


13.3

Personal Math Trainer 

13.3 Solving Absolute Value Equations - Class &
Homework

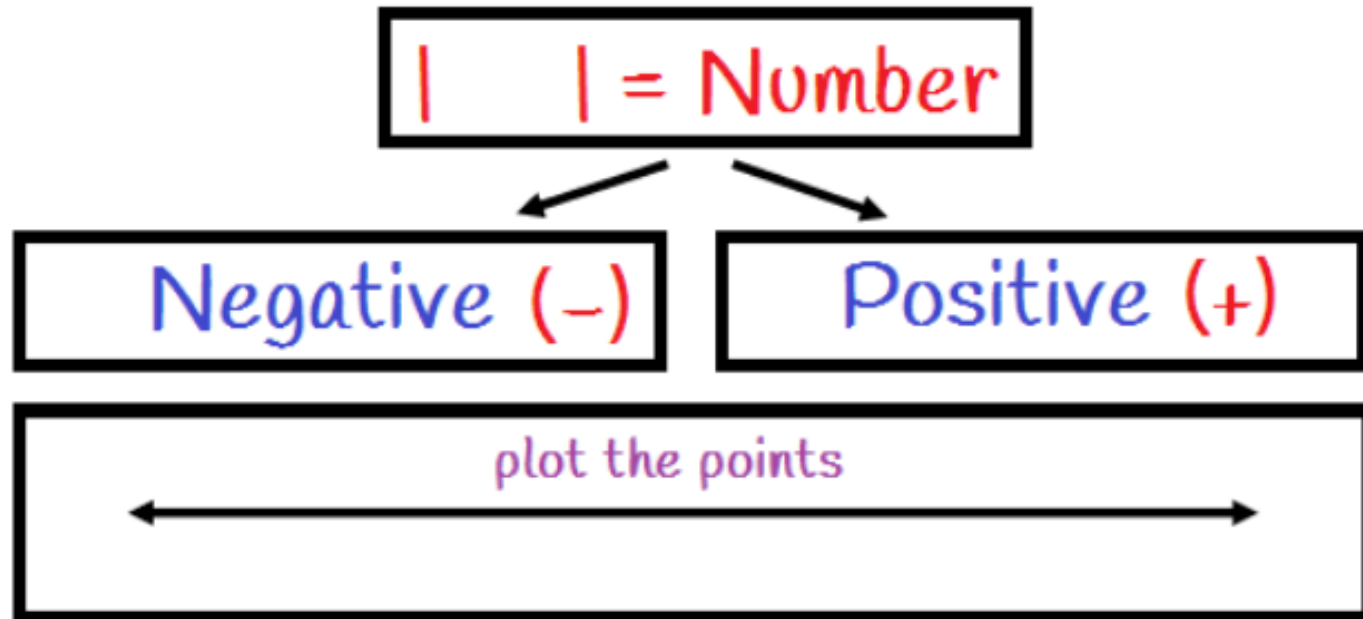


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How To Solve & Graph Absolute Value Equations

Steps:

1. Isolate the absolute value expression.
2. Rewrite as two equations, (- and +)
3. Solve both equations.
4. Plot the point on the number line.



1

Solve the equation and Graph the solutions on the number line.

$$\frac{1}{2}|x + 4| = 6$$

Multiply both sides by 2.

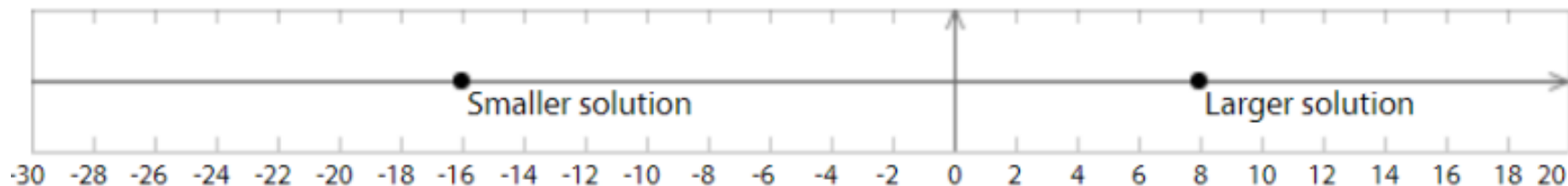
$$2 \cdot \frac{1}{2}|x + 4| = 6(2)$$

$$|x + 4| = 12$$

Rewrite as two equations.

$$\begin{array}{r} x + \cancel{4} = 12 \\ \quad \quad \quad \underline{-4} \quad \quad \quad \underline{-4} \\ x = 16 \end{array} \quad \text{or} \quad \begin{array}{r} x + \cancel{4} = 12 \\ \quad \quad \quad \underline{-4} \quad \quad \quad \underline{-4} \\ x = 8 \end{array}$$

Plot the point on the number line.



