

## Writing Equations of Hyperbolas

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

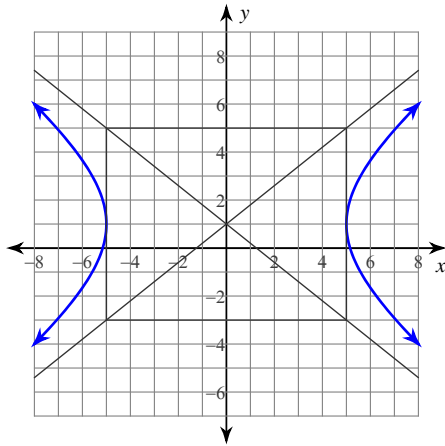
1)  $-x^2 + y^2 - 18x - 14y - 132 = 0$

2)  $9x^2 - 4y^2 - 90x + 32y - 163 = 0$

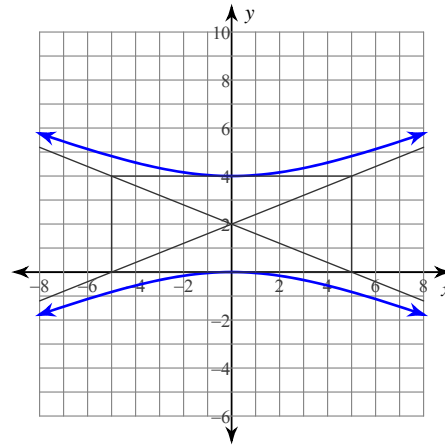
3)  $-16x^2 + 9y^2 + 32x + 144y - 16 = 0$

4)  $-2x^2 + 3y^2 + 4x - 60y + 268 = 0$

5)



6)



7) Vertices:  $(8, 14)$ ,  $(8, -10)$   
Conjugate Axis is 6 units long

8) Vertices:  $(4, 9 + \sqrt{30})$ ,  $(4, 9 - \sqrt{30})$   
Conjugate Axis is  $2\sqrt{195}$  units long

9) Vertices:  $(15, 1)$ ,  $(-1, 1)$   
Endpoints of Conjugate Axis:  $(7, 7)$   
 $(7, -5)$

10) Vertices:  $(-2, \frac{5}{2})$ ,  $(-16, \frac{5}{2})$   
Endpoints of Conjugate Axis:  $(-9, \frac{15}{2})$   
 $(-9, -\frac{5}{2})$

11) Vertices:  $(3, 0), (3, -18)$   
 Foci:  $(3, -9 + \sqrt{145}), (3, -9 - \sqrt{145})$

12) Vertices:  $(-5, 1), (-5, -7)$   
 Foci:  $(-5, -3 + \sqrt{97}), (-5, -3 - \sqrt{97})$

13) Vertices:  $(7, 4), (7, -24)$   
 Distance from Center to Focus =  $7\sqrt{5}$

14) Vertices:  $(-5, 22), (-5, -4)$   
 Distance from Center to Focus =  $\sqrt{218}$

15) Foci:  $(2, -6 + \sqrt{157}), (2, -6 - \sqrt{157})$   
 Asymptotes:  $y = \frac{6}{11}x - \frac{78}{11}$   
 $y = -\frac{6}{11}x - \frac{54}{11}$

16) Foci:  $(6\sqrt{5}, 10), (-6\sqrt{5}, 10)$   
 Asymptotes:  $y = \frac{1}{2}x + 10$   
 $y = -\frac{1}{2}x + 10$

17) Vertices:  $(0, -1), (-20, -1)$   
 Asymptotes:  $y = x + 9$   
 $y = -x - 11$

18) Vertices:  $(13, 0), (-1, 0)$   
 Asymptotes:  $y = x - 6$   
 $y = -x + 6$

19) Foci:  $(-9, -5 + 9\sqrt{2}), (-9, -5 - 9\sqrt{2})$   
 Conjugate Axis is 18 units long

