

Name _____ Date _____ Period _____

Solving Absolute Value Linear Equations

Algebra II Honors | Unit 2 | Day 5 | TEK A2.6.E

Objective: I can isolate an absolute value, split it into two cases, solve each case, and confirm my answers by hand and in Desmos - including equations with a variable on both sides.

Vocabulary

Isolate: get the absolute value expression _____ on one side before splitting.

Split into two cases: $|A| = B$ becomes $A = B$ _____ $A =$ _____.

Desmos check: graph each side of the equation as its own function - the solutions are exactly where the two graphs _____.

KEY IDEA

Step 1 - Isolate: get the absolute value alone on one side.

Step 2 - Split: $|A| = B$ becomes $A = B$ OR $A = -B$. Put parentheses around the whole -B.

Step 3 - Solve: solve each case separately.

Step 4 - Check: plug BOTH answers into the ORIGINAL equation.

Step 5 - Desmos check: type the left side as y1 and the right side as y2 - your answers should be the x-values where they cross.

Let's Work Through It

Example 1 — Solve $2|x + 1| - 3 = 7$.

Step 1 - Isolate: $2|x + 1| =$ _____ $\rightarrow |x + 1| =$ _____

Step 2 - Split: $x + 1 =$ _____ OR $x + 1 =$ _____

Step 3 - Solve: $x =$ _____ or $x =$ _____

Step 4 - Check: $2|4 + 1| - 3 =$ _____ $\checkmark$ $2|-6 + 1| - 3 =$ _____ $\checkmark$

Example 2 — Solve $|3x - 4| = 2x - 1$. The variable is on both sides now.

Step 2 - Split: $3x - 4 = 2x - 1$ OR $3x - 4 =$ _____

Step 3 - Solve: $x =$ _____ or $5x = 5 \rightarrow x =$ _____

Step 5 - Desmos: $y1 = |3x - 4|$, $y2 = 2x - 1$. They cross at $x =$ _____ and $x =$ _____.

Example 3 — Solve $|2x - 3| = x + 3$.

Step 2 - Split: $2x - 3 = x + 3$ OR $2x - 3 = \underline{\hspace{2cm}}$

Step 3 - Solve: $x = \underline{\hspace{2cm}}$ or $3x = 0 \rightarrow x = \underline{\hspace{2cm}}$

Step 4 - Check: $x = 6$: $|9| = 9, 6 + 3 = 9 \checkmark$ $x = 0$: $|-3| = 3, 0 + 3 = 3 \checkmark$

Step 5 - Desmos: $y1 = |2x - 3|$, $y2 = x + 3$. They cross at $x = \underline{\hspace{2cm}}$ and $x = \underline{\hspace{2cm}}$.

Example 4 — Solve $|3x + 1| = 2x + 9$.

Step 2 - Split: $3x + 1 = 2x + 9$ OR $3x + 1 = \underline{\hspace{2cm}}$

Step 3 - Solve: $x = \underline{\hspace{2cm}}$ or $5x = -10 \rightarrow x = \underline{\hspace{2cm}}$

Step 4 - Check: $x = 8$: $|25| = 25, 2(8) + 9 = 25 \checkmark$ $x = -2$: $|-5| = 5, 2(-2) + 9 = 5 \checkmark$

Step 5 - Desmos: $y1 = |3x + 1|$, $y2 = 2x + 9$. They cross at $x = \underline{\hspace{2cm}}$ and $x = \underline{\hspace{2cm}}$.

Your Turn

You Try 1 — Solve $3|x + 2| - 4 = 11$, then confirm it in Desmos.

Isolate: $|x + 2| = \underline{\hspace{2cm}}$ Split: $x + 2 = \underline{\hspace{2cm}}$ OR $x + 2 = \underline{\hspace{2cm}}$

Solve: $x = \underline{\hspace{2cm}}$ or $x = \underline{\hspace{2cm}}$ Desmos: $y1 = 3|x + 2| - 4$, $y2 = 11$ cross at $\underline{\hspace{2cm}}$

You Try 2 — Solve $|2x - 6| = x$, showing all five steps.

Split: $2x - 6 = x$ OR $2x - 6 = \underline{\hspace{2cm}}$

Solve: $x = \underline{\hspace{2cm}}$ or $x = \underline{\hspace{2cm}}$ Check: $\underline{\hspace{2cm}}$ Desmos: $\underline{\hspace{2cm}}$