

Solve by completing the square:

$$\frac{14}{2} = 7^2$$

$$x^2 + 10x - 75 = 0$$

$$x^2 + 10x + 25 = 75 + 25$$

$$\sqrt{(x+5)^2} = \pm\sqrt{100}$$

$$x+5 = \pm 10$$

$$x = -5 + 10 \quad \boxed{5}$$

$$x = -5 - 10 \quad \boxed{-15}$$

$$x^2 + 14x = -17$$

$$x^2 + 14x + 49 = -17 + 49$$

$$\sqrt{(x+7)^2} = \pm\sqrt{32} \quad \sqrt{16 \cdot 2}$$

$$x+7 = \pm 4\sqrt{2}$$

$$x = -7 \pm 4\sqrt{2}$$

The vertex form of a quadratic function is  $y = a(x - h)^2 + k$ , where  $(h, k)$  is the vertex of the parabola,  $x = h$  is the axis of symmetry, and  $a$  determines the shape of the parabola and the direction in which it opens.

**Example 5** Write Functions in Vertex Form

Write each function in vertex form. Identify the vertex.

a.  $y = x^2 + 6x - 5$

$$y = x^2 + 6x - 5$$

Original equation.

$$y = (x^2 + 6x + 9) - 5 - 9$$

Complete the square.

$$y = (x + 3)^2 - 14$$

Simplify.

The vertex is  $(-3, -14)$ .

Write each function in vertex form. Identify the vertex.

$$y = x^2 + 3x - 5$$

$$y + 5 = x^2 + 3x + \frac{9}{4}$$

$$y + \frac{29}{4} = \left(x + \frac{3}{2}\right)^2$$

$$y = \left(x + \frac{3}{2}\right)^2 - \frac{29}{4}$$

$$\left(\frac{3}{2}\right)^2 = \frac{9}{4}$$

Vertex

$$\left(-\frac{3}{2}, -\frac{29}{4}\right)$$

$$y = x^2 + 10x + 17$$

$$y - 17 + 25 = x^2 + 10x + \frac{25}{1}$$

$$y + 8 = (x + 5)^2$$

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

$$\frac{10}{2} = 5^2$$

Vertex  $(-5, -8)$



Write each function in vertex form. Identify the vertex.

$$y = x^2 + 4x + 6$$

$$y - 6 + 4 = x^2 + 4x + \frac{4}{1}$$

$$y - 2 = (x + 2)^2 + 2$$

$$y = (x + 2)^2 + 2$$

$$(-2, 2)$$

$$\left(\frac{4}{2}\right)^2 = 2^2$$

$$\frac{-22}{2} = -11^2$$

$$y = x^2 - 22x + 125$$

$$y - 125 + 121 = x^2 - 22x + \frac{121}{1}$$

$$y - 4 = (x - 11)^2$$

$$y = (x - 11)^2 + 4$$

$$(11, 4)$$