LC MATH I

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 $\rightarrow (\text{side})^2$

$$(x-11)^2 - 117 = 3$$ ← completing the square done

NOW, SOLVE BY TAKING SQUARE ROOTS

STEP 1: Isolate the square

$$(x-11)^2 - 117 = 3$$
$$+117 \quad +117$$
$$(x-11)^2 = 120$$

STEP 2: Take square roots

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

STEP 3: Simplify radical

$$x - 11 = \pm\sqrt{4 \cdot 30}$$
$$x - 11 = \pm 2\sqrt{30}$$

30 → 2, 15 → 3, 5

STEP 4: Isolate x

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

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

Your work should look exactly like this:

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

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

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

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

$+24 \quad +24$

$(x+5)^2 = 32$

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

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

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

$-5 \quad -5$

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

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

$-4 \quad -4$

$(x-3)^2 = 25$

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

$x-3 = \pm 5$

$+3 \quad +3$

$x = 3 \pm 5$

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

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

$2x^2 - 12 = 12$

$+12 \quad +12$

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

$x^2 = 12$

$x = \pm\sqrt{12}$

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

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