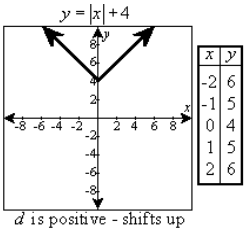
a is positive - opens up



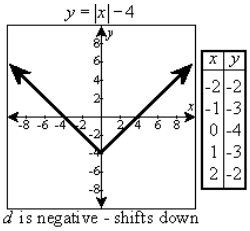
x	y
-2	-2
-1	-1
0	0
1	-1
2	-2

a is negative - opens down

When d is positive, the graph has a vertical shift up d units, and when d is negative, the graph has a vertical shift down d units.



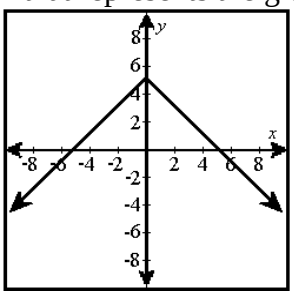
x	y
-2	6
-1	5
0	4
1	5
2	6



x	y
-2	-2
-1	-3
0	-4
1	-3
2	-2

Example 1:

Determine the equation that represents the graph below.



Solution:

The graph opens down, so the equation must have a negative value of *a*. It is shifted up five units on the *y*-axis, so *d* must equal 5. Therefore, the equation that represents the graph is $y = - |x| + 5$.

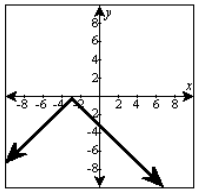
Answer: $y = - |x| + 5$

Example 2:

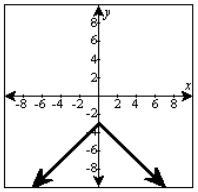
Choose the correct graph for the equation below.

$$y = |x| - 3$$

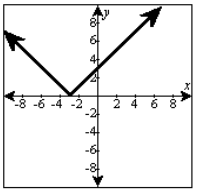
(A)



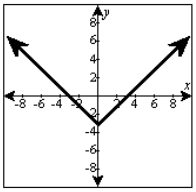
(B)



(C)



(D)



Solution:

The value of *a* is 1, so the graph opens up, which is true only in graphs C and D. The value of *d* is -3, so the graph is shifted down three units on the *y*-axis. Therefore, the correct answer is D.

Answer: D

A possible activity to reinforce this skill is to have the student create their own graphs on graph paper. Have the student make a T-chart (or x - y chart) of values for different equations. Then have the student plot the points on the graph paper to graph the absolute value equation. As an enrichment activity, provide him or her with equations that contain different values of *b* and *c* in the equation as discussed earlier in this tutorial. For example, the student could graph the equations $y = |2x|$ and $y = |x - 3|$ and determine the effects they have on the graph of $y = |x|$.