

## Eye Opener

Complete each statement with  $<$ ,  $=$ , or  $>$ .

62.  $|3 - 7| \blacksquare 4$

$=$

63.  $|-5| + 2 \blacksquare 6$

$>$

64.  $|6 - 2\frac{1}{4}| \blacksquare 3\frac{5}{8}$  [See Les!](#)

$3\frac{3}{4}$   
 $3.75 >$   
 $3\frac{1}{6}$

## Essential Understanding

You can solve absolute value equations and inequalities by isolating the absolute value expression, then writing the equivalent pair of linear equations or inequalities:

If  $|A| = b$  then  $A = b$  or  $A = -b$

If  $|A| > b$  then  $A > b$  or  $A < -b$

If  $|A| < b$  then  $A < b$  and  $A > -b$

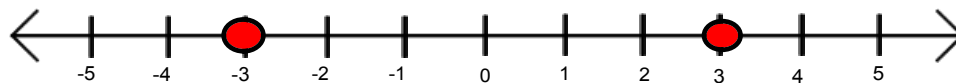


### Absolute Value

The absolute value of a number is its **distance** from zero on a number line, and since it represents distance it **can never be negative**.

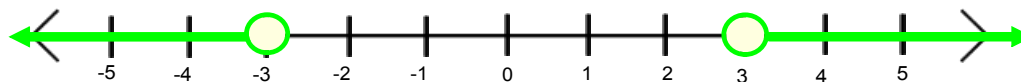
$|x| = 3$  means those points that are **exactly** three units away from zero on the number line.

That means  $x = 3$  or  $-3$  and would look like:



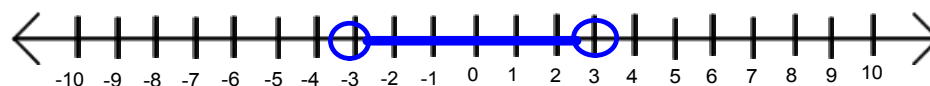
$|x| > 3$  means those points that are **more than** three units away from zero on the number line.

That means  $x > 3$  **OR**  $x < -3$  and would look like:



$|x| < 3$  means those points that are **less than** three units away from zero on the number line.

That means  $x < 3$  **AND**  $x > -3$  and would look like:





# 3-7 Absolute Value Equations & Inequalities

September 28, 2011

$|x| + 5 = 11$   
Isolate absolute value expression  
Rewrite 2 equations  
Solve, check

$$\begin{array}{r} 5-5 \\ \hline |x| = 6 \end{array}$$



$|2x + 5| = 13$   
Isolate absolute value expression  
Rewrite 2 equations  
Solve, check

$$\begin{array}{r} 2x+5=13 \\ 2x=8 \\ x=4 \end{array}$$



$$\begin{array}{r} 2x+5=-13 \\ 2x=-18 \\ x=-9 \end{array}$$

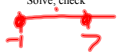
$|x - 1| = -3$   
Isolate absolute value expression  
Rewrite 2 equations  
Solve, check



$|x - 3| = 4$   
Isolate absolute value expression  
Rewrite 2 equations  
Solve, check

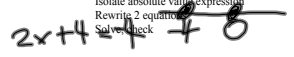
$$\begin{array}{r} x-3=4 \\ x=7 \\ x-3=-4 \\ x=-1 \end{array}$$

$$\begin{array}{r} x-3=4 \\ x=7 \\ x-3=-4 \\ x=-1 \end{array}$$



$3|2x + 4| = 12$   
Isolate absolute value expression  
Rewrite 2 equations  
Solve, check

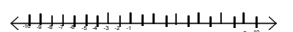
$$\begin{array}{r} |2x+4|=4 \\ 2x+4=4 \\ 2x=0 \\ x=0 \end{array}$$



$-4|3x + 9| + 5 = -12$   
Isolate absolute value expression  
Rewrite 2 equations  
Solve, check

$3|2x + 4| + 12 = 6$   
Isolate absolute value expression  
Rewrite 2 equations  
Solve, check

$$\begin{array}{r} 2x+4=13 \\ 2x=9 \\ x=4.5 \end{array}$$



$$-4|3x + 9| + 4 = -12$$

$$\begin{array}{r} -4 - 4 \end{array}$$

$$\frac{-4|3x+9|}{-4} = \frac{-16}{-4}$$

$$\frac{-4}{-4} \quad \frac{-4}{-4}$$

$$|3x+9| = 4$$

Isolate absolute value expression

Rewrite 2 equations

Solve, check

$$3x+9=4 \quad \text{or} \quad 3x+9=-4$$

$$\begin{array}{r} -9 \quad -9 \end{array}$$

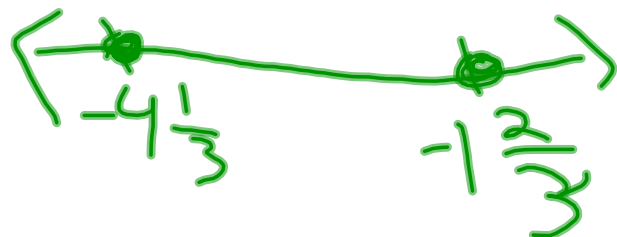
$$\begin{array}{r} -9 \quad -9 \end{array}$$

