

### EXAMPLE 3 Write a quadratic function in standard form

Write a quadratic function in standard form for the parabola that passes through the points  $(-1, -3)$ ,  $(0, -4)$ , and  $(2, 6)$ .

#### Solution

**STEP 1** **Substitute** the coordinates of each point into  $y = ax^2 + bx + c$  to obtain the system of three linear equations shown below.

$$-3 = a(-1)^2 + b(-1) + c \quad \text{Substitute } -1 \text{ for } x \text{ and } -3 \text{ for } y.$$

$$-3 = a - b + c \quad \text{Equation 1}$$

$$-4 = a(0)^2 + b(0) + c \quad \text{Substitute } 0 \text{ for } x \text{ and } -4 \text{ for } y.$$

$$-4 = c \quad \text{Equation 2}$$

$$6 = a(2)^2 + b(2) + c \quad \text{Substitute } 2 \text{ for } x \text{ and } 6 \text{ for } y.$$

$$6 = 4a + 2b + c \quad \text{Equation 3}$$

**STEP 2** **Rewrite** the system of three equations in Step 1 as a system of two equations by substituting  $-4$  for  $c$  in Equations 1 and 3.

$$a - b + c = -3 \quad \text{Equation 1}$$

$$a - b - 4 = -3 \quad \text{Substitute } -4 \text{ for } c.$$

$$a - b = 1 \quad \text{Revised Equation 1}$$

$$4a + 2b + c = 6 \quad \text{Equation 3}$$

$$4a + 2b - 4 = 6 \quad \text{Substitute } -4 \text{ for } c.$$

$$4a + 2b = 10 \quad \text{Revised Equation 3}$$

**STEP 3** **Solve** the system consisting of revised Equations 1 and 3. Use the elimination method.

$$\begin{array}{r} a - b = 1 \quad \times 2 \quad \rightarrow \quad 2a - 2b = 2 \\ 4a + 2b = 10 \\ \hline 6a = 12 \\ a = 2 \end{array}$$

So  $2 - b = 1$ , which means  $b = 1$ .

The solution is  $a = 2$ ,  $b = 1$ , and  $c = -4$ .

▶ A quadratic function for the parabola is  $y = 2x^2 + x - 4$ .

#### REVIEW SYSTEMS OF EQUATIONS

For help with solving systems of linear equations in three variables, see p. 178.



#### GUIDED PRACTICE for Examples 1, 2, and 3

Write a quadratic function whose graph has the given characteristics.

- vertex:  $(4, -5)$
- vertex:  $(-3, 1)$
- $x$ -intercepts:  $-2, 5$
- passes through:  $(2, -1)$
- passes through:  $(0, -8)$
- passes through:  $(6, 2)$

Write a quadratic function in standard form for the parabola that passes through the given points.

- $(-1, 5), (0, -1), (2, 11)$
- $(-2, -1), (0, 3), (4, 1)$
- $(-1, 0), (1, -2), (2, -15)$