

## Explain 1 Solving Absolute Value Equations Algebraically

To solve absolute value equations algebraically, first isolate the absolute value expression on one side of the equation the same way you would isolate a variable. Then use the rule:

If  $|x| = a$  (where  $a$  is a positive number), then  $x = a$  OR  $x = -a$ .

Notice the use of a **disjunction** here in the rule for values of  $x$ . You cannot know from the original equation whether the expression inside the absolute value bars is positive or negative, so you must work through both possibilities to finish isolating  $x$ .

**Example 1** Solve each absolute value equation algebraically. Graph the solutions on a number line.

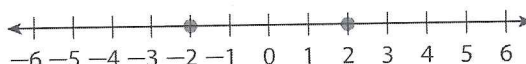
(A)  $|3x| + 2 = 8$

Subtract 2 from both sides.

Rewrite as two equations.

Solve for  $x$ .

$|3x| = 6$   
 $3x = 6$  or  $3x = -6$   
 $x = 2$  or  $x = -2$



(B)  $3|4x - 5| - 2 = 19$

Add 2 to both sides.

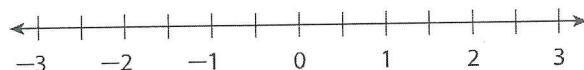
Divide both sides by 3.

Rewrite as two equations.

Add 5 to all four sides.

Solve for  $x$ .

$3|4x - 5| = 21$   
 $|4x - 5| = 7$   
 $4x - 5 = 7$  or  $4x - 5 = -7$   
 $4x = 12$  or  $4x = -2$   
 $x = 3$  or  $x = -\frac{1}{2}$



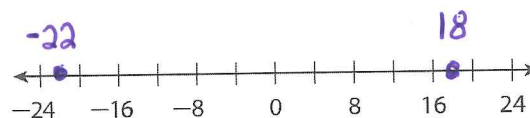
### Your Turn

Solve each absolute value equation algebraically. Graph the solutions on a number line.

3.  $\frac{1}{2}|x + 2| = 10$

$|x + 2| = 20$

$x + 2 = 20$  or  $x + 2 = -20$   
 $x = 18$  or  $x = -22$

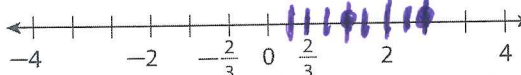


4.  $-2|3x - 6| + 5 = 1$

No Dist. Prop.

$-2|3x - 6| = -4$   
 $|3x - 6| = 2$

$3x - 6 = 2$  or  $3x - 6 = -2$   
 $3x = 8$  or  $3x = 4$   
 $x = \frac{8}{3}$  or  $x = \frac{4}{3}$





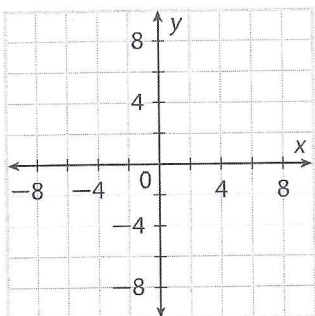
# Evaluate: Homework and Practice



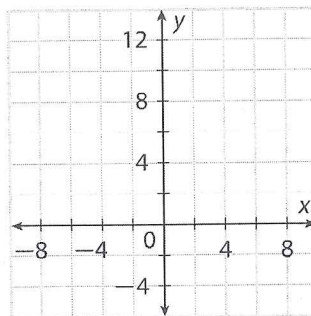
- Online Homework
- Hints and Help
- Extra Practice

Solve the following absolute value equations by graphing.

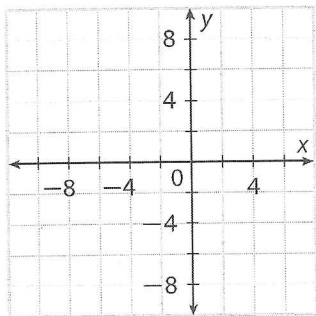
1.  $|x - 3| + 2 = 5$



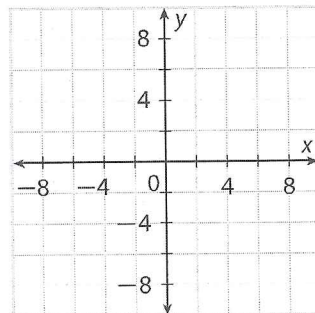
2.  $2|x + 1| + 5 = 9$



3.  $-2|x + 5| + 4 = 2$

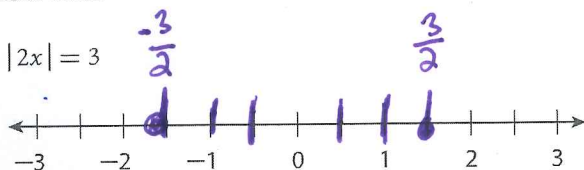


4.  $\left|\frac{3}{2}(x - 2)\right| + 3 = 2$

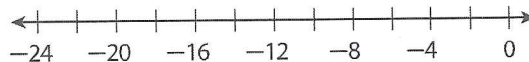


Solve each absolute value equation algebraically. Graph the solutions on a number line.

5.  $|2x| = 3$



6.  $\left|\frac{1}{3}x + 4\right| = 3$



$$|2x| = 3$$

$$\begin{array}{l} \swarrow \quad \searrow \\ \frac{2x}{2} = \frac{3}{2} \quad \frac{2x}{2} = \frac{-3}{2} \\ x = \frac{3}{2} \quad x = \frac{-3}{2} \end{array}$$