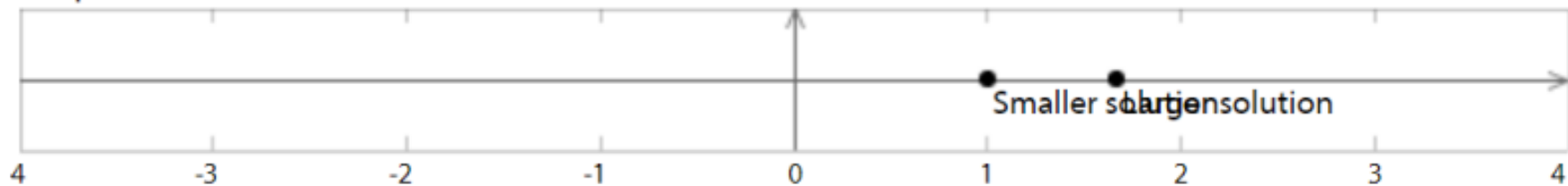
2 Solve & Graph $-2|3x - 4| + 6 = 4$

$$\begin{aligned} -2|3x - 4| + 6 &= 4 \\ \underline{-6 \quad -6} & \\ -2|3x - 4| &= -2 \\ \underline{-2 \quad -2} & \\ |3x - 4| &= 1 \end{aligned}$$

$(-)$ \swarrow $(+)$

$$\begin{array}{l} 3x - 4 = -1 \\ \underline{+4 \quad +4} \\ 3x = 3 \\ \underline{3 \quad 3} \\ x = 1 \end{array}$$
$$\begin{array}{l} 3x - 4 = 1 \\ \underline{+4 \quad +4} \\ 3x = 5 \\ \underline{3 \quad 3} \\ x = \frac{5}{3} \end{array}$$

Graph the solution.



3

Solve $|2x| = 6$ algebraically. Graph the solutions on the number line.

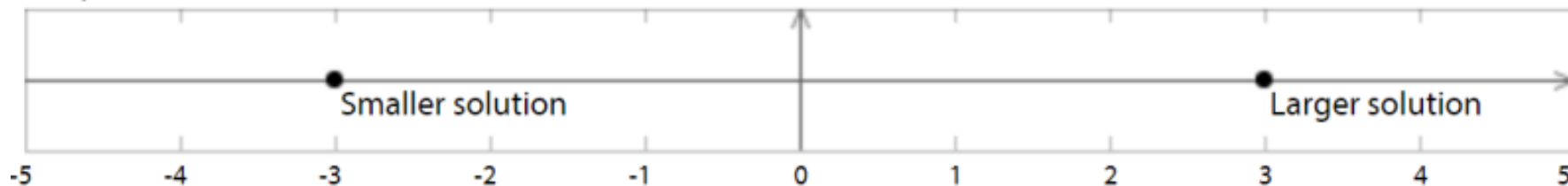
Rewrite as two equations.

$$2x = -6 \qquad \text{or} \qquad 2x = 6$$

Divide both sides of both equations by 2.

$$x = -3 \qquad \text{or} \qquad x = 3$$

Graph the solution.



4 Solve the equation $\left| \frac{1}{3}x + 3 \right| = 4$. Graph the solutions on the number line.

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

Begin with the original equation.

