Absolute Value Function

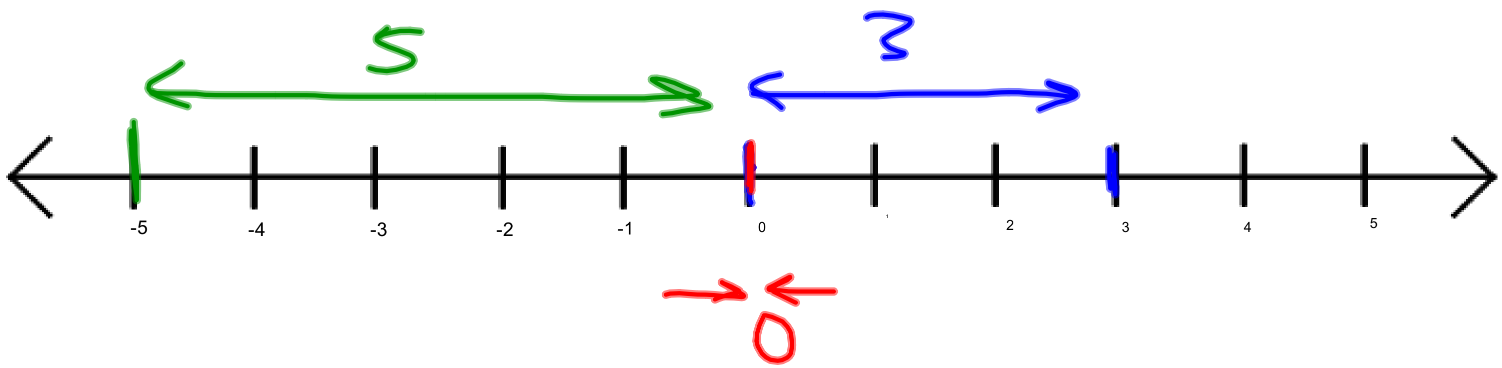
Sept 8/2016

The absolute value of a real number is the non-negative value of that number (since zero is neither positive or negative).

$$|3| = 3 \qquad |0| = 0 \qquad |-5| = 5$$

On a number line, the absolute value measures the distance from the origin to the value (distance is never negative).

Ex. Represent the absolute values of 3, 0, and -5 using a number line.



Function Notation:

$$f(x) = |x|, x \in \mathbb{R}$$

Using our definition of absolute value, we can reason

if: $x \geq 0, f(x) = x$

if: $x < 0, f(x) = -x$

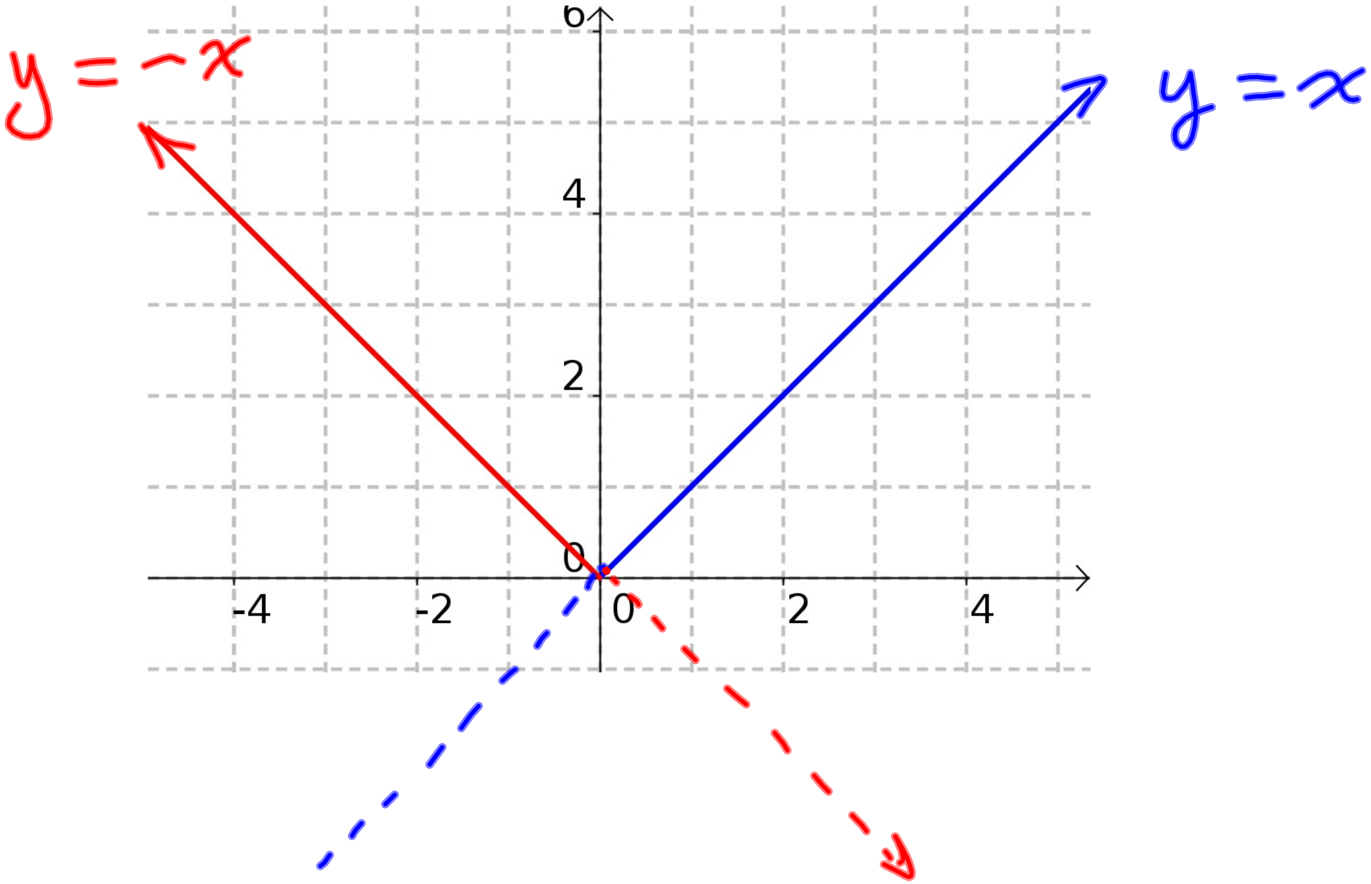
This allows for a <u>piecewise</u> representation of the function:

