DETAILED SOLUTIONS AND CONCEPTS - ABSOLUTE VALUE EQUATIONS

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PLEASE NOTE THAT YOU CANNOT USE A CALCULATOR ON THE ACCUPLACER - ELEMENTARY ALGEBRA TEST! YOU MUST BE ABLE TO DO THE FOLLOWING PROBLEMS WITHOUT A CALCULATOR!

How to Find Solutions of Absolute Value Equations

If c is positive, $|ax + b| = c$ is equivalent to $(ax + b) = c$ or $-(ax + b) = c$.

You have to solve both equations!!! The word "or" is a part of the formula and must be there. It does not mean that you can use either one of the equations when you solve the variable.

- Isolate the absolute value on one side of the equation. Be sure the coefficient is 1.
- Solve both equations $(ax + b) = c$ or $-(ax + b) = c$.
- Check the solutions in the original equation, rejecting any that do not satisfy it.

Problem 1:

Solve $|4 - 5x| - 19 = 0$

Let's isolate the absolute value as follows:

$|4 - 5x| = 19$

By definition, $(4 - 5x) = 19$

or $-(4 - 5x) = 19$

$-4 + 5x = 19$

and $-5x = 15$ or $5x = 23$

then $x = -3$ or $x = \frac{23}{5}$

Checking the solutions in the original equation we find

|4 - 5(-3)| = |4 + 15| = |19| = 19

$|4 - 5(\frac{23}{5})| = |4 - 23| = |-19| = 19$

Problem 2:

Solve **|3x| - 6 = 0**

Let's isolate the absolute value as follows:

|3x| = 6

By definition, ***3x = 6*** or ***-3x = 6***

and ***x = 2*** or ***x = -2***

Checking the solutions in the original equation we find

|3(2)| = |6| = 6

|3(-2)| = |-6| = 6

Problem 3:

Solve ***|x + 2| + 1 = 0***

Let's isolate the absolute value as follows:

|x + 2| = -1

Please note that an absolute value is never equal to a negative number. There is actually NO solution to this problem. However, let's just go ahead and pretend that we did not notice.

By definition, ***x + 2 = -1***

or ***-(x + 2) = -1***

-x -2 = -1

and ***x = -3*** or ***x = -1***

Checking the solutions in the original equation we find

|-3 + 2| + 1 = |-1| + 1 = 1 + 1 = 2 ≠ 0

|-1 + 2| + 1 = |1| + 1 = 1 + 1 = 2 ≠ 0

We find that there is NO solution.

Problem 4:

Solve **|x - 4| = 7**

By definition, ***x - 4 = 7***

or ***-(x - 4) = 7***

-x + 4 = 7

and ***x = 11*** or ***x = -3***

Checking the solutions in the original equation we find

|11 - 4| = |7| = 7

|-3 - 4| = |-7| = 7

Problem 5:

Solve **|3x + 2| - 1 = 4**

Let's isolate the absolute value as follows:

|3x + 2| = 5

By definition, ***3x + 2 = 5***

or ***-(3x + 2) = 5***

-3x - 2 = 5

and ***x = 1*** or $x = -\frac{7}{3}$

Problem 6:

Solve **|x| = 15**

By definition, ***x = 15*** or ***-x = 15***

and ***x = 15*** or ***x = -15***