

Solving Absolute Value Linear Equations

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

Objective: I can solve absolute value linear equations by isolating the absolute value and splitting into two cases.

Vocabulary

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

Split into two cases: $|A| = k$ ($k > 0$) becomes $A = k$ **OR** $A = -k$.

KEY IDEA

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

Step 2 - Split: $|A| = k$ becomes $A = k$ OR $A = -k$.

Step 3 - Solve: solve each case separately.

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

Let's Work Through It

Example 1 — Solve $|2x - 3| - 4 = 3$.

Step 1 - Isolate: $|2x - 3| = 7$

Step 2 - Split: $2x - 3 = 7$ OR $2x - 3 = -7$

Step 3 - Solve: $x = 5$ or $x = -2$ Solution set: $\{-2, 5\}$

Step 4 - Check: $|2(5) - 3| - 4 = 3$ ✓ $|2(-2) - 3| - 4 = 3$ ✓

Example 2 — Solve $|x| + 2 = 5$.

Isolate: $|x| = 3$

Split: $x = 3$ OR $x = -3$

Solve: both valid, since plugging either back in gives the same absolute value.

Example 3 — Solve $2|x + 1| - 3 = 7$.

Isolate: $2|x + 1| = 10 \rightarrow |x + 1| = 5$

Split: $x + 1 = 5$ OR $x + 1 = -5$

Solve: $x = 4$ or $x = -6$

Example 4 — Solve $3|x - 4| + 1 = 13$.

Isolate: $|x - 4| = 4$

Split: $x - 4 = 4$ OR $x - 4 = -4$

Solve: $x = 8$ or $x = 0$

Example 5 — Solve $|x - 4| = 9$.

Split: $x - 4 = 9$ OR $x - 4 = -9$

Solve: $x = 13$ or $x = -5$

Your Turn

You Try 1 — Solve $|3x + 6| = 12$.

Split: $3x + 6 = 12$ OR $3x + 6 = -12$

Solve: $x = 2$ or $x = -6$

You Try 2 — Solve $2|x - 5| - 1 = 9$, showing the isolate, split, and solve steps.

Isolate: $|x - 5| = 5$

Split: $x - 5 = 5$ OR $x - 5 = -5$

Solve: $x = 10$ or $x = 0$