

*Answer on Question #57408 – Math – Calculus*

**Question**

Graph each equation be sure to identify the important features such as the center, vertices, foci, directrix and asymptotes. The graph is scaled 8 tall and 8 wide.

$$\frac{(y - 2)^2}{4} - \frac{(x + 3)^2}{9} = 1$$

**Solution**

$\frac{(y-2)^2}{4} - \frac{(x+3)^2}{9} = 1$  represents a hyperbola.

The conic sections of the hyperbola is

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

The center of the hyperbola is  $O_1(h, k)$ :

$$O_1(-3, 2)$$

Because

$$a^2 = 4, a = 2,$$

$$b^2 = 9, b = 3,$$

the vertices of the hyperbola are

$$(-3, 2 \pm a), \text{ that is,}$$

$$V_1(-3, 0), V_2(-3, 4),$$

and

$$(-3 \pm b, 2), \text{ that is,}$$

$$V_3(-6, 2), V_4(0, 2).$$

Because

$$c^2 = a^2 + b^2,$$

$$c^2 = 4 + 9 \Rightarrow c = \sqrt{13},$$

the foci of the hyperbola are

$$F(-3, 2 \pm c), \text{ that is,}$$

$$F_1(-3, 5.6), F_2(-3, -1.6)$$

Equations of the asymptotes are

$$y - k = m(x - h), \text{ where } m = \pm \frac{a}{b},$$

$$y - 2 = \pm \frac{2}{3}(x + 3).$$

Graph of the function  $\frac{(y-2)^2}{4} - \frac{(x+3)^2}{9} = 1$  is given below.

