Absolute Value Function

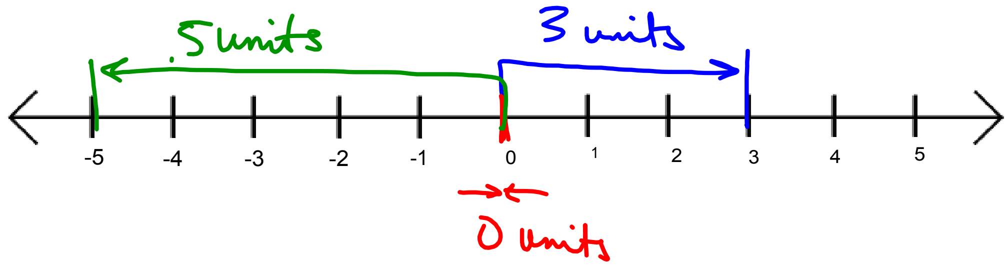
Sept 3/2014

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



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Function Notation:

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

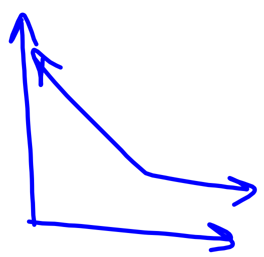
Using our definition of absolute value, we can reason

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

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

This allows for a piecewise representation of the function:

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



$f(-3) = -(-3)$
$= 3$

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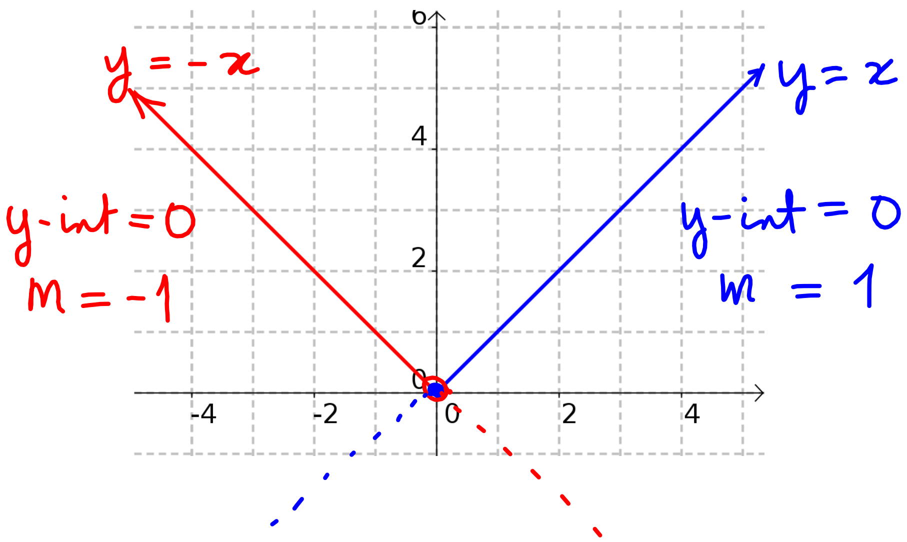
Graphical Representation:

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

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



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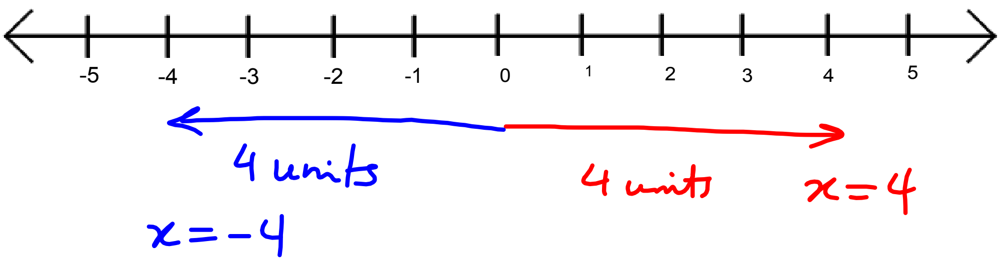
Ex.2 Show $\underbrace{|x| = 4}_{x \text{ is } 4 \text{ units from } 0}$ using a number line, then solve for x.



$|x| = 4$

$x = \pm 4$

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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:

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

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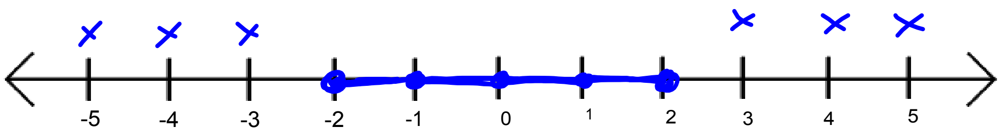
Ex.3 Given $|x| \leq 2$

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

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



$-2 \leq x \leq 2$

Same as

$|x| \leq 2$

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Assigned Work:

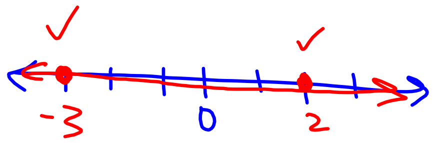
p.16 # 3 - 10

10
9
4d

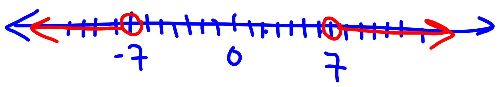
geogebra.org

desmos.___ ?

4(d) $|x| > -7$



$|x| > 7$



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9. $f(x) = |2x+1|$

$y = a\, f[k(x-p)] + q$

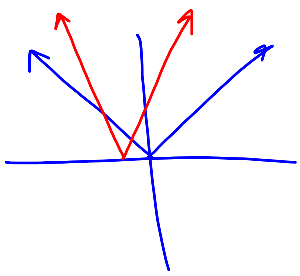
$f(x) = |2(x+\frac{1}{2})|$

h. compress by 2

h. shift left $\frac{1}{2}$ unit

$= 2|x+\frac{1}{2}|$

v. stretch by 2



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10. $f(x) = 3 - |2x - 5|$

$= -1\left|2\left(x - \frac{5}{2}\right)\right| + 3$

v. reflect

h. compress by 2

shift right by $\frac{5}{2}$

shift up by 3

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