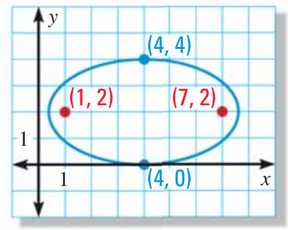
## EXAMPLE 4 Write an equation of a translated ellipse

**Write an equation of the ellipse with foci at (1, 2) and (7, 2) and co-vertices at (4, 0) and (4, 4).**

**Solution**




***STEP 1*** **Determine** the form of the equation. First sketch the ellipse. The foci lie on the major axis, so the axis is horizontal. The equation has this form:

$$\frac{(x-h)^2}{a^2} + \frac{(y-k)^2}{b^2} = 1$$

***STEP 2*** **Identify** $h$ and $k$ by finding the center, which is halfway between the foci (or the co-vertices).

$$(h, k) = \left(\frac{1+7}{2}, \frac{2+2}{2}\right) = (4, 2)$$

**FIND DISTANCE**
The co-vertices lie on a vertical line through the center and the foci lie on a horizontal line through the center, so you do not have to use the distance formula.

***STEP 3*** **Find** $b$, the distance between a co-vertex and the center (4, 2), and $c$, the distance between a focus and the center. Choose the co-vertex (4, 4) and the focus (1, 2): $b = |4 - 2| = 2$ and $c = |1 - 4| = 3$.

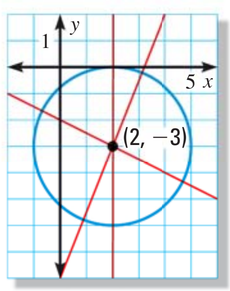
***STEP 4*** **Find** $a$. For an ellipse, $a^2 = b^2 + c^2 = 2^2 + 3^2 = 13$, so $a = \sqrt{13}$.

▶ The standard form of the equation is $\frac{(x-4)^2}{13} + \frac{(y-2)^2}{4} = 1$.

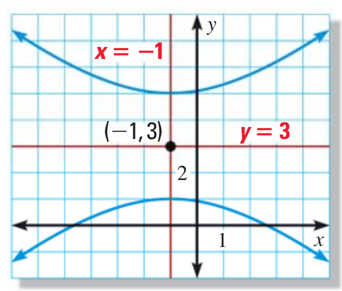
## EXAMPLE 5 Identify symmetries of conic sections

**Identify the line(s) of symmetry for each conic section in Examples 1–4.**

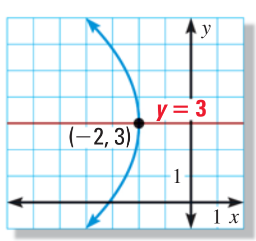
**Solution**



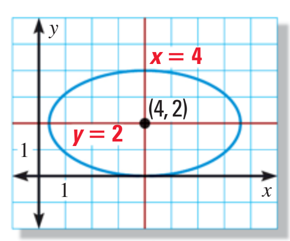

For the circle in Example 1, any line through the center (2, −3) is a line of symmetry.




For the hyperbola in Example 2, $x = -1$ and $y = 3$ are lines of symmetry.




For the parabola in Example 3, $y = 3$ is a line of symmetry.




For the ellipse in Example 4, $x = 4$ and $y = 2$ are lines of symmetry.