

 **CRITIQUE & EXPLAIN**

Hana and Enrique used different methods to solve the equation $x^2 - 6x + 9 = 16$.

Hana

$$x^2 - 6x + 9 = 16$$

$$x^2 - 6x - 7 = 0$$

$$(x - 7)(x + 1) = 0$$

$$x - 7 = 0 \text{ OR } x + 1 = 0$$

$$x = 7 \text{ OR } x = -1$$

The solutions are 7 and -1 .

Enrique

$$x^2 - 6x + 9 = 16$$

$$(x - 3)^2 = 16$$

I can square 4 or -4 to get 16.

$$x - 3 = 4 \text{ OR } x - 3 = -4$$

$$x = 7 \text{ OR } x = -1$$

The solutions are 7 and -1 .

A. Does Hana's method work? If her method is valid, explain the reasoning she used. If her method is not valid, explain why not. © MP.2

B. Does Enrique's method work? If his method is valid, explain the reasoning he used. If his method is not valid, explain why not.

C. **Use Structure** Can you use either Hana's or Enrique's method to solve the equation $x^2 + 10x + 25 = 3$? Explain. © MP.7

HABITS OF MIND

Make Sense and Persevere Why does Hana set her two factors equal to zero, while Enrique sets his factor equal to 4 and -4 ? © MP.1

**EXAMPLE 1** **Try It! Use Square Roots to Solve Quadratic Equations**

1. Find the solution(s) to the equations.

a. $81 = x^2 + 12x + 36$?

b. $9 = x^2 - 16x + 64$

HABITS OF MIND

Use Structure How do you recognize a perfect square trinomial? © MP.7

EXAMPLE 2 **Try It! Understand the Process of Completing the Square**

2. How can you write the equation $x^2 - 6x - 11 = 0$ in the form $(x - p)^2 = q$?

EXAMPLE 3 **Try It! Solve a Quadratic Equation by Completing the Square**

3. Solve the following equations by completing the square.

a. $0 = x^2 + 4x + 8$

b. $0 = x^2 - 8x + 17$

HABITS OF MIND

Reason Richard is completing the square to solve the equation $2x^2 + 8x = 19$. He wrote: $2(x^2 + 4x + 4) = 19 + \underline{\hspace{1cm}}$. What number should Richard write in the blank? © MP.2

**EXAMPLE 4** **Try It! Complete the Square to Solve a Real-World Problem**

4. The relationship between the time since the ball was thrown and height of the ball can be modeled by the equation $h = 32t - 16t^2$, where h is the height of the ball after t seconds. Complete the square to find how long it will take the ball to reach a height of 20 ft.

EXAMPLE 5 **Try It! Write a Quadratic Equation in Vertex Form**

5. Write each equation in vertex form. Identify the maximum or minimum value of the graph of each equation.
- a. $y = -3x^2 - 9x + 7$ b. $y = 2x^2 + 12x + 9$

HABITS OF MIND

Make Sense and Persevere A pelican swoops down under the surface of the ocean to catch a fish. An equation that describes the pelican's path is $y = 4x^2 - 16x + 15$. The pelican catches the fish at the deepest point of the dive. How deep was the fish swimming? © MP.1



Do You UNDERSTAND?

- ESSENTIAL QUESTION** How can you solve a quadratic equation by completing the square?
- Paula said that only quadratic equations with leading coefficients of 1 can be solved by completing the square. Is Paula correct? Explain. © MP.3
- Generalize** Given the expression $x^2 + bx$, describe how to find c so that $x^2 + bx + c$ is a perfect square trinomial. © MP.8
- Make Sense and Persevere** How can you complete the square to find the vertex of a parabola? © MP.1

Do You KNOW HOW?

Solve each equation by completing the square.

5. $0 = x^2 + 12x + 11$

6. $27 = 3x^2 + 12x$

7. $0 = 2x^2 + 6x - 14$

Write the equation in vertex form, and identify the maximum or minimum value of the graph of the function.

8. $y = x^2 + 6x - 6$

9. $y = -2x^2 + 20x - 42$

- The daily profit for a company is modeled by the function $p(x) = -0.5x^2 + 40x - 300$, where x is the number of units sold. How many units does the company need to sell each day to maximize profits?

