The Hyperbola

Standard Forms of Hyperbolas:

Horizontal Hyperbola:	Vertical Hyperbola:
$$\frac{(x-h)^2}{a^2} - \frac{(y-k)^2}{b^2} = 1$$	$$\frac{(y-k)^2}{a^2} - \frac{(x-h)^2}{b^2} = 1$$
Vertices: $(h \pm a, k)$	**Vertices:** $(h, k \pm a)$
Asymptotes: $(y-k) = \pm \frac{b}{a}(x-h)$	**Asymptotes:** $(y-k) = \pm \frac{a}{b}(x-h)$
Foci: $(h \pm c, k)$	**Foci:** $(h, k \pm c)$

Graph each hyperbola and identify the vertices, the location of its foci, and the equations of its asymptotes.
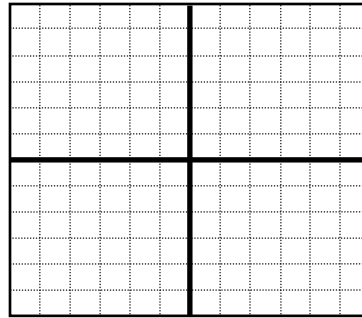
1) $9x^2 - 16y^2 = 144$

2) $y^2 - 25x^2 = 25$
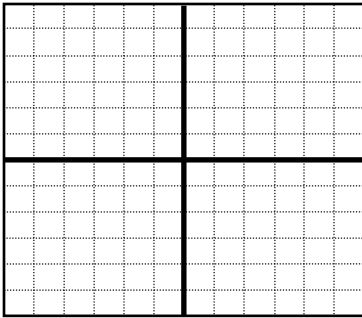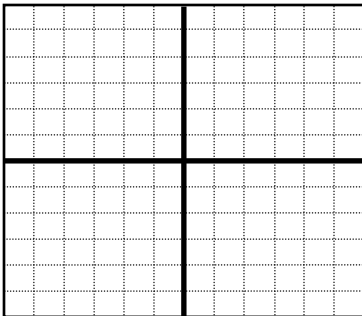
Vertices:

Foci:

Asymptotes:

Vertices:

Foci:

Asymptotes:

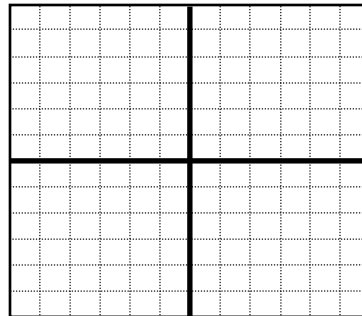**3)** $\frac{(x-2)^2}{4} - \frac{(y+2)^2}{16} = 1$

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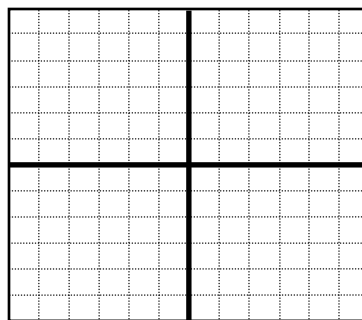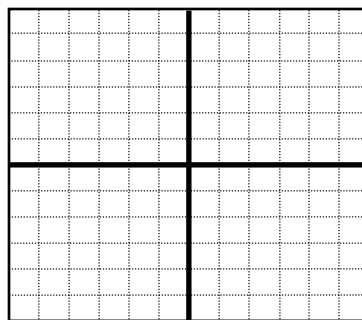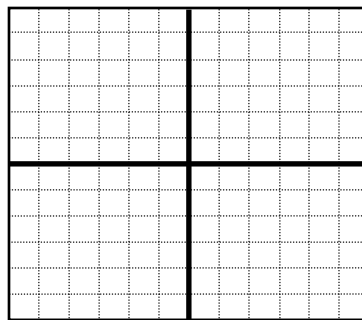
Vertices:

Foci:

Asymptotes:

Vertices:

Foci:

Asymptotes:

5)   Write an equation of the hyperbola with foci at (0, ±5) and vertices at (0, ±3).

6) Write an equation of the hyperbola with foci at $\left(3\pm\sqrt{10},3\right)$ and vertices at (4,3) and (2,3).

7) Write an equation of the hyperbola with foci at (4,5) and (4,-3) and vertices at (4,4) and (4,-2).

8)   Write the equation in standard form.

$$4x^2 - y^2 - 16x - 4y - 4 = 0$$

9) Write the equation in standard form.

$$-9x^2 + 16y^2 + 54x + 64y - 161 = 0$$