Rewrite as two equations.

$$\frac{1}{3}x + 3 = -4 \quad \text{or} \quad \frac{1}{3}x + 3 = 4$$

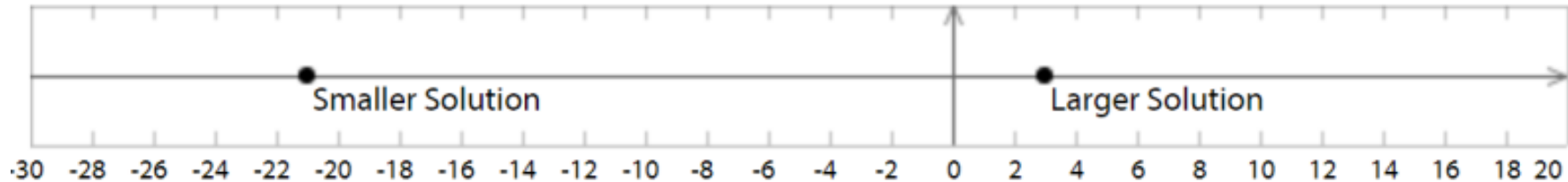
Subtract 3 from both sides of both equations.

$$\frac{1}{3}x = -7 \quad \text{or} \quad \frac{1}{3}x = 1$$

Multiply both sides of both equations by 3.

$$x = -21 \quad \text{or} \quad x = 3$$

The solutions are shown on the number line.



5

Solve $3|2x - 3| + 5 = 9$ algebraically. Graph the solutions on the number line.

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

Subtract 5 from both sides.

$$|2x - 3| = \frac{4}{3}$$

Divide both sides by 3.

Rewrite as two equations.

$$2x - 3 = -\frac{4}{3} \quad \text{or} \quad 2x - 3 = \frac{4}{3}$$

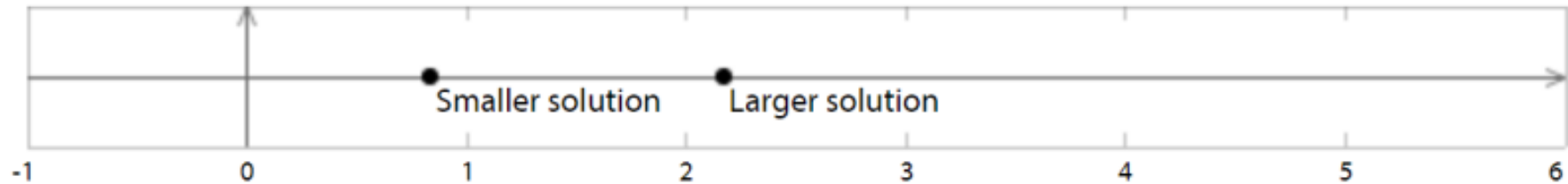
Add 3 to both sides of both equations.

$$2x = \frac{5}{3} \quad \text{or} \quad 2x = \frac{13}{3}$$

Divide both sides of both equations by 2.

$$x = \frac{5}{6} \quad \text{or} \quad x = \frac{13}{6}$$

Graph the solutions.



6

Solve $-6|-x - 4| + 10 = 4$ algebraically. Graph the solutions on the number line

$$-6|-x - 4| = -6$$

$$|-x - 4| = 1$$

Subtract 10 from both sides.

Divide both sides by -6 .

Rewrite as two equations.

$$-x - 4 = 1 \quad \text{or} \quad -x - 4 = -1$$

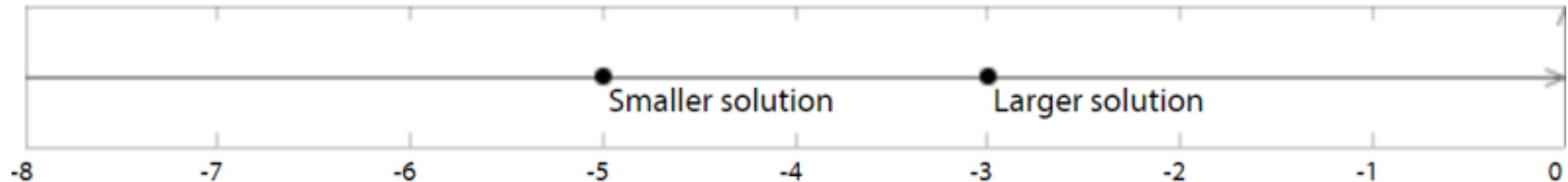
Add 4 to both sides of both equations.

$$-x = 5 \quad \text{or} \quad -x = 3$$

Divide both sides of both equations by -1 .

$$x = -5 \quad \text{or} \quad x = -3$$

Graph the solutions.




7

Consider the absolute-value equation $2(|x + 8| + 4) = 8$.

