

4.7 Complete the Square



TEKS 2A.2.B, 2A.5.E,
2A.8.A, 2A.8.D

Before

You solved quadratic equations by finding square roots.

Now

You will solve quadratic equations by completing the square.

Why?

So you can find a baseball's maximum height, as in Example 7.

Key Vocabulary

- completing the square

In Lesson 4.5, you solved equations of the form $x^2 = k$ by finding square roots. This method also works if one side of an equation is a perfect square trinomial.

EXAMPLE 1 Solve a quadratic equation by finding square roots

Solve $x^2 - 8x + 16 = 25$.

$$x^2 - 8x + 16 = 25$$

Write original equation.

$$(x - 4)^2 = 25$$

Write left side as a binomial squared.

$$x - 4 = \pm 5$$

Take square roots of each side.

$$x = 4 \pm 5$$

Solve for x .

▶ The solutions are $4 + 5 = 9$ and $4 - 5 = -1$.

ANOTHER WAY

You can also find the solutions by writing the given equation as $x^2 - 8x - 9 = 0$ and solving this equation by factoring.

PERFECT SQUARES In Example 1, the trinomial $x^2 - 8x + 16$ is a perfect square because it equals $(x - 4)^2$. Sometimes you need to add a term to an expression $x^2 + bx$ to make it a square. This process is called **completing the square**.

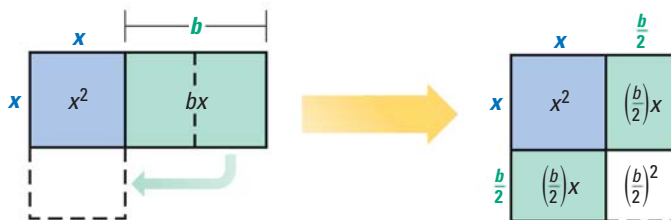
KEY CONCEPT

For Your Notebook

Completing the Square

Words To complete the square for the expression $x^2 + bx$, add $\left(\frac{b}{2}\right)^2$.

Diagrams In each diagram, the combined area of the shaded regions is $x^2 + bx$. Adding $\left(\frac{b}{2}\right)^2$ completes the square in the second diagram.



Algebra $x^2 + bx + \left(\frac{b}{2}\right)^2 = \left(x + \frac{b}{2}\right)\left(x + \frac{b}{2}\right) = \left(x + \frac{b}{2}\right)^2$