20) Foci:  $(8, -5 + \sqrt{53}), (8, -5 - \sqrt{53})$   
 Endpoints of Conjugate Axis:  $(15, -5)$   
 $(1, -5)$

21) Foci:  $(-10, 10 + 4\sqrt{10}), (-10, 10 - 4\sqrt{10})$   
 Points on the hyperbola are 24 units closer to one focus than the other

22) Center at  $(-1, -1)$   
 Transverse axis is vertical and 24 units long  
 Conjugate axis is 8 units long

23) Center at  $(-10, -7)$   
 Transverse axis is vertical; central rectangle is 10 units wide and 10 units tall

24) Vertices:  $(4, 9 + 3\sqrt{10}), (4, 9 - 3\sqrt{10})$   
 Perimeter of Central Rectangle =  $16\sqrt{10}$

## Writing Equations of Hyperbolas

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

1)  $-x^2 + y^2 - 18x - 14y - 132 = 0$

$$\frac{(y-7)^2}{100} - \frac{(x+9)^2}{100} = 1$$

2)  $9x^2 - 4y^2 - 90x + 32y - 163 = 0$

$$\frac{(x-5)^2}{36} - \frac{(y-4)^2}{81} = 1$$

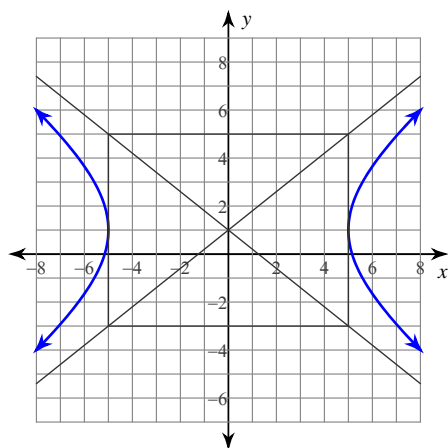
3)  $-16x^2 + 9y^2 + 32x + 144y - 16 = 0$

$$\frac{(y+8)^2}{64} - \frac{(x-1)^2}{36} = 1$$

4)  $-2x^2 + 3y^2 + 4x - 60y + 268 = 0$

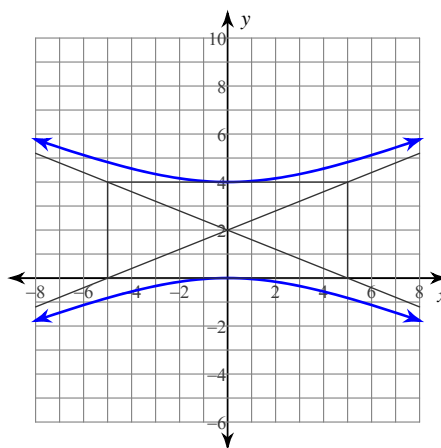
$$\frac{(y-10)^2}{10} - \frac{(x-1)^2}{15} = 1$$

5)



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

6)



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

7) Vertices:  $(8, 14)$ ,  $(8, -10)$

Conjugate Axis is 6 units long

$$\frac{(y-2)^2}{144} - \frac{(x-8)^2}{9} = 1$$

8) Vertices:  $(4, 9 + \sqrt{30})$ ,  $(4, 9 - \sqrt{30})$

Conjugate Axis is  $2\sqrt{195}$  units long

$$\frac{(y-9)^2}{30} - \frac{(x-4)^2}{195} = 1$$

9) Vertices:  $(15, 1)$ ,  $(-1, 1)$

Endpoints of Conjugate Axis:  $(7, 7)$   
 $(7, -5)$

$$\frac{(x-7)^2}{64} - \frac{(y-1)^2}{36} = 1$$

10) Vertices:  $(-2, \frac{5}{2})$ ,  $(-16, \frac{5}{2})$

Endpoints of Conjugate Axis:  $(-9, \frac{15}{2})$   
 $(-9, -\frac{5}{2})$

$$\frac{(x+9)^2}{49} - \frac{(y-\frac{5}{2})^2}{25} = 1$$

- 11) Vertices:  $(3, 0), (3, -18)$   
 Foci:  $(3, -9 + \sqrt{145}), (3, -9 - \sqrt{145})$

