absolute value

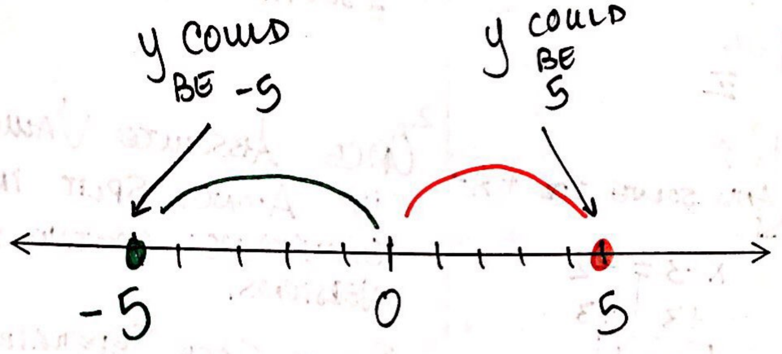
Name:

Make the line below into a number line. Then plot a number, y, that is 5 units away for zero.

WHAT NUMBER IS 5 UNITS AWAY FROM ZERO?

$|y| = 5$

Distance is always positive



BOTH POSSIBLE VALUES FOR y ARE 5 UNITS FROM ZERO, BUT IN DIFFERENT DIRECTIONS

$|y| = 5$

$\boxed{y = -5 \text{ or } y = +5}$

What number are the solutions equidistant from? ZERO

THE SAME DISTANCE AWAY

Will every absolute value equation have **two different numbers** that are equidistant from zero? No.

SOMETIMES THERE WILL BE 2 NUMBERS THAT ARE THE SAME DISTANCE FROM ZERO, BUT SOMETIMES THERE IS ONLY ONE, OR SOMETIMES NO NUMBER AT ALL....

One Number	No Number
(WHAT ONE NUMBER IS ZERO UNITS FROM ZERO?) ZERO! Ex: $\lvert x\rvert = 0$ or $\lvert x+2\rvert = 0$ or $\lvert 2x-3\rvert = 0$	(WHAT KIND OF ABSOLUTE-VALUE EQUATION HAS NO SOLUTION?) $\lvert x\rvert = -7$ or $\lvert 3x+5\rvert = -3$ HOW COULD A VALUE BE NEGATIVE UNITS FROM ZERO?

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Name:

Algebra 1: Unit 1, lesson 6 Notes: Solving Absolute-Value Equations

Steps to Solving an Absolute-Value Equation

Example 1:

$2|x-3|+1=5$

$-1 \quad -1$

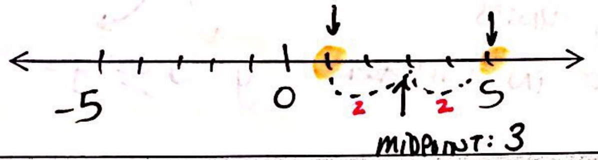
$\frac{2|x-3|}{2}=\frac{4}{2}$

$|x-3|=2$

DROP ABSOLUTE VALUE AND SOLVE FOR + & -

$x-3=+2$ | $x-3=-2$
$+3 \quad +3$ | $+3 \quad +3$
$\boxed{x=5}$ | $\boxed{x=1}$

solution | solution



Steps:

1. ISOLATE ABSOLUTE VALUE EXPRESSION
2. ONCE ABSOLUTE VALUE EXPRESSION IS ALONE, SPLIT INTO 2 EQUATIONS: POSITIVE & NEGATIVE VERSIONS.
3. SOLVE EACH SEPERATELY.
4. PLOT ON NUMBER LINE: CHECK IF YOU WANT.

Draw some conclusions.

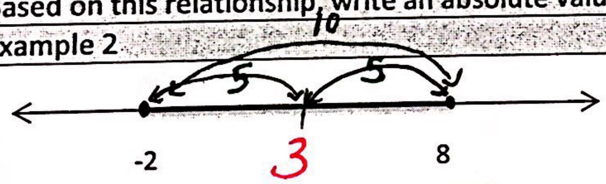
Using the equation and number line from example 1, examine the relationships between the value of the solutions, midpoint, and distance.

