

Answer on Question #57232 – Math – Calculus

1. Graph this hyperbola

$$\frac{(x + 3)^2}{81} - \frac{(y - 2)^2}{169} = 1.$$

Solution

It is a horizontal hyperbola

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

with the center at point $C(h, k) = C(-3, 2)$. Besides, $a^2 = 81$, $b^2 = 169$, hence $a = 9$, $b = 13$.

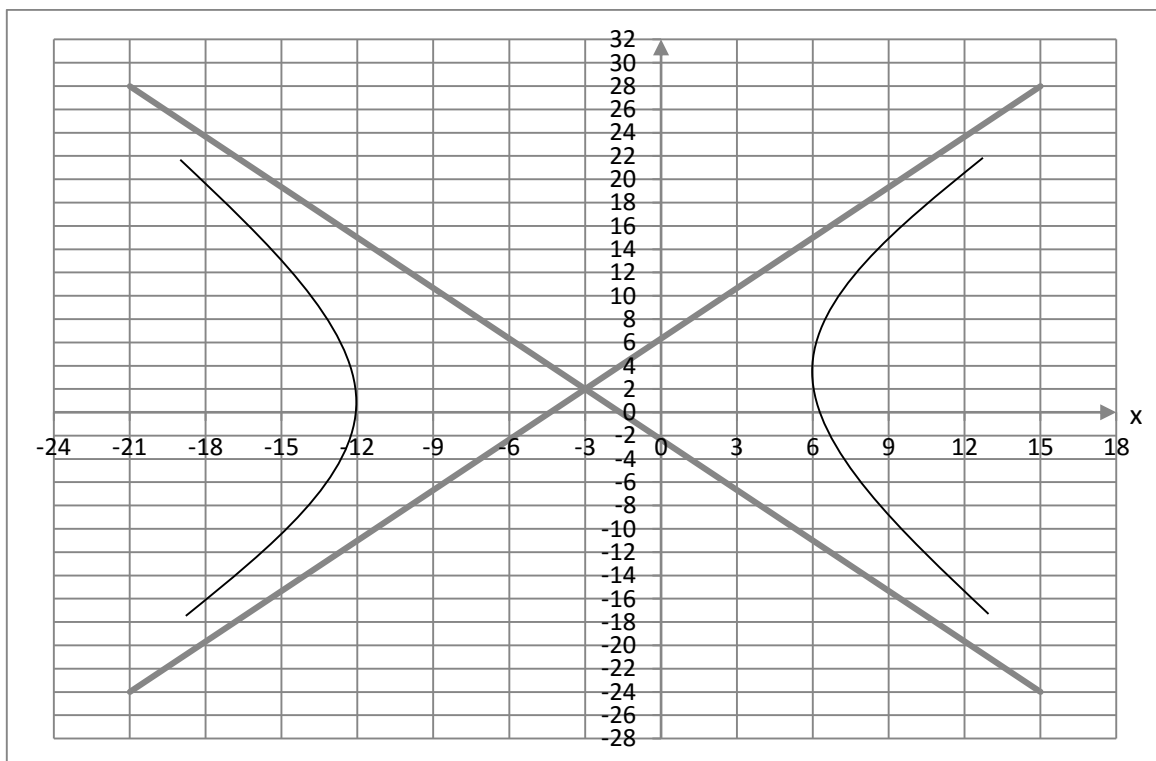
A horizontal hyperbola has vertices at $A(h + a, k) = A(-3 + 9, 2) = A(6, 2)$ and $B(h - a, k) = B(-3 - 9, 2) = B(-12, 2)$.

The asymptotes of a horizontal hyperbola are $y = -\frac{b}{a}(x - h) + k$ and $y = \frac{b}{a}(x - h) + k$, i.e.

$y - 2 = \pm \frac{13}{9}(x + 3)$, hence

$y = \frac{13}{9}x + \frac{19}{3}$ and $y = -\frac{13}{9}x - \frac{7}{3}$. Graph is given below.

