

## Graphing and Properties of Hyperbolas

Identify the vertices, foci, and direction of opening of each.

1)  $\frac{x^2}{81} - \frac{y^2}{4} = 1$

2)  $\frac{x^2}{121} - \frac{y^2}{81} = 1$

3)  $\frac{y^2}{25} - \frac{x^2}{16} = 1$

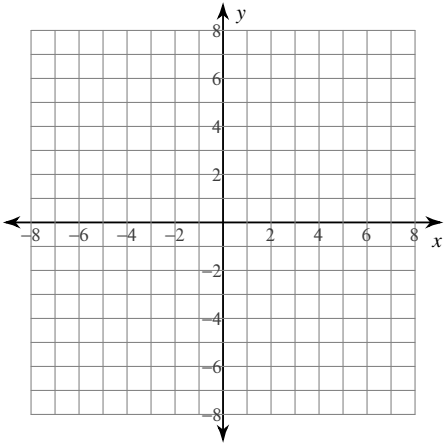
4)  $\frac{x^2}{121} - \frac{y^2}{36} = 1$

5)  $\frac{(x+2)^2}{169} - \frac{(y+8)^2}{4} = 1$

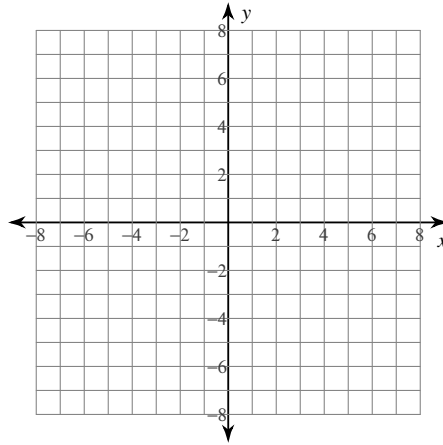
6)  $\frac{(y+8)^2}{36} - \frac{(x+2)^2}{25} = 1$

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

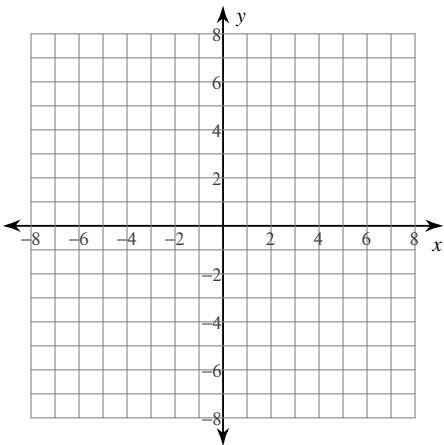
$$7) \frac{x^2}{20} - \frac{(y+1)^2}{10} = 1$$



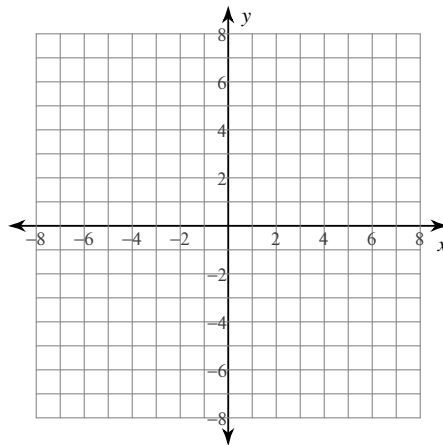
$$8) \frac{(x-3)^2}{4} - \frac{(y+1)^2}{9} = 1$$



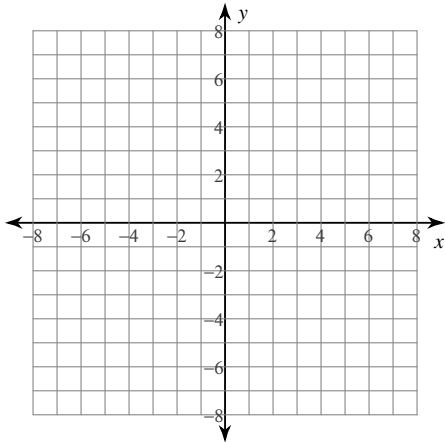
$$9) \frac{(y-1)^2}{9} - \frac{(x+1)^2}{16} = 1$$



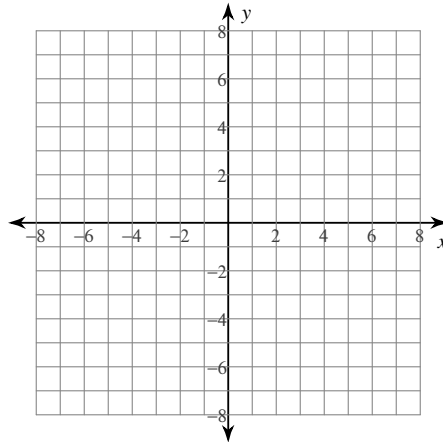
$$10) \frac{y^2}{9} - \frac{(x-2)^2}{9} = 1$$



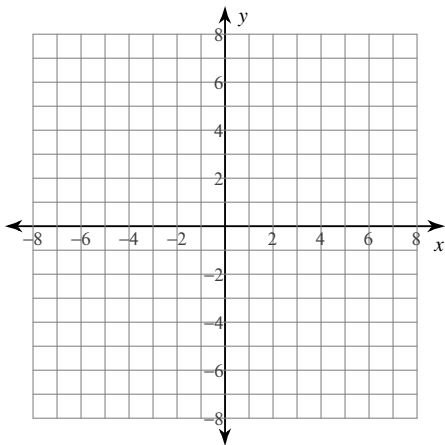
$$11) \frac{y^2}{25} - \frac{x^2}{25} = 1$$



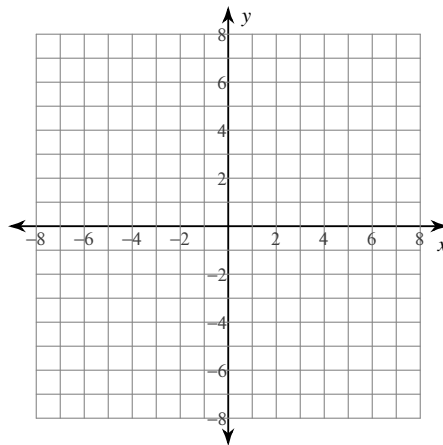
$$12) \frac{x^2}{25} - \frac{(y-2)^2}{4} = 1$$



$$13) \frac{(x-1)^2}{4} - \frac{(y-3)^2}{4} = 1$$



$$14) \frac{y^2}{9} - \frac{x^2}{25} = 1$$



**Identify the asymptotes, length of the transverse axis, length of the conjugate axis, length of the latus rectum, and eccentricity of each.**

$$15) -10y - y^2 = -4x^2 - 72x - 199$$

$$16) -y^2 + 12y - 19 = 18x - x^2$$

## Graphing and Properties of Hyperbolas

Identify the vertices, foci, and direction of opening of each.

$$1) \frac{x^2}{81} - \frac{y^2}{4} = 1$$

Vertices:  $(9, 0), (-9, 0)$   
 Foci:  $(\sqrt{85}, 0), (-\sqrt{85}, 0)$   
 Opens left/right

$$2) \frac{x^2}{121} - \frac{y^2}{81} = 1$$

Vertices:  $(11, 0), (-11, 0)$   
 Foci:  $(\sqrt{202}, 0), (-\sqrt{202}, 0)$   
 Opens left/right

$$3) \frac{y^2}{25} - \frac{x^2}{16} = 1$$

Vertices:  $(0, 5), (0, -5)$   
 Foci:  $(0, \sqrt{41}), (0, -\sqrt{41})$   
 Opens up/down

$$4) \frac{x^2}{121} - \frac{y^2}{36} = 1$$

Vertices:  $(11, 0), (-11, 0)$   
 Foci:  $(\sqrt{157}, 0), (-\sqrt{157}, 0)$   
 Opens left/right

$$5) \frac{(x+2)^2}{169} - \frac{(y+8)^2}{4} = 1$$

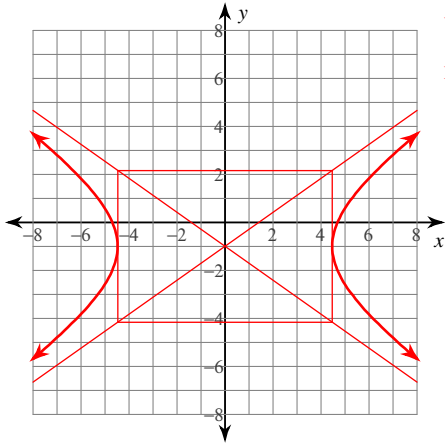
Vertices:  $(11, -8), (-15, -8)$   
 Foci:  $(-2 + \sqrt{173}, -8), (-2 - \sqrt{173}, -8)$   
 Opens left/right

$$6) \frac{(y+8)^2}{36} - \frac{(x+2)^2}{25} = 1$$

Vertices:  $(-2, -2), (-2, -14)$   
 Foci:  $(-2, -8 + \sqrt{61}), (-2, -8 - \sqrt{61})$   
 Opens up/down

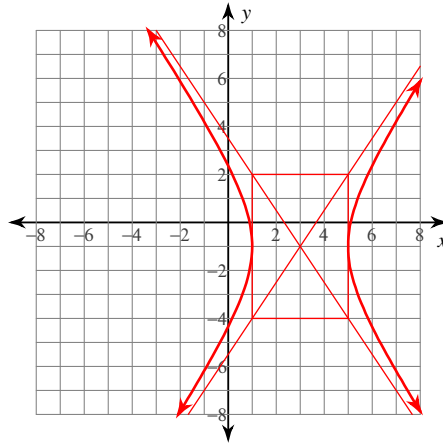
Identify the vertices and foci of each. Then sketch the graph.

$$7) \frac{x^2}{20} - \frac{(y+1)^2}{10} = 1$$



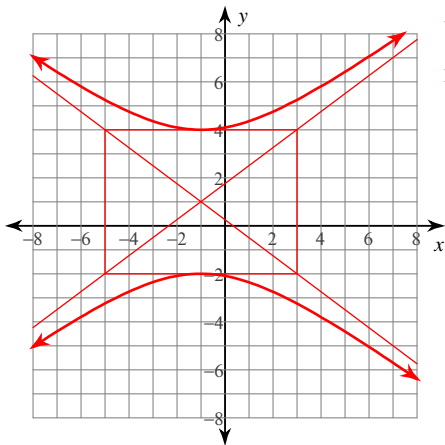
Vertices:  $(2\sqrt{5}, -1)$   
 $(-2\sqrt{5}, -1)$   
 Foci:  $(\sqrt{30}, -1)$   
 $(-\sqrt{30}, -1)$

$$8) \frac{(x-3)^2}{4} - \frac{(y+1)^2}{9} = 1$$



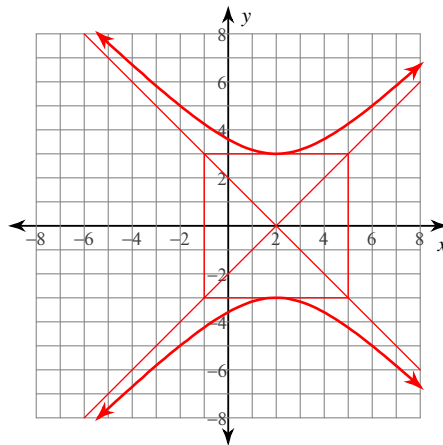
Vertices:  $(5, -1)$   
 $(1, -1)$   
 Foci:  $(3 + \sqrt{13}, -1)$   
 $(3 - \sqrt{13}, -1)$

$$9) \frac{(y-1)^2}{9} - \frac{(x+1)^2}{16} = 1$$



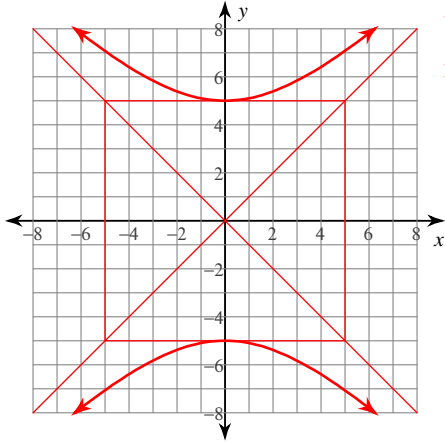
Vertices:  $(-1, 4)$   
 $(-1, -2)$   
 Foci:  $(-1, 6)$   
 $(-1, -4)$

$$10) \frac{y^2}{9} - \frac{(x-2)^2}{9} = 1$$



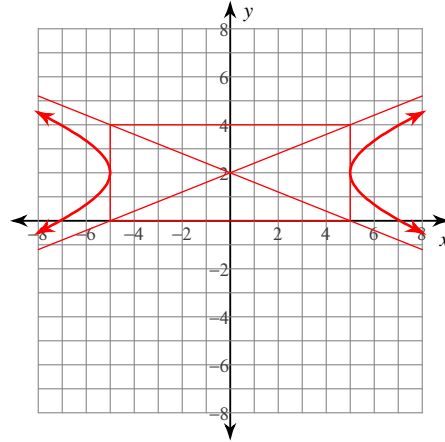
Vertices:  $(2, 3)$   
 $(2, -3)$   
 Foci:  $(2, 3\sqrt{2})$   
 $(2, -3\sqrt{2})$

$$11) \frac{y^2}{25} - \frac{x^2}{25} = 1$$



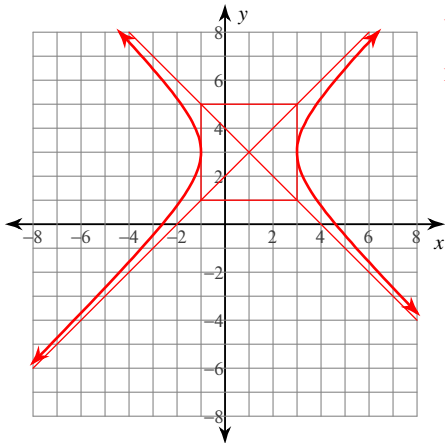
Vertices: (0, 5)  
(0, -5)  
Foci: (0,  $5\sqrt{2}$ )  
(0,  $-5\sqrt{2}$ )

$$12) \frac{x^2}{25} - \frac{(y-2)^2}{4} = 1$$



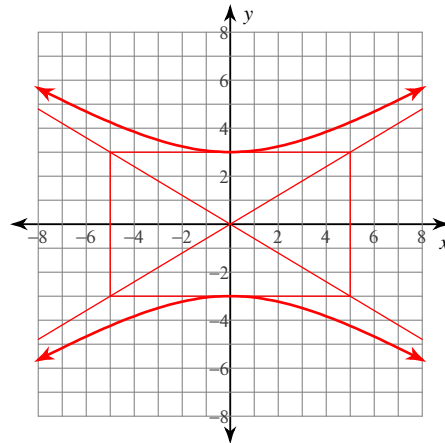
Vertices: (5, 2)  
(-5, 2)  
Foci: ( $\sqrt{29}$ , 2)  
( $-\sqrt{29}$ , 2)

$$13) \frac{(x-1)^2}{4} - \frac{(y-3)^2}{4} = 1$$



Vertices: (3, 3)  
(-1, 3)  
Foci: ( $1 + 2\sqrt{2}$ , 3)  
( $1 - 2\sqrt{2}$ , 3)

$$14) \frac{y^2}{9} - \frac{x^2}{25} = 1$$



Vertices: (0, 3)  
(0, -3)  
Foci: (0,  $\sqrt{34}$ )  
(0,  $-\sqrt{34}$ )

**Identify the asymptotes, length of the transverse axis, length of the conjugate axis, length of the latus rectum, and eccentricity of each.**

$$15) -10y - y^2 = -4x^2 - 72x - 199$$

Asym.:  $y = 2x + 13$

$y = -2x - 23$

Transverse Axis: 10 units

Conjugate Axis: 20 units

Latus Rectum: 40 units

Eccentricity:  $\sqrt{5} \approx 2.236$

$$16) -y^2 + 12y - 19 = 18x - x^2$$

Asym.:  $y = x - 3$

$y = -x + 15$

Transverse Axis: 16 units

Conjugate Axis: 16 units

Latus Rectum: 16 units

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