Solving Absolute Value Equations

Level 1 - Solve simple absolute value equations
Level 2 - Solve multi-step absolute value equations
Level 3 - Create and solve absolute value equations

Absolute value tells how far a number is from zero on a number line, no matter which direction. That means |–3| and |3| both equal 3, because both are three units away from zero.

When solving absolute value equations, you're really solving two equations, one for the positive case and one for the negative case.

If |x| = a, then x = a or x = –a, as long as a ≥ 0.

When an equation is more complex, like |expression| = number, you must isolate the absolute value before splitting it into two cases.

Example #1 $\left\|\frac{-x}{3}\right\| = 7$	**Example #2** $\|x+2\| = 12$	**Example #3** $-2\left\|\frac{x}{4}\right\| + 2 = -8$
$\left(\frac{-x}{3}\right) = 7$ *or* $-\left(\frac{-x}{3}\right) = 7$ $\frac{-x}{3} = 7$ *or* $\frac{-x}{3} = -7$ $-x = 21$ *or* $-x = -21$ $\boxed{x = -21 \text{ or } x = 21}$	$(x+2) = 12$ *or* $-(x+2) = 12$ $x+2 = 12$ *or* $x+2 = -12$ $\boxed{x = 10 \text{ or } x = -14}$	*isolate the absolute value*: $-2\left\|\frac{x}{4}\right\| = -10$ $\left\|\frac{x}{4}\right\| = 5$ *create the two equations and solve*: $\left(\frac{x}{4}\right) = 5$ *or* $-\left(\frac{x}{4}\right) = 5$ $\frac{x}{4} = 5$ *or* $\frac{x}{4} = -5$ $\boxed{x = 20 \text{ or } x = -20}$

Remember:

- Always isolate the absolute value before splitting into two equations.
- Remember that absolute value cannot equal a negative number.
- Double-check each solution by substituting it back into the original equation.