I. Ellipse

Ellipse- the collection, or locus, of all points in the plane, the sum of whose distances from two fixed points, called the foci, is constant.

Major axis is the x-axis:

an equation of the ellipse with center at (0, 0), foci at (-c, 0) and, and vertices at (-a, 0) and (a, 0) is

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1,$$
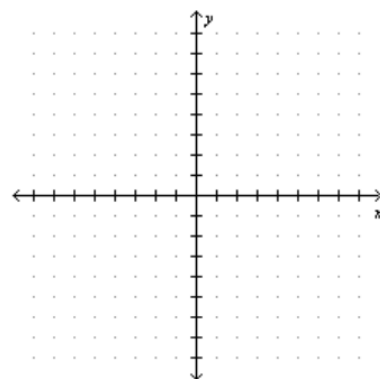
where a > b > 0 and b² = a² – c²

Major axis is the y-axis:

an equation of the ellipse with center at (0, 0), foci at (0, -c), and vertices at (-a, 0) and (a, 0) is

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1,$$

where a > b > 0 and b² = a² – c²

A. Ellipses with centers at (0, 0)

1. Find an equation of an ellipse with center at the origin, one focus at (3, 0), and a vertex at (−4, 0).
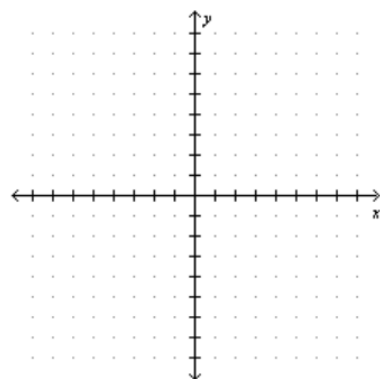
2. Analyze and graph. $\frac{x^2}{25} + \frac{y^2}{9} = 1$
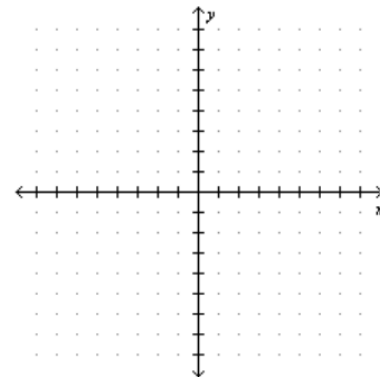
center:

foci:

vertices:
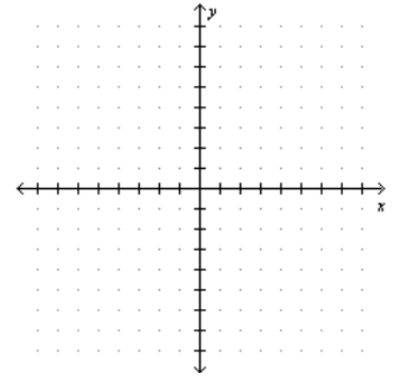
3. Analyze and graph. $9x^2 + y^2 = 9$

center:

foci:

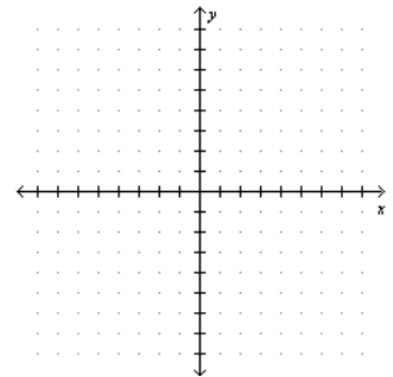vertices:

4. Find an equation of the ellipse having one focus at (0, 2) and vertices at (0, −3) and (0, 3).

B. Ellipses with centers at (h, k)

equation	center	major axis	foci	vertices
$\dfrac{(x-h)^2}{a^2} + \dfrac{(y-k)^2}{b^2} = 1$	(h, k)	parallel to the x-axis	(h + c, k) (h − c, k)	(h + a, k) (h − a, k)
$\dfrac{(x-h)^2}{b^2} + \dfrac{(y-k)^2}{a^2} = 1$	(h, k)	parallel to the y-axis	(h, k + c) (h, k − c)	(h, k + a) (h, k − a)

5. Find an equation of an ellipse with center at (2, −3), one focus at (3, −3), and one vertex at (5, −3).
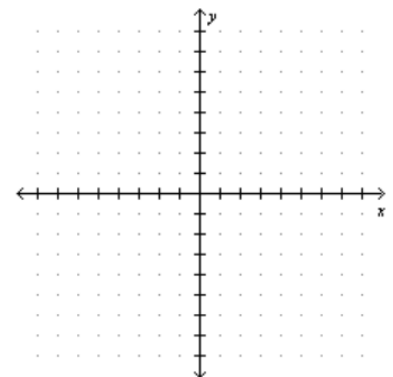
6. Analyze and graph. $4x^2 + y^2 - 8x + 4y + 4 = 0$

center:

foci:

vertices:

7. The whispering gallery in the Museum of Science and Industry in Chicago is 47.3 feet long. The distance from the center of the room to the foci is 20.3 feet. Find an equation that describes the shape of the room. How high is the room at its center?