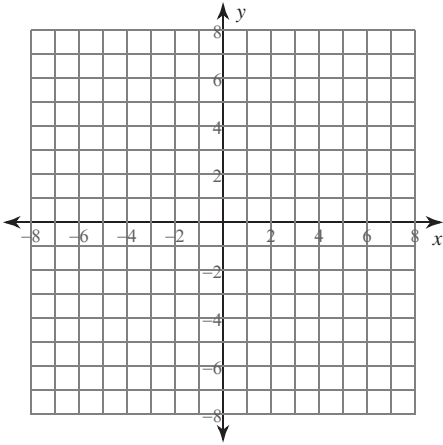


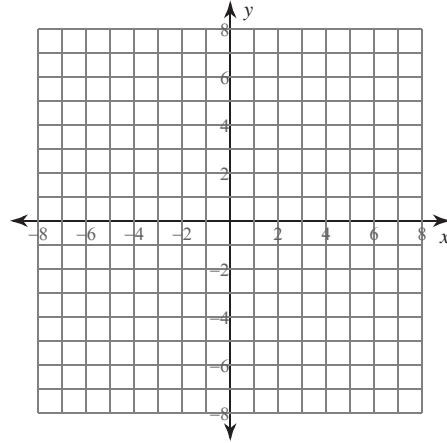
## Hyperbolas

Identify the vertices, foci, and asymptotes of each. Then sketch the graph.

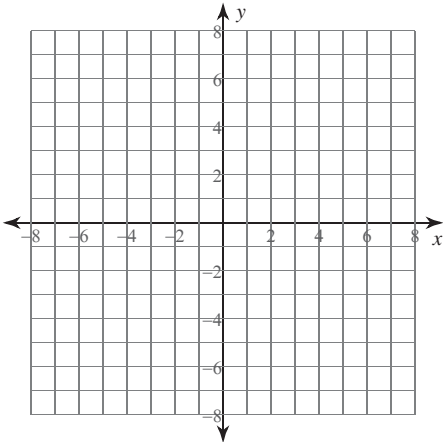
$$1) \frac{x^2}{9} - \frac{y^2}{25} = 1$$



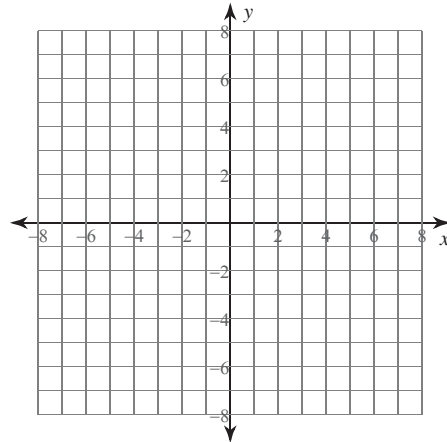
$$2) (y + 4)^2 - (x - 3)^2 = 1$$



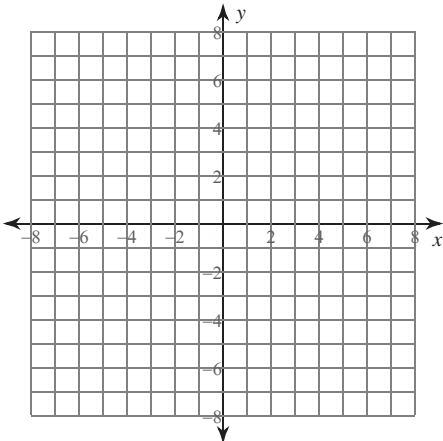
$$3) \frac{y^2}{16} - (x + 4)^2 = 1$$



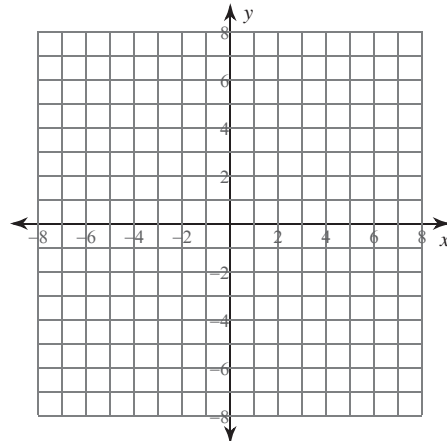
$$4) \frac{y^2}{10} - \frac{(x - 1)^2}{10} = 1$$



$$5) 9x^2 - 4y^2 - 18x + 16y - 43 = 0$$



$$6) -9x^2 - 32y = -16y^2 + 128$$



Identify the vertices, foci, asymptotes, direction of opening, length of the transverse axis, length of the conjugate axis, length of the latus rectum, and eccentricity of each.

