GENERAL

solving absolute value inequalities worksheet

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Solving Absolute Value Inequalities Worksheet: A Complete Guide for Students and Educators

Absolute value inequalities are a staple in algebra courses, yet many students find them intimidating. The key to mastering these problems lies in practice, clear strategies, and a solid understanding of the underlying concepts. This article is your go-to resource for tackling absolute value inequalities, complete with step by step worksheets, illustrative examples, common pitfalls, and practical tips for both learners and teachers. Whether you're a high school student preparing for exams, a tutor looking for fresh practice material, or a teacher seeking engaging classroom activities, this guide will help you navigate the world of absolute value inequalities with confidence.

What Are Absolute Value Inequalities?

In algebra, the absolute value of a number is its distance from zero on the number line, regardless of direction. For any real number *x*, the absolute value is written as |x| and defined as:

1. Positive or zero values: |x| = x if x ≥ 0.
2. Negative values: |x| = -x if x < 0.

When you encounter an inequality that includes an absolute value, you're essentially asking: "For which values of *x* does the distance from zero satisfy a given relationship?" Solving these inequalities often requires splitting the problem into two separate cases—one for when the expression inside the absolute value is non negative, and another for when it's negative.

Why Are Absolute Value Inequalities Important?

- They provide a foundation for understanding real world scenarios that involve distances, errors, and tolerances.
- They sharpen logical reasoning skills by requiring case by case analysis.
- They bridge basic algebra to more advanced topics such as linear programming and optimization.
- They are frequently tested on standardized exams, including the SAT, ACT, and AP Calculus.

Types of Absolute Value Inequalities

Absolute value inequalities come in two main forms:

These inequalities describe a bounded distance from zero. They translate to a double ended inequality:

|expression| < a !Ô -a < expression < a

These inequalities describe a distance that exceeds a threshold. They translate to a union of two intervals:

|expression| > a !Ô expression < -a or expression > a

Understanding the transformation rules is essential for constructing accurate solution sets.

Step by Step Strategy for Solving Absolute Value Inequalities

Below is a systematic approach that you can apply to any absolute value inequality. Following these steps ensures consistency and reduces the likelihood of errors.

1. Isolate the absolute value expression. If the inequality contains additional terms, bring them to the other side

of the inequality.

2. Determine the type of inequality. Identify whether it’s a “less than” (bounded) or “greater than” (unbounded) inequality.
3. Set up the equivalent system. For |x| < a, write -a < x < a. For |x| > a, write x < -a or x > a.
4. Solve each part. Treat the resulting inequalities as ordinary linear inequalities.
5. Combine the results. For “less than” cases, intersect the intervals. For “greater than” cases, union the intervals.
6. Check the solution. Plug a test value from each interval back into the original inequality to verify correctness.

Illustrative Example Worksheets

Below are three example worksheets that demonstrate the application of the strategy described above. Each worksheet includes a set of problems of varying difficulty, followed by detailed solutions.

1. Problem: Solve |x - 3| < 5.
2. Problem: Solve |2x + 1| > 7.
3. Problem: Solve |x + 4| &leq 0.

Solutions:

|2x + 1| > 7 translates to 2x + 1 < -7 or 2x + 1 > 7. Solving each gives 2x < -8 !’ x < -4 and 2x > 6 !’ x > 3. Solution set: (-" , -4) "* (3, ").

|x + 4| &leq 0 is only true when the expression inside the absolute value equals zero, because absolute values are never negative. Setting x + 4 = 0 gives x = -4. Solution set: {-4}.

1. Problem: Solve |3x - 2| &leq 4 & |x + 1| > 2.
2. Problem: Solve |x/2 - 3| < 1.
3. Problem: Solve |x^2 - 4| > 0.

Solutions:

|x/2 - 3| < 1 !’ -1 < x/2 - 3 < 1 !’ add 3: 2 < x/2 < 4 !’ multiply by 2: 4 < x < 8. Solution set: (4, 8).

|x^2 - 4| > 0 is true for all real numbers except where the expression inside equals zero. Solve x^2 - 4 = 0 !’ (x - 2) (x + 2) = 0 !’ x = 2 or x = -2. Therefore, solution set: ! \\{-2, 2}.

1. Problem: A delivery truck travels at a constant speed. The distance from the starting point at time t is |5t - 20| miles. Find the time intervals when the truck is within 10 miles of the start.
2. Problem: The temperature deviation from the average over a week is represented by |T - 70| degrees. If the deviation must not exceed 5 degrees, write the inequality and solve for T.
3. Problem: A security system triggers when the distance from a reference point exceeds 15 meters. The distance is modeled by |2x + 5| meters. Determine all positions x that will activate the alarm.

Solutions:

Set up inequality: |T - 70| <= 5 !’ -5 < T - 70 < 5 !’ add 70: 65 < T < 75. Temperature must be between 65 and 75 degrees.

Alarm triggers when |2x + 5| > 15. Solve: 2x + 5 < -15 or 2x + 5 > 15 !’ 2x < -20 !’ x < -10 or 2x > 10 !’ x > 5. Positions x less than -10 meters or greater than 5 meters activate the alarm.

Common Mistakes and How to Avoid Them

- Ignoring the absolute value sign: Always treat the absolute value as a distance. Forgetting to split the inequality leads to incorrect intervals.
- Incorrect sign handling: When moving terms across the inequality, remember that multiplying or dividing by a negative number reverses the inequality sign.
- Overlooking the equality case: For “less than or equal to” (≤) and “greater than or equal to” (≥) inequalities, remember to include the boundary points in the solution set.
- Missing the union or intersection: For “greater than” inequalities, you should take the union of the two disjoint intervals; for “less than” inequalities, you intersect the two bounds.

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