$$\frac{(y+9)^2}{81} - \frac{(x-3)^2}{64} = 1$$

- 13) Vertices:  $(7, 4), (7, -24)$   
 Distance from Center to Focus =  $7\sqrt{5}$

$$\frac{(y+10)^2}{196} - \frac{(x-7)^2}{49} = 1$$

- 15) Foci:  $(2, -6 + \sqrt{157}), (2, -6 - \sqrt{157})$

$$\text{Asymptotes: } y = \frac{6}{11}x - \frac{78}{11}$$

$$y = -\frac{6}{11}x - \frac{54}{11}$$

$$\frac{(y+6)^2}{36} - \frac{(x-2)^2}{121} = 1$$

- 17) Vertices:  $(0, -1), (-20, -1)$   
 Asymptotes:  $y = x + 9$   
 $y = -x - 11$

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

- 19) Foci:  $(-9, -5 + 9\sqrt{2}), (-9, -5 - 9\sqrt{2})$   
 Conjugate Axis is 18 units long

$$\frac{(y+5)^2}{81} - \frac{(x+9)^2}{81} = 1$$

- 21) Foci:  $(-10, 10 + 4\sqrt{10}), (-10, 10 - 4\sqrt{10})$   
 Points on the hyperbola are 24 units closer to one focus than the other

$$\frac{(y-10)^2}{144} - \frac{(x+10)^2}{16} = 1$$

- 23) Center at  $(-10, -7)$   
 Transverse axis is vertical; central rectangle is 10 units wide and 10 units tall

$$\frac{(y+7)^2}{25} - \frac{(x+10)^2}{25} = 1$$

- 12) Vertices:  $(-5, 1), (-5, -7)$   
 Foci:  $(-5, -3 + \sqrt{97}), (-5, -3 - \sqrt{97})$

$$\frac{(y+3)^2}{16} - \frac{(x+5)^2}{81} = 1$$

- 14) Vertices:  $(-5, 22), (-5, -4)$   
 Distance from Center to Focus =  $\sqrt{218}$

$$\frac{(y-9)^2}{169} - \frac{(x+5)^2}{49} = 1$$

- 16) Foci:  $(6\sqrt{5}, 10), (-6\sqrt{5}, 10)$

$$\text{Asymptotes: } y = \frac{1}{2}x + 10$$

$$y = -\frac{1}{2}x + 10$$

$$\frac{x^2}{144} - \frac{(y-10)^2}{36} = 1$$

- 18) Vertices:  $(13, 0), (-1, 0)$   
 Asymptotes:  $y = x - 6$   
 $y = -x + 6$

$$\frac{(x-6)^2}{49} - \frac{y^2}{49} = 1$$

- 20) Foci:  $(8, -5 + \sqrt{53}), (8, -5 - \sqrt{53})$   
 Endpoints of Conjugate Axis:  $(15, -5)$   
 $(1, -5)$

$$\frac{(y+5)^2}{4} - \frac{(x-8)^2}{49} = 1$$

- 22) Center at  $(-1, -1)$   
 Transverse axis is vertical and 24 units long  
 Conjugate axis is 8 units long

$$\frac{(y+1)^2}{144} - \frac{(x+1)^2}{16} = 1$$

- 24) Vertices:  $(4, 9 + 3\sqrt{10}), (4, 9 - 3\sqrt{10})$   
 Perimeter of Central Rectangle =  $16\sqrt{10}$

$$\frac{(y-9)^2}{90} - \frac{(x-4)^2}{10} = 1$$