

**Unit Overview #5: Solve by Completing the Square and Taking Square Roots**

How to solve, step-by-step:

$$x^2 - 22x + 4 = 3$$

STEP 1: separate the  $x^2$  &  $x$  terms from the rest

$$(x^2 - 22x) + 4 = 3$$

STEP 2: Find the number that completes the square

OPTION 1

	$x$	$-11$
$x$	$x^2$	$-11x$
$-11$	$-11x$	$121$

OPTION 2

$$\left(\frac{b}{2}\right)^2 = \left(\frac{-22}{2}\right)^2 = (-11)^2 = 121$$

STEP 3: Add that number to the square AND balance the equation

$$(x^2 - 22x + 121) + 4 - 121 = 3$$

STEP 4: Rewrite as a square Area  $\rightarrow$  (side)<sup>2</sup>

$$(x - 11)^2 - 117 = 3 \leftarrow \text{completing the square done}$$

--- NOW, SOLVE BY TAKING SQUARE ROOTS ---

STEP 1: Isolate the square

$$(x - 11)^2 - 117 = 3$$

$$+ 117 \quad + 117$$

STEP 2: Take square roots

$$(x - 11)^2 = 120$$

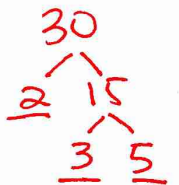
$$x - 11 = \pm \sqrt{120}$$

STEP 3: Simplify radical

$$x - 11 = \pm \sqrt{4 \cdot 30}$$

$$x - 11 = \pm 2\sqrt{30}$$

$$+ 11 \quad + 11$$



STEP 4: isolate  $x$

$$x = \{11 \pm 2\sqrt{30}\}$$

$$x = \{11 + 2\sqrt{30}, 11 - 2\sqrt{30}\}$$

Your work should look exactly like this:

$$x^2 + 10x + 1 = 8$$

$$(x^2 + 10x) + 1 = 8$$

$$(x^2 + 10x + 25) + 1 - 25 = 8$$

$$(x+5)^2 - 24 = 8$$

$$+24 \quad +24$$

$$(x+5)^2 = 32$$

$$x+5 = \pm\sqrt{32}$$

$$x+5 = \pm\sqrt{16 \cdot 2}$$

$$x+5 = \pm 4\sqrt{2}$$

$$-5 \quad -5$$

$$x = \{-5 \pm 4\sqrt{2}\}$$

$$(x-3)^2 + 4 = 29$$

$$-4 \quad -4$$

$$(x-3)^2 = 25$$

$$x-3 = \pm\sqrt{25}$$

$$x-3 = \pm 5$$

$$+3 \quad +3$$

$$x = 3 \pm 5$$

$$x = \{3+5, 3-5\}$$

$$x = \{8, -2\}$$

$$2x^2 - 12 = 12$$

$$+12 \quad +12$$

$$\frac{2x^2}{2} = \frac{24}{2}$$

$$x^2 = 12$$

$$x = \pm\sqrt{12}$$

$$x = \pm\sqrt{4 \cdot 3}$$

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