7)  $x^2 - y^2 - 6x + 16y - 119 = 0$

8)  $-4x^2 + y^2 + 8x - 20y - 4 = 0$

Use the information provided to write the standard form equation of each hyperbola.

9) Vertices:  $(1 + 3\sqrt{15}, -7), (1 - 3\sqrt{15}, -7)$   
 Endpoints of Conjugate Axis:  $(1, -7 + 5\sqrt{5})$   
 $(1, -7 - 5\sqrt{5})$

10) Vertices:  $(19, 2), (1, 2)$   
 Foci:  $(10 + \sqrt{130}, 2), (10 - \sqrt{130}, 2)$

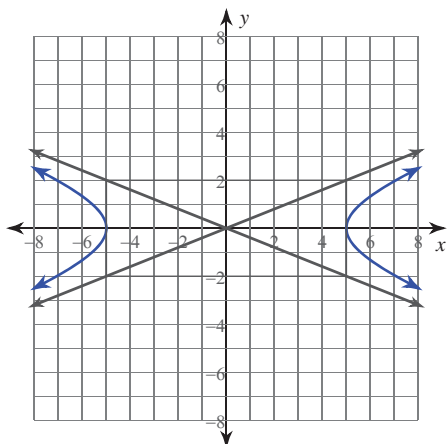
11) Vertices:  $(-10, 1), (-10, -17)$   
 Perimeter of Central Rectangle = 76

12) Vertices:  $(7, -2), (5, -2)$   
 Asymptotes:  $y = 11x - 68$   
 $y = -11x + 64$

13) Center at  $(10, -4)$   
 Transverse axis is vertical and 18 units long  
 Conjugate axis is 10 units long

14) Foci:  $(6, 1 + 2\sqrt{58}), (6, 1 - 2\sqrt{58})$   
 Points on the hyperbola are 28 units closer to one focus than the other

15)

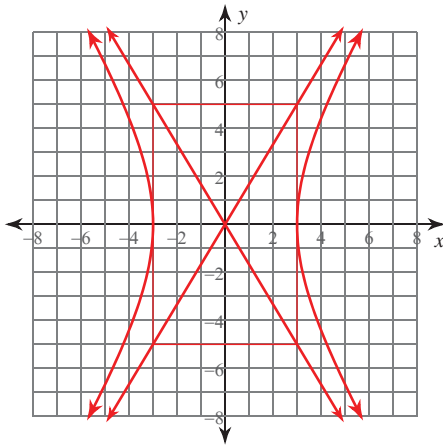


16) Center at  $(-6, 9)$   
 Vertex at  $(-18, 9)$   
 Eccentricity =  $\frac{5}{4}$

# Hyperbolas

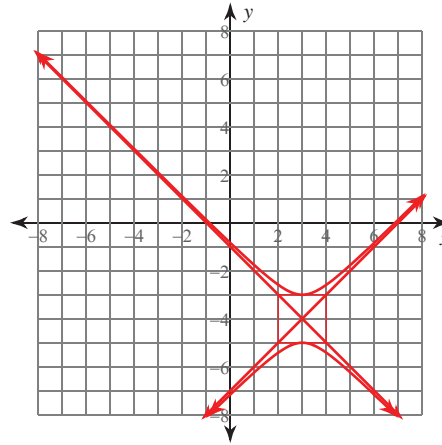
Identify the vertices, foci, and asymptotes of each. Then sketch the graph.

