9.3 Equations and Inequalities with Absolute Values

Equations with Absolute Values

Recall that the absolute value of a number, $|x|$, represents the distance from 0 for that number. Essentially, it takes any number and turns it positive. If we have an equation involving absolute values, we typically end up with 2 values as answers - why?

Rewriting Absolute Value Equations

If c is some positive number and u is an algebraic expression, then we can rewrite $|u| = c$ as $u = c$ or $u = -c$.

Example 9.3.1. Solve:

$$|2x - 1| = 5$$

Example 9.3.2. Solve:

$$2|1 - 3x| - 28 = 0$$

Rewriting Equations with 2 Absolute Values
If u and v are both some algebraic expression, then we can rewrite $|u| = |v|$ as $u = v$ or $u = -v$.

Example 9.3.3. Solve:
$$|2x - 7| = |x + 3|$$

Inequalities with Absolute Values

Inequalities of the form $|u| < c$
If c is a positive number and u is an algebraic expression, then $|u| < c$ can be rewritten as the compound inequality $-c < u < c$.

Example 9.3.4. Solve:
$$|x - 2| < 5$$

Example 9.3.5. Solve:

$$-3|5x-2|+20 \geqslant -19$$

Inequalities of the form $|u| > c$

If c is a positive number and u is an algebraic expression, then $|u| > c$ can be rewritten as $u < -c$ or $u > c$.

Example 9.3.6. Solve:

$$|2x-5| \geqslant 3$$