y



2. Graph this hyperbola

$$\frac{(y + 3)^2}{169} - \frac{(x - 2)^2}{81} = 1.$$

Solution

It is a vertical hyperbola

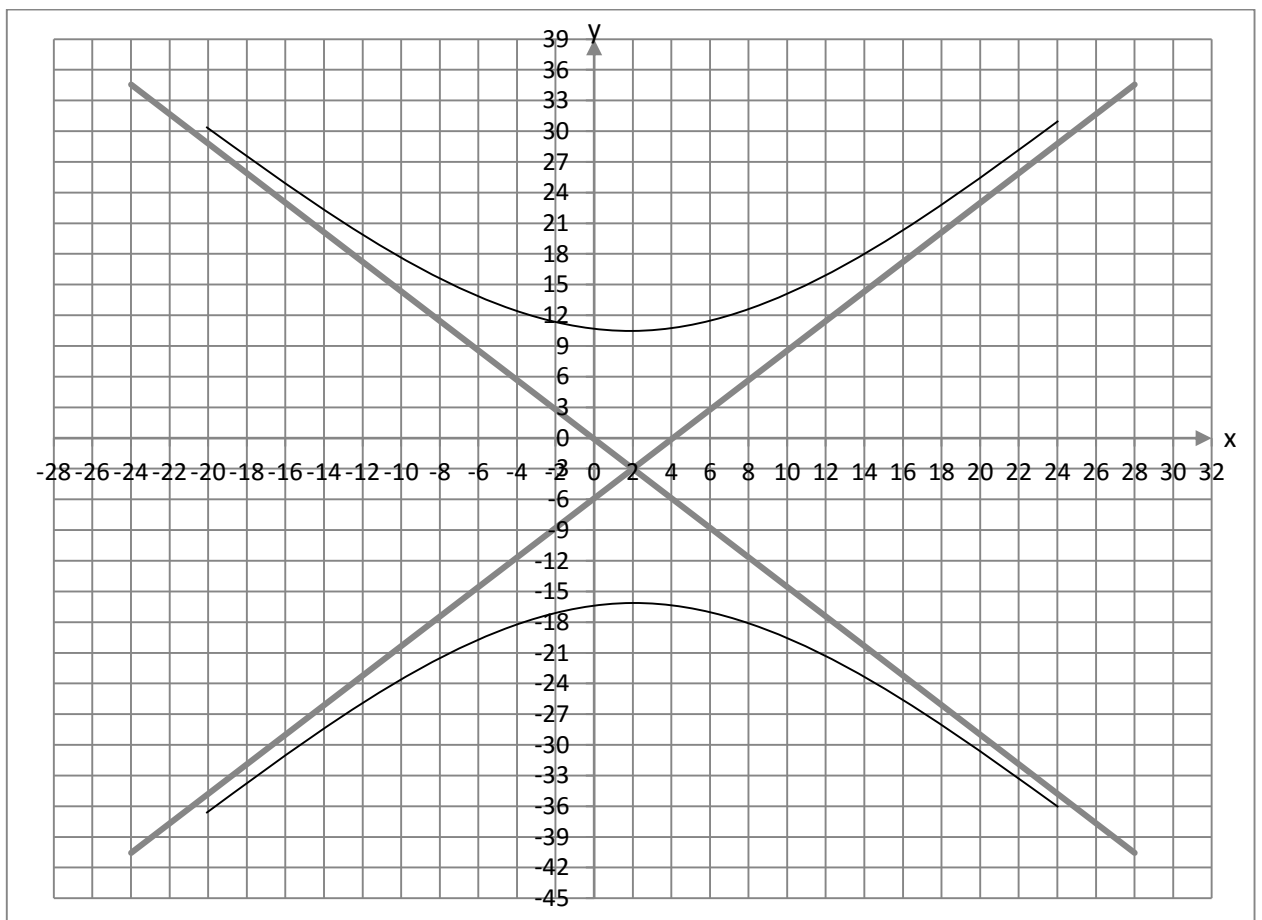
$$\frac{(y - k)^2}{a^2} - \frac{(x - h)^2}{b^2} = 1$$

with the center at point $C(h, k) = C(2, -3)$. Besides, $a^2 = 169$, $b^2 = 81$, hence $a = 13$,

$b = 9$. A vertical hyperbola has vertices at points $A(h, k + a) = A(2, -3 + 13) = A(2, 10)$ and $B(h, k - a) = B(2, -3 - 13) = B(2, -16)$. The asymptotes of vertical hyperbola are $y = -\frac{a}{b}(x - h) + k$ and $y = \frac{a}{b}(x - h) + k$, i.e. $y = -\frac{13}{9}(x - 2) - 3$ and $y = \frac{13}{9}(x - 2) - 3$, hence

$$y = \frac{13}{9}x - \frac{53}{9} \text{ and } y = -\frac{13}{9}x - \frac{1}{9}.$$

Graph is given below.



3. Graph this hyperbola

$$\frac{(x - 3)^2}{169} - \frac{(y + 2)^2}{81} = 1.$$

Solution

It is a horizontal hyperbola

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

with the center at point $C(h, k) = C(3, -2)$. Besides, $a^2 = 169$, $b^2 = 81$, hence $a = 13$, $b = 9$.

