7.3 Absolute Value Equations

Example 1

Solve an Absolute Value Equation

Solve $|x - 3| = 7$.

$x-3 = 7$

$x = 10$

$-(x-3) = 7$

$-x+3 = 7$

$-x = 4$

$x = -4$

$x-3 = -7$

check. $|7| = 7$ ✓

check. $|-7| = 7$ ✓

$x = 10$ or $x = -4$

Your Turn

Solve $|6 - x| = 2$ graphically and algebraically.

$6 - x = 2$

$-x = -4$

$x = 4$

$|2| = 2$ ✓

$-(6-x) = 2$

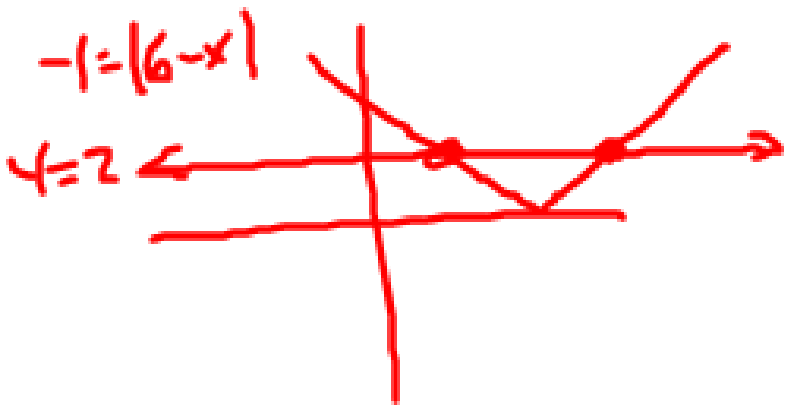
$-6 + x = 2$

$x = 8$

$|6-8| = 2$

$|-2| = 2$ ✓

$x = 4$ or $x = 8$



Example 3

Absolute Value Equation

Solve $|2x - 5| = 5 - 3x$.

$2x-5 = 5-3x$

$5x = 10$

$x = 2$

$|4-5| = 5-6$

$|-1| = -1$

$1 = -1$

extraneous.

$-(2x-5) = 5-3x$

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

$x = 0$

$|-5| = 5$

$5 = 5$ ✓

$\therefore x = 0$

Example 4

Absolute Value Equation

Solve $|3x - 4| + 12 = 9$.

$|3x-4| = -3$

↑

negative.

no solution

Example 5

Solve an Absolute Value Equation Involving a Quadratic Expression

Solve $|x^2 - 2x| = 1$.

$x^2 - 2x = 1$

$x^2 - 2x - 1 = 0$

$x = \frac{2 \pm \sqrt{4+4}}{2}$

$x = \frac{2 \pm \sqrt{8}}{2}$

$x = \frac{2 \pm 2\sqrt{2}}{2}$

$x = 1 \pm \sqrt{2}$

$x = 1+\sqrt{2}$ ✓ $x = 1-\sqrt{2}$ ✓

$1+2+2\sqrt{2}-2-2\sqrt{2} = 1$

$1 = 1$

$-(x^2 - 2x) = 1$

$x^2 - 2x = -1$

$x^2 - 2x + 1 = 0$

$(x-1)(x-1) = 0$

$x = 1$

$|1-2| = 1$

$|-1| = 1$ ✓

$x = 1+\sqrt{2}$ or $1-\sqrt{2}$ or 1

$1+2-2\sqrt{2}-2+2\sqrt{2} = 1$

$1 = 1$ ✓

Example 6

Solve an Absolute Value Equation Involving Linear and Quadratic Expressions

Solve $|x - 10| = x^2 - 10x$.

$x-10 = x^2-10x$

$0 = x^2-11x+10$

$0 = (x-10)(x-1)$

$x=10 \quad x=1$

$-(x-10) = x^2-10x$

$-x+10 = x^2-10x$

$0 = x^2-9x-10$

$0 = (x-10)(x+1)$

$x=10 \quad x=-1$

check $x=10$

$|0| = 100-100$ ✓

Check $x=1$

$|1-10| = |-10$

$|-9| = -9$

$9 = -9$ x

check $x=-1$

$|-1-10| = |-10(-1)$

$|-11| = |+10$

$11 = 11$ ✓

$x=10$ or $x=-1$

Today: 4-6 pg.389

Tomorrow: HWP (7.1, 7,2) 7-17, 20, 22 pgs.389-391