$|x-3|=2$

- THE MIDPOINT OF 1 & 5 IS 3.
- DISTANCE BETWEEN SOLUTION & MIDPOINT IS 2.

Based on this relationship, write an absolute value equation for the following graphs.

Example 2



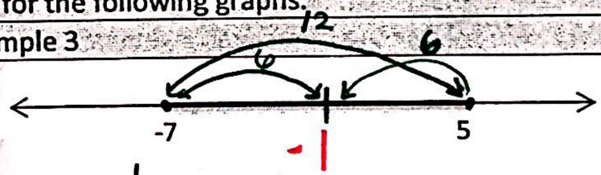
$\boxed{|x-3|=5}$

Check

$x-3=5$
$+3 \quad +3$
$x=8$ ✓

$x-3=-5$
$+3 \quad +3$
$x=-2$ ✓

Example 3



$|x - -1|=6$

$\boxed{|x+1|=6}$

CHECK

$x+1=6$
$-1 \quad -1$
$x=5$ ✓

$x+1=-6$
$-1 \quad -1$
$x=-7$ ✓

The structure of an absolute value equation:

$|x-\text{midpoint}|$ = distance between solution and midpoint

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Name:

Example 4

$|2x-10|+4=4$

$-4 \quad -4$

$|2x-10|=0$

THERE WILL ONLY BE ONE SOLUTION

$2x-10=0$

$+10 \quad +10$

$\frac{2x}{2}=\frac{10}{2}$

$x=5$

0 5

Example 5

$|3x+9|+10=4$

$-10 \quad -10$

$|3x+9|=-6$

WHEN ABSOLUTE VALUE IS ISOLATED AND IT = A NEGATIVE

NO SOLUTION

Example 6

$|x-2|-5=3$

$+5 \quad +5$

$|x-2|=8$

$x-2=8$ $\quad$ $x-2=-8$

$+2 \quad +2$ $\quad$ $+2 \quad +2$

$\boxed{x=10}$ $\quad$ $\boxed{x=-6}$

-6 0 10

Example 7

$\frac{4|2x+6|}{4}=\frac{16}{4}$

$|2x+6|=4$

-5 -1 0

$2x+6=4$ $\quad$ $2x+6=-4$

$-6 \quad -6$ $\quad$ $-6 \quad -6$

$\frac{2x}{2}=\frac{-2}{2}$ $\quad$ $\frac{2x}{2}=\frac{-10}{2}$

$\boxed{x=-1}$ $\quad$ $\boxed{x=-5}$

Example 8

$-2|4x-1|-3=-11$

$+3 \quad +3$

$\frac{-2|4x-1|}{-2}=\frac{-8}{-2}$

$|4x-1|=4$

$4x-1=4$ $\quad$ $4x-1=-4$

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

$\frac{4x}{4}=\frac{5}{4}$ $\quad$ $\frac{4x}{4}=\frac{-3}{4}$

$\boxed{x=\frac{5}{4}}$ $\quad$ $\boxed{x=-\frac{3}{4}}$

Example 9: The minimum sustained wind speed of a category 1 hurricane is 74mph. The maximum sustained wind speed is 95mph.

WRITE AN ABSOLUTE VALUE EQUATION THAT REPRESENTS THE MAX & MIN SPEEDS?

(1) PLOT MINIMUM & MAXIMUM: FIND DISTANCE BETWEEN THEM. 21

(2) FIND MIDPOINT: 84.5

(3) USE MIDPOINT and DISTANCE BETWEEN MIDPT & SOLUTION: 10.5

21

10.5 10.5

74 84.5 95

$|x - \text{MID}|$ = DISTANCE BETWEEN MIDPOINT & SOLUTION

$\boxed{|x-84.5|=10.5}$

Ticket out the Door

Pretend you are a distance runner. Your slowest 3-mile run is _________ minutes and your fastest 3-mile run is _________ minutes. Write an absolute value equation that represents your minimum and maximum speeds.

Notes