Absolute Value Inequalities

Absolute value inequalities are similar to regular inequalities with a few important guidelines you should keep in mind when doing them:

1) If you are multiplying or dividing BOTH sides of the inequality by the SAME NEGATIVE number, the inequality sign is FLIPPED.

2) The number on the side OPPOSITE of the variable has to be POSITIVE since absolute value only works with positive numbers.

3) You are finding 2 solutions, one where the number on the opposite side of the variable is positive (solutions are SAME sign as original problem unless it is FLIPPED for - numbers) and one where the number is negative (sign is always FLIPPED for these solutions even after the - number flip).

Let's practice with a few examples!

1) $|x+12| < 30$

Subtract 12 to solve both inequalities.

$$\begin{array}{rr|rr} |x+12| < 30 & & |x+12| < -30 & \\ -12 & -12 & -12 & -12 \\ \hline x < 18 & & x > -42 & \end{array}$$

$$-42 < x < 18$$

2) $|-4v| \geq -16$

Divide both sides by -4 (making sure to FLIP the inequality sign for the inequality with 16!) after creating 2 inequalities (one with 16 and -16) to get the solutions.

$$\frac{|-4v|}{-4} \geq \frac{16}{-4} \qquad \frac{|-4v|}{-4} \geq \frac{-16}{-4}$$

$$v \leq -4 \qquad v \geq 4$$

$$v \leq -4 \text{ OR } v \geq 4$$

3) $|2a+7| > 33$

Create 2 inequalities (one with 33 and -33) before subtracting 7 and then dividing 2 from both sides to get the solutions.

$$|2a + 7| > 33 \qquad |2a + 7| > -33$$
$$-7 \quad -7 \qquad -7 \quad -7$$
$$\frac{|2a|}{2} > \frac{26}{2} \qquad \frac{|2a|}{2} > \frac{-40}{2}$$

$$a > 13 \qquad a < -20$$

$$a < -20 \text{ OR } a > 13$$

Make sure to keep practicing these inequalities!

Tips for Solving Problems:

1. When doing absolute value inequalities, make sure that the solution to the inequality with the NEGATIVE number FLIPS its sign from what it was originally in the problem (if multiplying or dividing by a negative number, FLIP the sign twice).

2. If the 2 solutions to your inequality with their signs fall IN BETWEEN each other (like $b > 13$ and $b < 17$), then write your final solution as $13 < b < 17$ (b can be IN BETWEEN 13 and 17).

3. Remember to keep the SAME inequality sign for your solution of the inequality that has a positive number on the side opposite of the variable (unless you are multiplying or dividing by a negative number, where the sign is FLIPPED).