Solve the equation for x .

$$|x + 8| + 4 = 4 \quad \text{Divide both sides by 2.}$$

$$|x + 8| = 0 \quad \text{Subtract 4 from both sides.}$$

Part 1 

How many solutions are there to the equation?

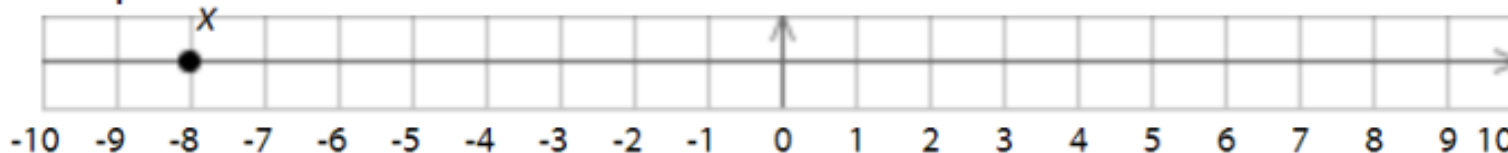
$$x + 8 = 0$$

$$x = -8$$

- A There are no solutions. *|absolute| = Negative(-)*
- B There is one solution. *|absolute| = 0*
- C There are two solutions. *|absolute| = Positive(+)*
- D There are infinitely many solutions. *None*

Part 2 of 2

Graph the solution on the number line.



8

Consider the absolute value equation $8|2x + 6| - 5 = -5$.Part 1 

How many solutions are there to the equation?

- A There are no solutions.
- B There is one solution.
- C There are two solutions.
- D There are infinitely many solutions.

$$8|2x + 6| - 5 = -5$$

$$8|2x + 6| = 0$$

$$|2x + 6| = 0$$

The absolute value is equal to zero.
There is one solution.

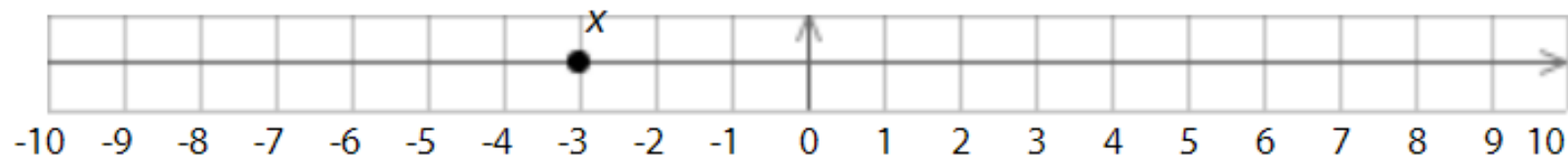
$$2x + 6 = 0$$

$$2x = -6$$

$$x = -3$$

Part 2 of 2

Graph the solution on the number line.



9

Solve the absolute-value equation $|2(x + 3) - 2| + 5 = 7$. If a solution is not an integer, give it in fraction form.

$$|2(x + 3) - 2| + 5 = 7.$$

Apply the Distributive Property and simplify.

$$|2x + 4| + 5 = 7$$

Subtract 5 from both sides.

$$|2x + 4| = 2$$

Rewrite as two equations.

$$2x + 4 = -2 \quad \text{or} \quad 2x + 4 = 2$$

Subtract 4 from both sides of both equations.

$$2x = -6 \quad \text{or} \quad 2x = -2$$

Divide both sides of both equations by 2.

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

10

This absolute value equation has nested absolute values.

$$||2x + 5| - 7| = 16$$

Rewrite as two equations.

$$\frac{|2x + 5| - 7 = -16}{+7 \quad +7} \quad \text{or} \quad \frac{|2x + 5| - 7 = 16}{+7 \quad +7}$$

$$|2x + 5| = -9$$

equal to a negative number;
it has no solutions.

$$|2x + 5| = 23$$

Rewrite as two equations.

$$2x + 5 = -23 \quad \text{or} \quad 2x + 5 = 23$$

$$2x = -28 \quad \text{or} \quad 2x = 18$$

$$x = -14 \quad \text{or} \quad x = 9$$

Part 1 out of 2

What are the solutions?

The solution is $x = -14$ or $x = 9$.

Part 2



How many solutions does this absolute-value equation have? Complete the explanation.

There because produced solutions.