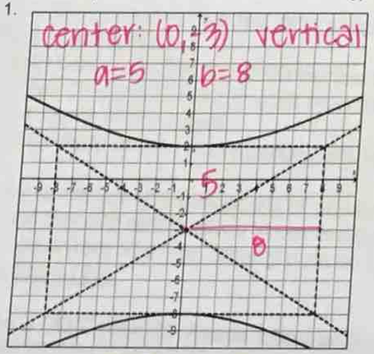
Practice – Hyperbolas

Name _____ Date _____ Period _____

Write the equation in standard form for each hyperbola.

1.

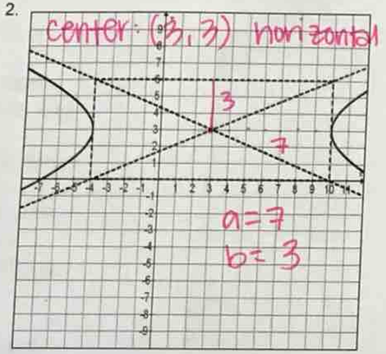


center: (0, 3) vertical

a=5 b=8

$$\frac{(y+3)^2}{25} - \frac{x^2}{64} = 1$$

2.



center: (3, 3) horizontal

a=7

b=3

$$\frac{(x-3)^2}{49} - \frac{(y-3)^2}{9} = 1$$

Find the critical values for each hyperbola and then graph.

3. $\frac{x^2}{64} - \frac{y^2}{36} = 1$ a=8 b=6 horiz.

Center (0, 0)

Vertices (-8, 0) and (8, 0)

Co-vertices (0, -6) and (0, 6)

Foci (-10, 0) and (10, 0)

Slopes of Asymptotes ±3/4

Domain (-∞, -8] U [8, ∞)

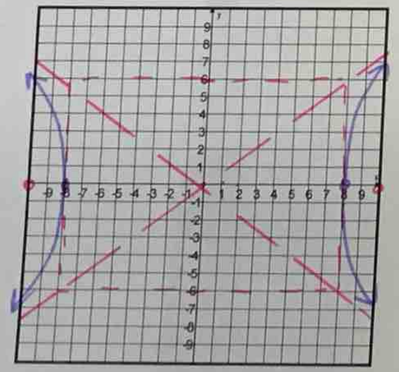
Range (-∞, ∞)

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

$c^2 = 64 + 36$

$c^2 = 100$

$c = 10$



4. $\frac{y^2}{25} - \frac{x^2}{81} = 1$ a=5 b=9 vertical

Center (0, 0)

Vertices (0, 5) and (0, -5)

Co-vertices (-9, 0) and (9, 0)

Foci (0, ±√106)

Slopes of Asymptotes ± 5/9

Domain (-∞, ∞)

Range (-∞, -5] U [5, ∞)

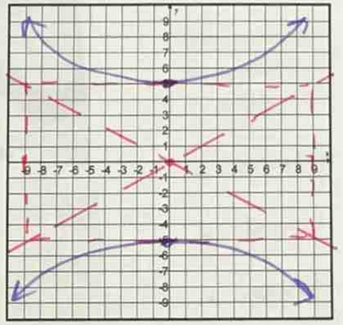
$c^2 = 25 + 81$

$c^2 = 106$

$c = \sqrt{106}$

Domain

Range



5. $\frac{(y-1)^2}{64} - \frac{(x+2)^2}{36} = 1$ a=8 b=6 vertical

Center (-2, 1)

Vertices (-2, 9) and (-2, -7)

Co-vertices (-8, 1) and (4, 1)

Foci (-2, 11) and (-2, -9)

Slopes of Asymptotes ± 4/3

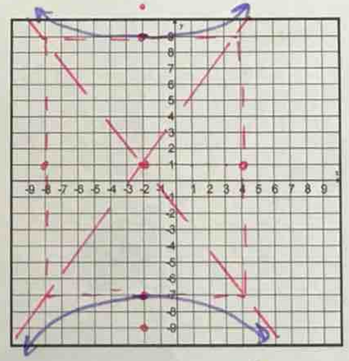
Domain (-∞, ∞)

Range (-∞, -7] U [9, ∞)

$c^2 = 64 + 36$

$c^2 = 100$

$c = 10$



6. $\frac{(x+5)^2}{25} - \frac{(y-3)^2}{16} = 1$ a=5 b=4 horiz.

Center (-5, 3)

Vertices (-10, 3) and (0, 3)

Co-vertices (-5, 7) and (-5, -1)

Foci (-5-√41, 3) and (-5+√41, 3)

Slopes of Asymptotes ± 4/5

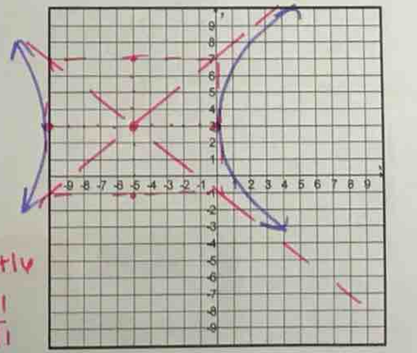
Domain (-∞, -10] U [0, ∞)

Range (-∞, ∞)

$c^2 = 25 + 16$

$c^2 = 41$

$c = \sqrt{41}$



7. What happens to the graph of $\frac{x^2}{a^2} - \frac{y^2}{16} = 1$ as the value of *a* increases? What happens to the graph of $\frac{x^2}{16} - \frac{y^2}{b^2} = 1$ as the values of *b* increase?

- a increases → branches of hyperbola get narrower
- b increases → branches of hyperbola get wider

8. What is the length of the conjugate axis of the hyperbola with equation $\frac{x^2}{49} - \frac{y^2}{121} = 1$?

A 7
B 11
C 14
D 22

↑ minor axis

horizontal

↳ minor is vertical

2b = 2(11)

9. Find an equation of a hyperbola with vertices (0, ±2) and foci (0, ±4).

vertical, center (0, 0)

a=2

c=4

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

$16 = 4 + b^2$

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

10. The hyperbola is centered at (2, -3) and has a horizontal transverse axis. The distance between the vertices is 14 and the length of the conjugate axis is 4. Find the equation of the hyperbola.

a=7

b=2

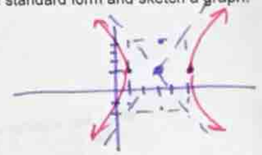
$$\frac{(x-2)^2}{49} - \frac{(y+3)^2}{4} =$$

11. Given $\frac{-4(y-1)^2}{36} + \frac{9(x-3)^2}{36} = \frac{36}{36}$. Write the equation in standard form and sketch a graph.

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

center: (3, 1) horizontal

a=2 b=3



12. Write the equation of the hyperbola centered at the origin with vertex at (6, 0) and asymptotes with equations $y = \pm\frac{2}{3}x$ $\frac{b}{a}$

horizontal

a=6

b=4

$$\frac{x^2}{36} - \frac{y^2}{16} = 1$$

13. What is the slope of one of the asymptotes of the graph of $\frac{36}{36} = \frac{9x^2}{36} - \frac{4y^2}{36}$?

$m = \pm 3/2$

$1 = \frac{x^2}{4} - \frac{y^2}{6}$

a=2 b=3