$$f(x) = \begin{cases} x, & x \geq 0 \\ -x, & x < 0 \end{cases}$$

Graphical Representation:

For the parent function, $f(x) = |x|$, we can construct a table of values, or consider the piecewise definition.

$f(x) = -x, x < 0$ $\qquad$ $f(x) = x, x \geq 0$



A quadratic equation is typically solved:

$$\begin{aligned} x^2 &= 9 \\ x &= \pm\sqrt{9} \\ x &= \pm 3 \end{aligned}$$

The absolute value yields a similar looking final form:

$$\begin{aligned} |x| &= 3 \\ x &= \pm 3 \end{aligned}$$

You may see a quadratic solution expressed as:

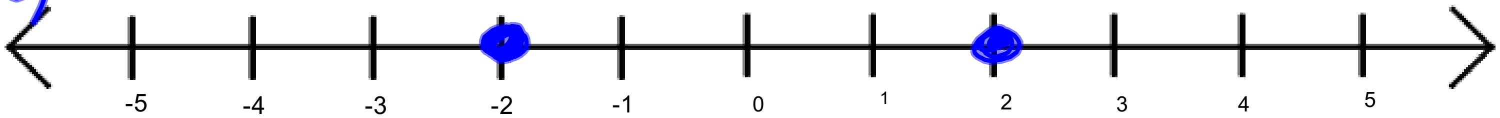
$$\begin{aligned} x^2 &= 9 \\ |x| &= \sqrt{9} \\ |x| &= 3 \end{aligned}$$

Ex. Given $|x| \leq 2$

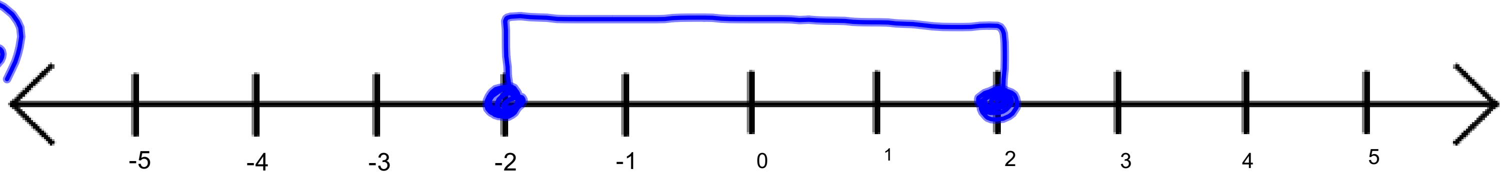
(a) represent $|x| = 2$ on the number line.

(b) extend to $|x| \leq 2$

(a)



(b)



$-2 \leq x \leq 2$

Ex. Solve $|x-2|=3$

let $A = x-2$

$|A| = 3$

$A = 3$

or

$A = -3$

$x-2=3$

$\boxed{x=5}$

$x-2=-3$

$\boxed{x=-1}$

Assigned Work:

p.16 # 3 - 10

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

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