Notes 2-5 Solving Absolute Value Equations Name Key

Period _____

The absolute value of a number is the distance between zero & the numbers.

Distance is always positive, therefore the absolute value of a number will always be positive.

Ex: $|-7| =$ 7 $|5 - 6.5| =$ $|-1.5| = 1.5$ $|(-9)(-5)| =$ $|45| = 45$

Evaluating expressions with absolute values:

Ex: Evaluate: $8 - |2n - 5|$ if n = -7.5

$8 - |2(-7.5) - 5|$

$= 8 - |-15 - 5|$

$= 8 - |-20| = 8 - 20 = -12$

1) Evaluate: $|4x + 3| - 3$ if x = -2

$|4(-2) + 3| - 3$

$= |-8 + 3| - 3$

$= |-5| - 3 = 5 - 3 = 2$

Solving Absolute Value Equations:

When we move 'x' number of units on a number line, we can move in the positive or negative direction, so there are often two solutions to absolute value equations.

Solving absolute value equations:
Step 1: isolate the absolute value bars
Step 2: remove the bars and write two equations – one positive and one negative
Step 3: solve each equation.
Step 4: check your solutions.

Ex: $|x - 12| = 9$

$x - 12 = 9$ or $x - 12 = -9$

$+12 \quad +12 \qquad +12 \quad +12$

$x = 21$ $x = 3$

2) $|y + 5| = 8$

$y + 5 = 8$ or $y + 5 = -8$

$-5 \quad -5 \qquad -5 \quad -5$

$y = 3$ or $y = -13$

Ex: $3|2x - 3| = 9$

$\frac{3}{3} \quad \frac{9}{3}$

$|2x - 3| = 3$

$2x - 3 = 3$ or $2x - 3 = -3$

$+3 \quad +3 \qquad +3 \quad +3$

$\frac{2x}{2} = \frac{6}{2}$ $x = 3$ $\frac{2x}{2} = \frac{0}{2}$ $x = 0$

3) $-5|x + 1| = -20$

$\frac{-5}{-5} \quad \frac{-20}{-5}$

$|x + 1| = 4$

$x + 1 = 4$ or $x + 1 = -4$

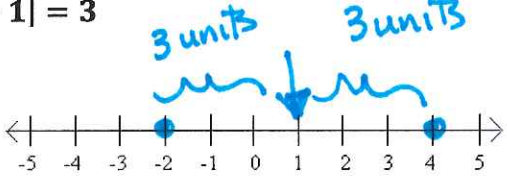
$-1 \quad -1 \qquad -1 \quad -1$

$x = 3$ $x = -5$

Writing Absolute Value Equations from a Number Line

To help understand how adding or subtracting to the x inside the absolute symbol affects the equation, we will look at the solutions set for 2 different examples.

$|x - 1| = 3$



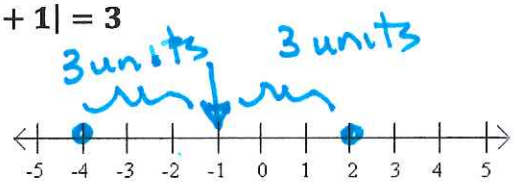
$|x-1| = 3$

$x-1 = 3$ or $x-1 = -3$

$+1 \quad +1 \qquad +1 \quad +1$

$x = 4$ or $x = -2$

$|x + 1| = 3$



can be written: $|x-(-1)| = 3$

$|x+1| = 3$

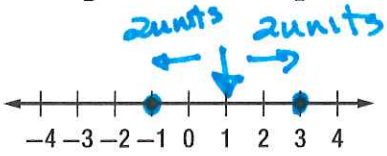
$x+1 = 3$ or $x+1 = -3$

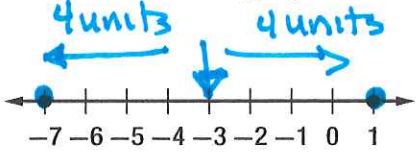
$-1 \quad -1 \qquad -1 \quad -1$

$x = 2$ or $x = -4$

When writing an absolute value equation from a given solution set, look for the center point, then write the equation as 'x minus that value' inside the absolute bars.

Example: Write an equation involving absolute value for each graph. Check your work.





Check

$|x-1| = 2$

$x-1 = 2$ or $x-1 = -2$

$+1 \quad +1 \qquad +1 \quad +1$

✓ $x = 3$ $x = -1$ ✓

$|x-(-3)| = 4$ or $|x+3| = 4$

$x+3 = 4$ or $x+3 = -4$

$-3 \quad -3 \qquad -3 \quad -3$

✓ $x = 1$ ✓ $x = -7$

Writing Absolute Value Equations from Word problems:

Most freshwater tropical fish thrive if the water is within 2 degrees of 78 degrees Fahrenheit. Write an equation to determine the least and greatest optimal temperatures.

$|x - 78| = 2$

actual water temp

desired

mid point

temperature can be 76 or 78.

Check:

$x-78 = 2$ or $x-78 = -2$

$+78 \quad +78 \qquad +78 \quad +78$

✓ $x = 80$ ✓ $x = 76$