$$\frac{3x}{3} = \frac{-5}{3}$$

$$\frac{3x}{3} = \frac{-13}{3}$$

$$x = -1\frac{2}{3} \quad \text{or}$$

$$x = 4\frac{1}{3}$$



**Absolute Value Inequalities Involving >**

$$|x + 2| > 5$$

$$|x + 2| = 5$$

$$\begin{array}{r} x + 2 = 5 \\ \underline{-2 \quad -2} \\ x = 3 \end{array} \quad \vee \quad \begin{array}{r} x + 2 = -5 \\ \underline{-2 \quad -2} \\ x = -7 \end{array}$$

Isolate the absolute value expression

Write the two equivalent pair of linear inequalities

Solve the two inequalities

Graph the solutions

Check answer



$$2|x| - 5 \geq 1$$

$$\begin{array}{r} +5 \quad +5 \\ 2|x| \geq 6 \\ \underline{\quad \quad \quad} \\ 2|x| \geq 6 \\ \underline{\quad \quad \quad} \\ |x| \geq 3 \end{array}$$

Isolate the absolute value expression

Write the two equivalent pair of linear inequalities

Solve the two inequalities

Graph the solutions

Check answer

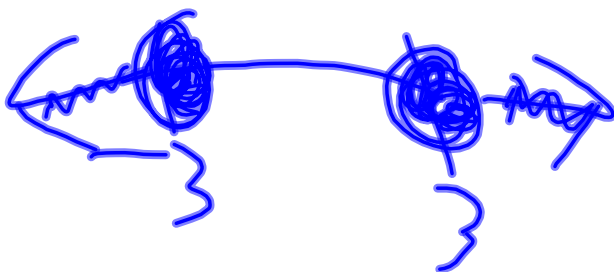
Isolate the absolute value expression

Write the two equivalent pair of linear inequalities

Solve the two inequalities

Graph the solutions

Check answer

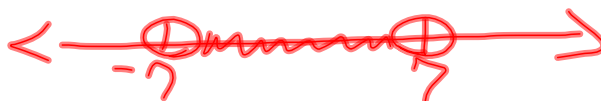


Absolute Value Inequalities Involving <

$$|x| - 10 < -3$$

$$\begin{array}{r} +10 +10 \\ \hline |x| < 7 \end{array}$$

$$x = 7 \quad x = -7$$



Isolate the absolute value expression

Write the two equivalent pair of linear inequalities

Solve the two inequalities

Graph the solutions

Check answer

$$4 - 3|x + 2| \leq -14$$

Isolate the absolute value expression

Write the two equivalent pair of linear inequalities

Solve the two inequalities

Graph the solutions

Check answer

$$3|x| - 2 < 4$$

$$\begin{array}{r} +2 +2 \\ \hline 3|x| < 6 \\ \hline |x| < 2 \end{array}$$

Isolate the absolute value expression

Write the two equivalent pair of linear inequalities

Solve the two inequalities

Graph the solutions

Check answer



3-7 Absolute Value Equations & Inequalities \* - SMART Notebook

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Write the two equivalent pair of linear inequalities  
Solve the two inequalities  
Graph the solutions  
Check answer

$+10 + 10$   
 $|x| < 7$

$x = 7$     $x = -7$

$4 - 3|x + 2| \leq -14$

Isolate the absolute value expression  
Write the two equivalent pair of linear inequalities  
Solve the two inequalities  
Graph the solutions  
Check answer

$3|x| - 2 < 4$

Isolate the absolute value expression  
Write the two equivalent pair of linear inequalities  
Solve the two inequalities  
Graph the solutions  
Check answer

[Extend Page](#)

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$$4 - 3|x + 2| \leq -14$$

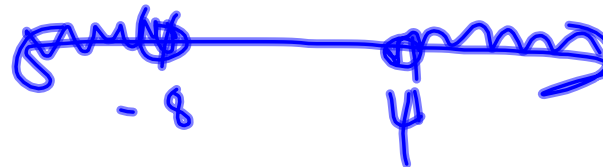
$$\frac{-3|x+2|}{-3} = \frac{-18}{-3}$$

$$|x+2| \geq 6$$

$$\begin{aligned} x+2 &= 6 \\ x &= 4 \end{aligned}$$

Isolate the absolute value expression  
 Write the two equivalent pair of linear inequalities  
 Solve the two inequalities  
 Graph the solutions  
 Check answer

$$\begin{aligned} x+2 &= -6 \\ x &= -8 \end{aligned}$$



The ideal diameter of a piston is 90,000 mm. The actual diameter can vary at most by .0008 mm. Find the range of acceptable diameters.

$x =$

Inequality:

Solve:

Graph solution:



