

NOTES: Completing the Square Date: 1-29-18

There are multiple ways to solve a quadratic (x^2) function

METHOD 1: Solve by Factoring

- MAKE SURE x^2 IS POSITIVE AND EQUATION = 0

Example: $x^2 + 14x = -33$
 $+33 +33$

$$x^2 + 14x + 33 = 0$$
$$(x+11)(x+3) = 0$$

$$x = -11 \quad x = -3$$

METHOD 2: Solve by Taking Square Roots

- USE WHEN YOU HAVE x^2 AND (NO) x TERM
(OR)
- WHEN YOU HAVE A $()^2$ ← PARENTHESIS SQUARED

Example: $(x+3)^2 = 16$

$$x+3 = \pm 4$$
$$-3 \quad -3$$
$$x = \pm 4 - 3$$

$$x = 1 \quad x = -7$$

Example: $x^2 - 12 = 0$

$$+12 +12$$

$$\sqrt{x^2} = \sqrt{12}$$

$$x = \pm 2\sqrt{3}$$

OR

$$x \approx 3.46$$

NEW: Method 3: Completing the Square

USED TO MAKE SOMETHING THAT (CANNOT) BE FACTORED INTO A $()^2$ ← SQUARE EQUATION SO WE CAN SOLVE WITH SQUARE ROOTS

Example: $x^2 - 10x - 54 = 0$

Hmm...
CAN WE FACTOR
THIS?

(NO)

54
1, 54
2, 27
3, 18
6, 9

SO, IF WE CANNOT FACTOR IT, WE NEED TO MAKE IT A $()^2$ PROBLEM SO WE CAN SOLVE WITH SQUARE ROOTS!

METHOD 3: Completing the Square

Algebra

$$x^2 - 10x - 54 = 0$$

$$+54 +54$$

$$x^2 - 10x = 54$$

$$x^2 - 10x + \left(\frac{-10}{2}\right)^2 = 54 + \left(\frac{-10}{2}\right)^2$$

$$x^2 - 10x + 25 = 54 + 25$$

$$x^2 - 10x + 25 = 79$$

$$(x-5)^2 = 79$$

$$\sqrt{(x-5)^2} = \sqrt{79}$$

$$x-5 = \pm\sqrt{79}$$

$$x = \pm\sqrt{79} + 5$$

or

IN DECIMAL FORM

$$x \approx 13.9$$

$$x \approx -3.9$$

Steps/explanation

ORIGINAL EQUATION

keep the x^2 term and x term on one side, and move the constant to the right

we will ADD IN A SPECIAL SQUARE $\left(\frac{b}{2}\right)^2$ to BOTH SIDES

Simplify!

FACTOR THE LEFT INTO A PERFECT SQUARE!
★ THIS METHOD ALWAYS CREATES A PERFECT FACTOR SQUARE!

NOW SOLVE USING SQUARE ROOTS!