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## Solving Absolute Value Equations

## 1. Intro to Absolute Value

The Absolute Value of a number is the number's distance from zero (picture the number line).


Thus, the following equations are TRUE: $|5|=5,|-5|=5,|0|=0$.
Solve the following equations. Remember that there may be multiple solutions.

$$
\left.\begin{aligned}
& \text { 1. }|x|=3 \\
& x=3 \& x=-3
\end{aligned}\left|\begin{array}{c}
\text { 2. }|x|=7 \\
x=7 \& x=-7
\end{array}\right| \begin{aligned}
& \text { 3. } \\
& |x|=0 \\
& x=0
\end{aligned} \right\rvert\, \begin{aligned}
& \text { 4. }|x|=-3 \\
& \text { No Solution }
\end{aligned}
$$

I hope you discovered that equation 3 had only one solution and equation 4 had no solutions. The only number with a distance of zero is zero, and there are no numbers that are a negative distance from zero.

## 2. Solving Absolute Value Equations by Undoing

We solve absolute value equations just like radical equations and quadratic equations in vertex form (follow SADMEP order). The absolute value bars function as "parentheses," just like the radical symbol, so you will undo the inside of the function last.

Solve the equations side by side and notice how similar the processes are. Check solution(s).

3. Vertex (Center of Solutions)

When you solve a basic absolute value equation, like $|x|=10$, the solutions of 10 and -10 are centered around zero on the number line. We call the center of solutions the vertex. Solve the following equations and represent the solutions with a number line. Identify the vertex.


If you are solving the equation $|x-7|=10$, what is the vertex?
If you are solving the equation $|x+7|=10$, what is the vertex?
Generalize your findings, ie. if you are solving $\lfloor|x-h|=y$, what is the vertex?

4. Extra Practice

Solve the following equations. Be careful, there will be situations with 1 or no solution.