1)  $\frac{x^2}{9} - \frac{y^2}{25} = 1$



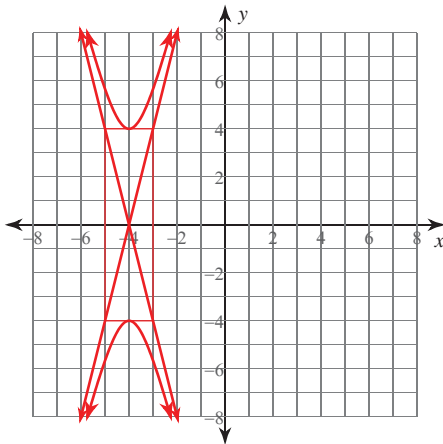
Vertices:  $(3, 0)$   
 $(-3, 0)$   
 Foci:  $(\sqrt{34}, 0)$   
 $(-\sqrt{34}, 0)$   
 Asym.:  $y = \frac{5}{3}x$   
 $y = -\frac{5}{3}x$

2)  $(y + 4)^2 - (x - 3)^2 = 1$



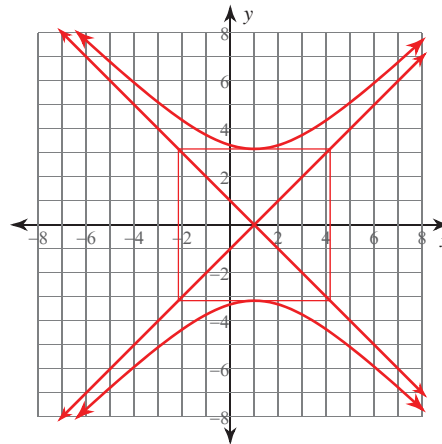
Vertices:  $(3, -3)$   
 $(3, -5)$   
 Foci:  $(3, -4 + \sqrt{2})$   
 $(3, -4 - \sqrt{2})$   
 Asym.:  $y = x - 7$   
 $y = -x - 1$

3)  $\frac{y^2}{16} - (x + 4)^2 = 1$



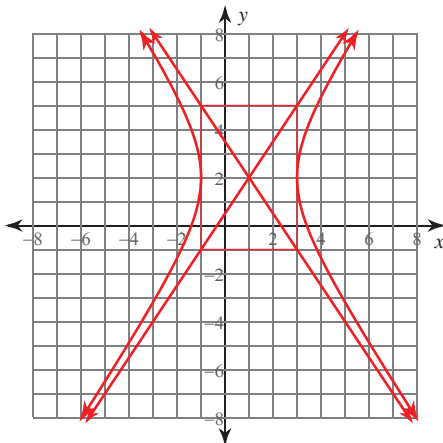
Vertices:  $(-4, 4)$   
 $(-4, -4)$   
 Foci:  $(-4, \sqrt{17})$   
 $(-4, -\sqrt{17})$   
 Asym.:  $y = 4x + 16$   
 $y = -4x - 16$

4)  $\frac{y^2}{10} - \frac{(x - 1)^2}{10} = 1$



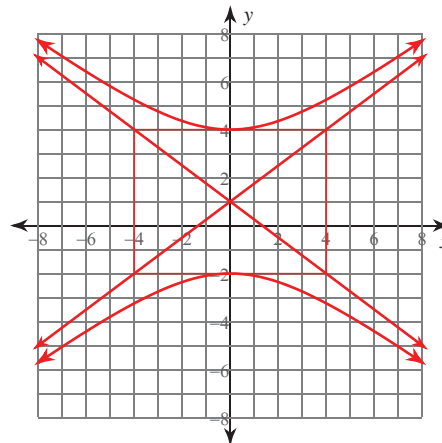
Vertices:  $(1, \sqrt{10})$   
 $(1, -\sqrt{10})$   
 Foci:  $(1, 2\sqrt{5})$   
 $(1, -2\sqrt{5})$   
 Asym.:  $y = x - 1$   
 $y = -x + 1$

5)  $9x^2 - 4y^2 - 18x + 16y - 43 = 0$



Vertices:  $(3, 2)$   
 $(-1, 2)$   
 Foci:  $(1 + \sqrt{13}, 2)$   
 $(1 - \sqrt{13}, 2)$   
 Asym.:  $y = \frac{3}{2}x + \frac{1}{2}$   
 $y = -\frac{3}{2}x + \frac{7}{2}$

6)  $-9x^2 - 32y = -16y^2 + 128$



Vertices:  $(0, 4)$   
 $(0, -2)$   
 Foci:  $(0, 6)$   
 $(0, -4)$   
 Asym.:  $y = \frac{3}{4}x + 1$   
 $y = -\frac{3}{4}x + 1$

Identify the vertices, foci, asymptotes, direction of opening, length of the transverse axis, length of the conjugate axis, length of the latus rectum, and eccentricity of each.

