✓ GUIDED PRACTICE for Examples 3, 4, and 5

Write an equation of the conic section.

5. Parabola with vertex at $(3, -1)$ and focus at $(3, 2)$

6. Hyperbola with vertices at $(-7, 3)$ and $(-1, 3)$ and foci at $(-9, 3)$ and $(1, 3)$

Identify the line(s) of symmetry for the conic section.

7. $\frac{(x-5)^2}{64} + \frac{y^2}{16} = 1$ **8.** $(x+5)^2 = 8(y-2)$ **9.** $\frac{(x-1)^2}{49} - \frac{(y-2)^2}{121} = 1$

KEY CONCEPT *For Your Notebook*

Classifying Conics Using Their Equations

Any conic can be described by a **general second-degree equation** in x and y: $Ax^2 + Bxy + Cy^2 + Dx + Ey + F = 0$. The expression $B^2 - 4AC$ is the **discriminant** of the equation and can be used to identify the type of conic.

Discriminant	Type of Conic
$B^2 - 4AC < 0$, $B = 0$, and $A = C$	Circle
$B^2 - 4AC < 0$ and either $B \neq 0$ or $A \neq C$	Ellipse
$B^2 - 4AC = 0$	Parabola
$B^2 - 4AC > 0$	Hyperbola

If $B = 0$, each axis of the conic is horizontal or vertical.

EXAMPLE 6 Classify a conic

Classify the conic given by $4x^2 + y^2 - 8x - 8 = 0$. Then graph the equation.

Solution

Note that $A = 4$, $B = 0$, and $C = 1$, so the value of the discriminant is:

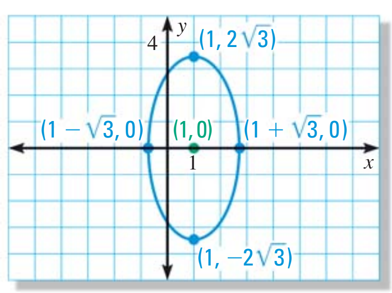
$$B^2 - 4AC = 0^2 - 4(4)(1) = -16$$

Because $B^2 - 4AC < 0$ and $A \neq C$, the conic is an ellipse.

COMPLETE THE SQUARE
For help with completing the square, see p. 284.

To graph the ellipse, first complete the square in x.

$$4x^2 + y^2 - 8x - 8 = 0$$
$$(4x^2 - 8x) + y^2 = 8$$
$$4(x^2 - 2x) + y^2 = 8$$
$$4(x^2 - 2x + ?) + y^2 = 8 + 4(?)$$
$$4(x^2 - 2x + 1) + y^2 = 8 + 4(1)$$
$$4(x-1)^2 + y^2 = 12$$
$$\frac{(x-1)^2}{3} + \frac{y^2}{12} = 1$$



From the equation, you can see that $(h, k) = (1, 0)$, $a = \sqrt{12} = 2\sqrt{3}$, and $b = \sqrt{3}$. Use these facts to draw the ellipse.