Conic Section (Hyperbola)

1. Find the equation of the hyperbola with focus (-1,1), directrix $x - y + 1 = 0$ and eccentricity 2
2. Find the standard equation of the hyperbola with focus (5,0), (-5,0) and eccentricity $\frac{5}{3}$
3. Find the equation of the hyperbola which passes through the point (0,3) with asymptotes $2x - y - 3 = 0$ and $2x + y - 5 = 0$
4. A hyperbola passes through the point M(-9,2) and its two asymptotes are $y = \pm\frac{2}{3}x$. Find the equation of the hyperbola
5. Identify the centre, vertices, foci and equations of the asymptotes for the following hyperbolas , then graph
   a. $9x^2 - 16y^2 - 144 = 0$
   b. $\frac{(y+3)^2}{4} - \frac{(x-2)^2}{36} = 1$
   c. $49y^2 - 25x^2 + 98y - 100x + 1174 = 0$
6. Find the equation of the hyperbola where the difference of the focal radii is 6, and the endpoints of the conjugate axis are (-2,8) and (-2,-2)
7. Find the equation for the hyperbola where one of the vertices is at (-3,2) and the asymptotes are $y - 2 = \pm\frac{2}{3}(x - 3)$
8. A comet's path (as it approaches the sun) can be modelled by one branch of the hyperbola $\frac{y^2}{1096} - \frac{x^2}{41334} = 1$, where the sun is at the focus of that part of the hyperbola. Each unit of the coordinate system is 1 million miles.
   a. Find the coordinates of the sun (assuming it is at the focus with non-negative coordinates). Round to the nearest hundredth
   b. How close does the comet come to the sun?
9. Two buildings in a shopping complex are shaped like a branches of the hyperbola $729x^2 - 1024y^2 - 746496 = 0$, where x and y are in feet. How far apart are the buildings at their closest part?
10. Two radar sites are tracking an airplane that is flying on a hyperbolic path. The first radar site is located at (0,0) and shows the airplane to be 200 meters away at a certain time. The second radar site, located 160 miles east of the first, shows the airplane to be 100 meters away at this same time. Find the coordinates of all possible points where the airplane could be located. (Find the equation of the hyperbola where the plane could be located)
11. Alpha particles are deflected along the hyperbolic paths when they are directed towards the nuclei of gold atoms. If an alpha particle gets as close as 10 units to the nucleus along a hyperbolic path with asymptote $y = \frac{2}{5}x$, what is the equation of its path?
12. Find the vertices, centre, foci and asymptotes of each of the hyperbolas
    a. $\frac{x^2}{9} - \frac{y^2}{7} = 1$
    b. $y^2 - \frac{x^2}{9} = 1$
13. The equation of hyperbola is given as
    a. $\frac{(x-3)^2}{4} - \frac{(y+2)^2}{9} = 1$
    b. $(y+3)^2 - \frac{(x+2)^2}{3} = 1$

    Find the vertices, centre, foci and asymptotes of each of the hyperbolas
14. Find the vertices, centre, foci and asymptotes of the hyperbola $9x^2 - y^2 = 9$
15. Find an equation for the hyperbola that has its centre at the origin and satisfies the following given conditions. Hence sketch the graph.
    a. Foci $(\pm 4,0)$, vertices $(\pm 3,0)$
    b. Foci $\left(0, \pm\sqrt{6}\right)$, asymptotes $y = \pm\frac{\sqrt{2}}{2}x$
16. Find the equation of a hyperbola with centre (-1,3) , vertex (2,3) and focus (4,3). Hence, sketch its graph.