EXAMPLE 1 Graph an equation of an ellipse

Graph the equation $4x^2 + 25y^2 = 100$. Identify the vertices, co-vertices, and foci of the ellipse.

Solution

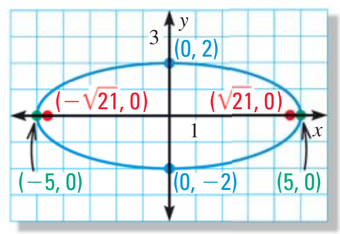
STEP 1 **Rewrite** the equation in standard form.

$$4x^2 + 25y^2 = 100 \quad \text{Write original equation.}$$

$$\frac{4x^2}{100} + \frac{25y^2}{100} = \frac{100}{100} \quad \text{Divide each side by 100.}$$

$$\frac{x^2}{25} + \frac{y^2}{4} = 1 \quad \text{Simplify.}$$

STEP 2 **Identify** the vertices, co-vertices, and foci. Note that $a^2 = 25$ and $b^2 = 4$, so $a = 5$ and $b = 2$. The denominator of the x^2-term is greater than that of the y^2-term, so the major axis is horizontal.



The vertices of the ellipse are at $(\pm a, 0) = (\pm 5, 0)$. The co-vertices are at $(0, \pm b) = (0, \pm 2)$. Find the foci.

$$c^2 = a^2 - b^2 = 5^2 - 2^2 = 21, \text{ so } c = \sqrt{21}$$

The foci are at $(\pm\sqrt{21}, 0)$, or about $(\pm 4.6, 0)$.

STEP 3 **Draw** the ellipse that passes through each vertex and co-vertex.

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ANOTHER WAY

You can graph the ellipse using a graphing calculator by solving for y to obtain

$$y = \pm 2\sqrt{1 - \frac{x^2}{25}}$$

and then entering this equation as two separate functions.

✓ GUIDED PRACTICE for Example 1

Graph the equation. Identify the vertices, co-vertices, and foci of the ellipse.

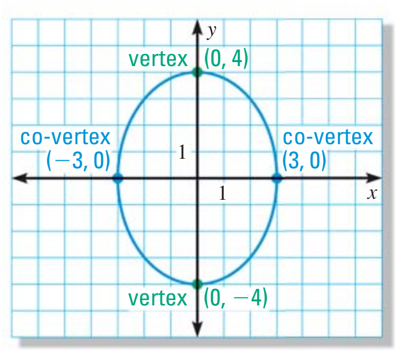
1. $\frac{x^2}{16} + \frac{y^2}{9} = 1$ **2.** $\frac{x^2}{36} + \frac{y^2}{49} = 1$ **3.** $25x^2 + 9y^2 = 225$

EXAMPLE 2 Write an equation given a vertex and a co-vertex

Write an equation of the ellipse that has a vertex at (0, 4), a co-vertex at (−3, 0), and center at (0, 0).

Solution

Sketch the ellipse as a check for your final equation. By symmetry, the ellipse must also have a vertex at (0, −4) and a co-vertex at (3, 0).



Because the vertex is on the y-axis and the co-vertex is on the x-axis, the major axis is vertical with $a = 4$, and the minor axis is horizontal with $b = 3$.

▶ An equation is $\frac{x^2}{3^2} + \frac{y^2}{4^2} = 1$, or $\frac{x^2}{9} + \frac{y^2}{16} = 1$.