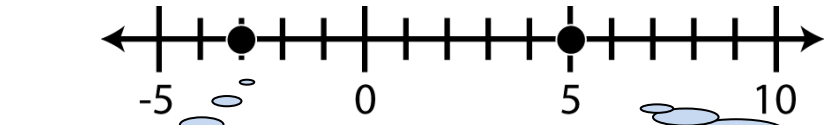
Intermediate algebra
Class notes
Solving Absolute Value Equations (section 16.2)

Understanding what the absolute value of a number means will help us solve these equations.

Recall: Absolute value:

What does absolute value mean? For instance, when we say |5| = 5 or |-3| = 3, what are we saying about 5 and -3? Think about the real number line below.



Here is -3.

What does absolute value tell us about a number?

So, if we write $|w| = 5$, what must w be? There are only two possibilities. What are they?

"w is the number that is 5 units from zero"

$w = ?$ or $w = ?$

Knowing what absolute value means helps us change the equation $|w| = 5$ into two equations *without* absolute value involved, $w = -5$ or $w = 5$. We will use this idea to solve more complicated absolute value equations.

expl 1: Solve.

$|2x - 11| = 5$

This says "$2x - 11$" is the number that is 5 units from zero. So what could this number "$2x - 11$" be? Write your answers as two separate equations. Then solve the equations to find x.

Again, these new equations do *not* have absolute value signs!

Check your answers. (Did you get $x = 3$ or 8?) Plug both answers into the original equation.

$|2x - 11| = 5$ Put 3 in to check it. $|2x - 11| = 5$

Put 8 in to check it.

expl 2: Solve.

$|2x + 8 - 3x| = 6$

What should we do first?

expl 3: Solve.

$2|5x - 3| + 7 = 21$

Isolate the absolute value part before using the procedure from above.

Check your answers using the calculator. Make sure you always use the *original* equation to check answers.

$2|5x - 3| + 7 = 21$

Put 2 in to check it.

Absolute value is found in the **MATH** menu, under **NUM**.

$2|5x - 3| + 7 = 21$

Put $-\frac{4}{5}$ in to check it.

Try it on the calculator: 2 abs(5(-4/5) – 3) + 7 ENTER

MATH
Arrow over to **NUM**
Select **abs(**

Division button

End the parentheses that **abs(** started.

What do we hope we get out? Did you?

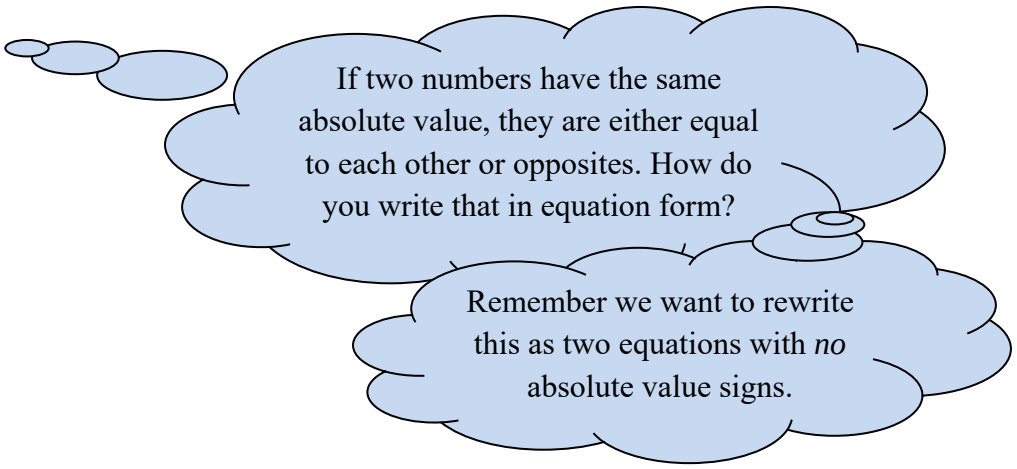
expl 4: Solve.

$|2x - 3| = -5$

Think about this one before doing any algebra to save you work.

expl 5: Solve.

$|x - 14| = |3x + 2|$



Worksheet: Solving absolute value equations:

This worksheet explores why we solve these equations the way we do and gives us a bit of practice. It will also investigate equations like those in examples 4 and 5 above.

It is always a good idea to check your answers. Try to get into the habit on every problem.

Also, think about the general equation-solving process. To solve an equation, we rewrite it in simpler and simpler forms, until we get to a solution like $x = 5$. We saw that in solving quadratic equations by factoring and then breaking the factors into equations of their own, solving rational equations by eliminating the fractions, and here when we replace the original absolute value equation by two equations with no absolute value signs. Aah, algebra.