

1.6. Advanced Algebra

Solving Absolute Value Inequalities

DATE: 9/30

Target 2A. Utilize a graph to illustrate the solution set of an absolute value inequality.



Absolute Value Inequalities

For all real numbers a and b , $b > 0$, the following statements are true:

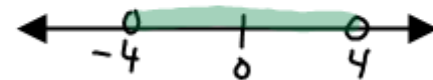
1. If $|a| < b$, then $-b < a < b$ "AND"

2. If $|a| > b$, then $a > b$ "OR" $a < -b$

Also true for:
 \leq, \geq

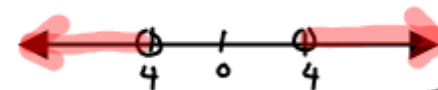
Examples based on the above statements. "AND"

1. If $|a| < 4$, then $-4 < a < 4$



The distance from zero is less than 4.

2. If $|a| > 4$, then $a > 4$ "OR" $a < -4$



The distance from zero is greater than 4.

Recall:
The absolute value of a # is the distance from zero on the # line.

Solve a Multi-Step Absolute Value Inequality

1. Solve $|2x - 1| < 5$ Graph the solution on a number line. Then give the solution set in both set-builder and interval notation.

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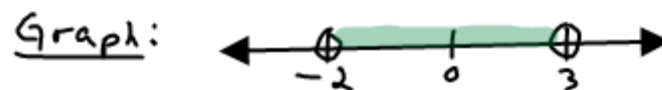
Solve a Multi-Step Absolute Value Inequality

1. Solve $|2x - 1| < 5$. Graph the solution on a number line. Then give the solution set in both set-builder and interval notation.

Like #1 above. So $|2x - 1| < 5 \Rightarrow -5 < 2x - 1 < 5$

$$\begin{array}{r} \text{Solve } -5 < 2x - 1 < 5 \\ +1 \quad +1 \quad +1 \\ \hline -4 < 2x < 6 \\ \frac{-4}{2} < \frac{2x}{2} < \frac{6}{2} \\ \hline -2 < x < 3 \end{array}$$

Set builder: $\{x \mid -2 < x < 3\}$



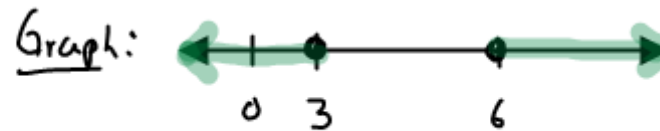
Interval: $(-2, 3)$

2. Solve $|3x - 12| \geq 6$. Graph the solution on a number line. Then give the solution set in both set-builder and interval notation.

Like #2 above. So $|3x - 12| \geq 6 \Rightarrow 3x - 12 \geq 6$ "or" $3x - 12 \leq -6$. Now Solve.

$$\begin{array}{r} 3x - 12 \geq 6 \quad \text{OR} \quad 3x - 12 \leq -6 \\ +12 \quad +12 \quad \quad \quad +12 \quad +12 \\ \hline 3x \geq 18 \quad \quad \quad 3x \leq 6 \\ \frac{3x}{3} \geq \frac{18}{3} \quad \quad \quad \frac{3x}{3} \leq \frac{6}{3} \\ \hline x \geq 6 \quad \quad \quad \text{OR} \quad \quad \quad x \leq 3 \end{array}$$

Set builder: $\{x \mid x \geq 6 \text{ or } x \leq 3\}$



Interval: $(-\infty, 3] \cup [6, +\infty)$

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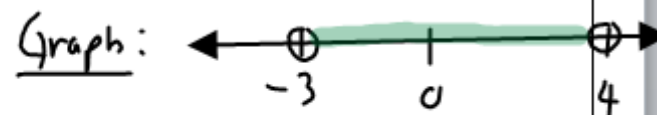
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3. Solve $|6r - 3| < 21$. Graph the solution on a number line. Then give the solution set in both set-builder and interval notation.

$$|6r - 3| < 21 \Rightarrow \begin{array}{ccc} -21 < 6r - 3 < 21 \\ +3 & +3 & +3 \\ \hline -18 < 6r < 24 \\ \frac{-18}{6} < \frac{6r}{6} < \frac{24}{6} \\ -3 < r < 4 \end{array}$$



Interval notation: $(-3, 4)$

Set-builder: $\{r \mid -3 < r < 4\}$

4. Solve $|b - 4| > 6$. Graph the solution on a number line. Then give the solution set in both set-builder and interval notation.

$$|b - 4| > 6 \Rightarrow \begin{array}{ccc} b - 4 > 6 & \text{OR} & b - 4 < -6 \\ +4 & +4 & +4 \\ \hline b > 10 & \text{OR} & b < -2 \end{array}$$

Interval:

$$(-\infty, -2) \cup (10, +\infty)$$

Set-builder: $\{b \mid b > 10 \text{ OR } b < -2\}$



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5. Solve $|7x| + 4 < 0$. Graph the solution on a number line. Then give the solution set in both set-builder and interval notation.

$$\begin{array}{r} |7x| + 4 < 0 \\ -4 \quad -4 \\ \hline \end{array}$$

$|7x| < -4 \Rightarrow$ Looks like an "AND". But the distance on the # line from zero cannot be -4 . So NO SOLUTION!

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