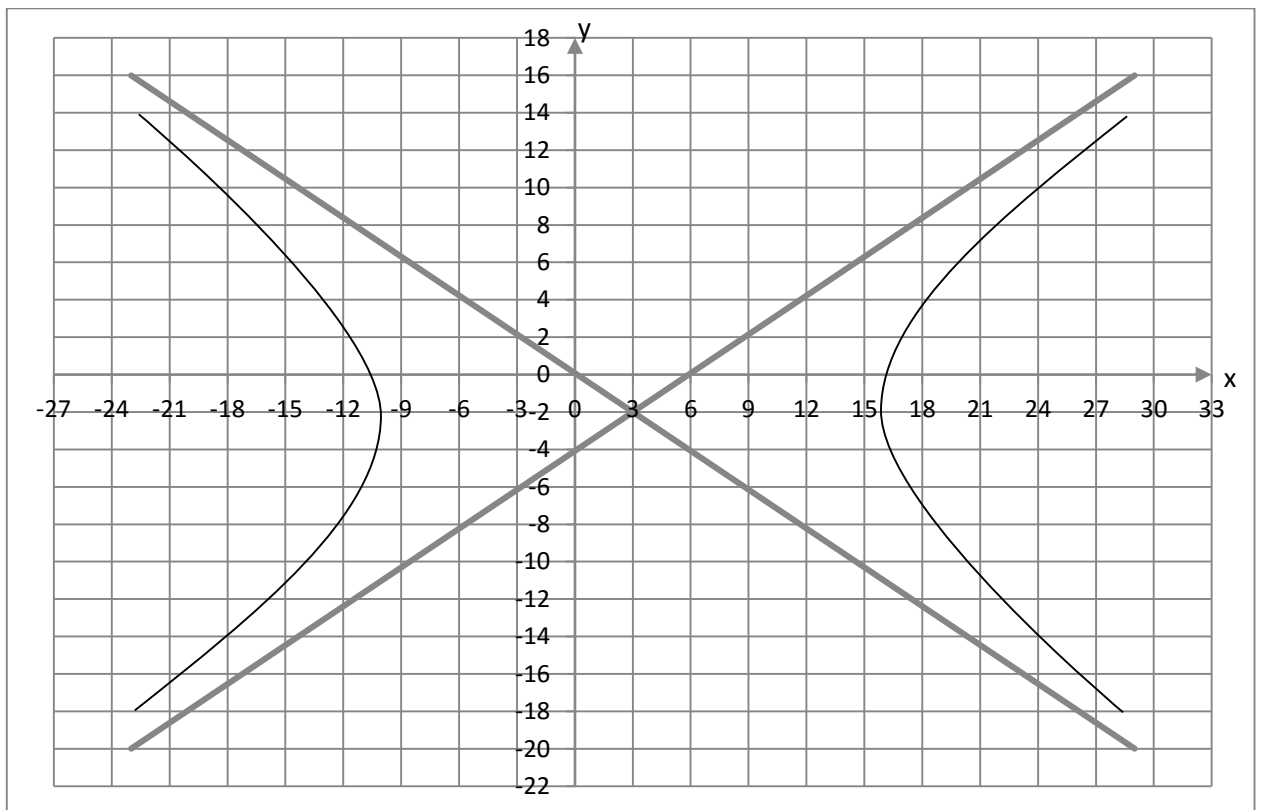
A horizontal hyperbola has vertices at $A(h + a, k) = A(3 + 13, -2) = A(16, -2)$ and $B(h - a, k) = B(3 - 13, -2) = B(-10, -2)$.

The asymptotes of a horizontal hyperbola are $y = -\frac{b}{a}(x - h) + k$ and $y = \frac{b}{a}(x - h) + k$, i.e.

$y + 2 = \pm \frac{9}{13}(x - 3)$, hence

$$y = \frac{9}{13}x - \frac{53}{13} \text{ and } y = -\frac{9}{13}x + \frac{1}{13}.$$

Graph is given below.



4. Graph this hyperbola

$$\frac{(y - 3)^2}{169} - \frac{(x + 2)^2}{81} = 1.$$

Solution

It is a vertical hyperbola

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

with the center at point $C(h, k) = C(-2, 3)$. Besides, $a^2 = 169$, $b^2 = 81$, hence $a = 13$,

$b = 9$. A vertical hyperbola has vertices at points $A(h, k + a) = A(-2, 3 + 13) = A(-2, 16)$ and $B(h, k - a) = B(-2, 3 - 13) = B(-2, -10)$. The asymptotes of vertical hyperbola are $y = -\frac{a}{b}(x - h) + k$ and $y = \frac{a}{b}(x - h) + k$, i.e. $y = -\frac{13}{9}(x + 2) + 3$ and $y = \frac{13}{9}(x + 2) + 3$, hence

$$y = \frac{13}{9}x + \frac{53}{9} \text{ and } y = -\frac{13}{9}x + \frac{1}{9}.$$

Graph is given below.