7)  $x^2 - y^2 - 6x + 16y - 119 = 0$

Vertices:  $(11, 8), (-5, 8)$

Foci:  $(3 + 8\sqrt{2}, 8), (3 - 8\sqrt{2}, 8)$

Asym.:  $y = x + 5$

$y = -x + 11$

Opens left/right

Transverse Axis: 16 units

Conjugate Axis: 16 units

Latus Rectum: 16 units

Eccentricity:  $\sqrt{2} \approx 1.414$

8)  $-4x^2 + y^2 + 8x - 20y - 4 = 0$

Vertices:  $(1, 20), (1, 0)$

Foci:  $(1, 10 + 5\sqrt{5}), (1, 10 - 5\sqrt{5})$

Asym.:  $y = 2x + 8$

$y = -2x + 12$

Opens up/down

Transverse Axis: 20 units

Conjugate Axis: 10 units

Latus Rectum: 5 units

Eccentricity:  $\frac{\sqrt{5}}{2} \approx 1.118$

Use the information provided to write the standard form equation of each hyperbola.

9) Vertices:  $(1 + 3\sqrt{15}, -7), (1 - 3\sqrt{15}, -7)$

Endpoints of Conjugate Axis:  $(1, -7 + 5\sqrt{5})$   
 $(1, -7 - 5\sqrt{5})$

$$\frac{(x-1)^2}{135} - \frac{(y+7)^2}{125} = 1$$

10) Vertices:  $(19, 2), (1, 2)$

Foci:  $(10 + \sqrt{130}, 2), (10 - \sqrt{130}, 2)$

$$\frac{(x-10)^2}{81} - \frac{(y-2)^2}{49} = 1$$

11) Vertices:  $(-10, 1), (-10, -17)$

Perimeter of Central Rectangle = 76

$$\frac{(y+8)^2}{81} - \frac{(x+10)^2}{100} = 1$$

12) Vertices:  $(7, -2), (5, -2)$

Asymptotes:  $y = 11x - 68$

$y = -11x + 64$

$$(x-6)^2 - \frac{(y+2)^2}{121} = 1$$

13) Center at  $(10, -4)$

Transverse axis is vertical and 18 units long

Conjugate axis is 10 units long

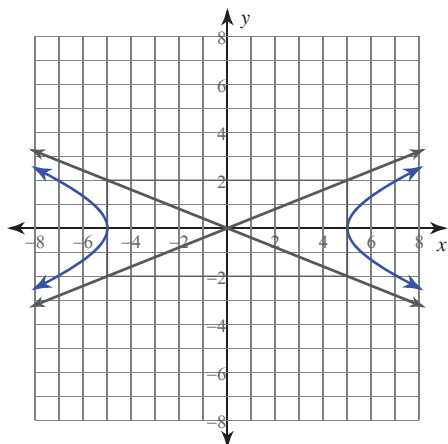
$$\frac{(y+4)^2}{81} - \frac{(x-10)^2}{25} = 1$$

14) Foci:  $(6, 1 + 2\sqrt{58}), (6, 1 - 2\sqrt{58})$

Points on the hyperbola are 28 units closer to one focus than the other

$$\frac{(y-1)^2}{196} - \frac{(x-6)^2}{36} = 1$$

15)



$$\frac{x^2}{25} - \frac{y^2}{4} = 1$$

16) Center at  $(-6, 9)$

Vertex at  $(-18, 9)$

Eccentricity =  $\frac{5}{4}$

$$\frac{(x+6)^2}{144} - \frac{(y-9)^2}{81} = 1$$