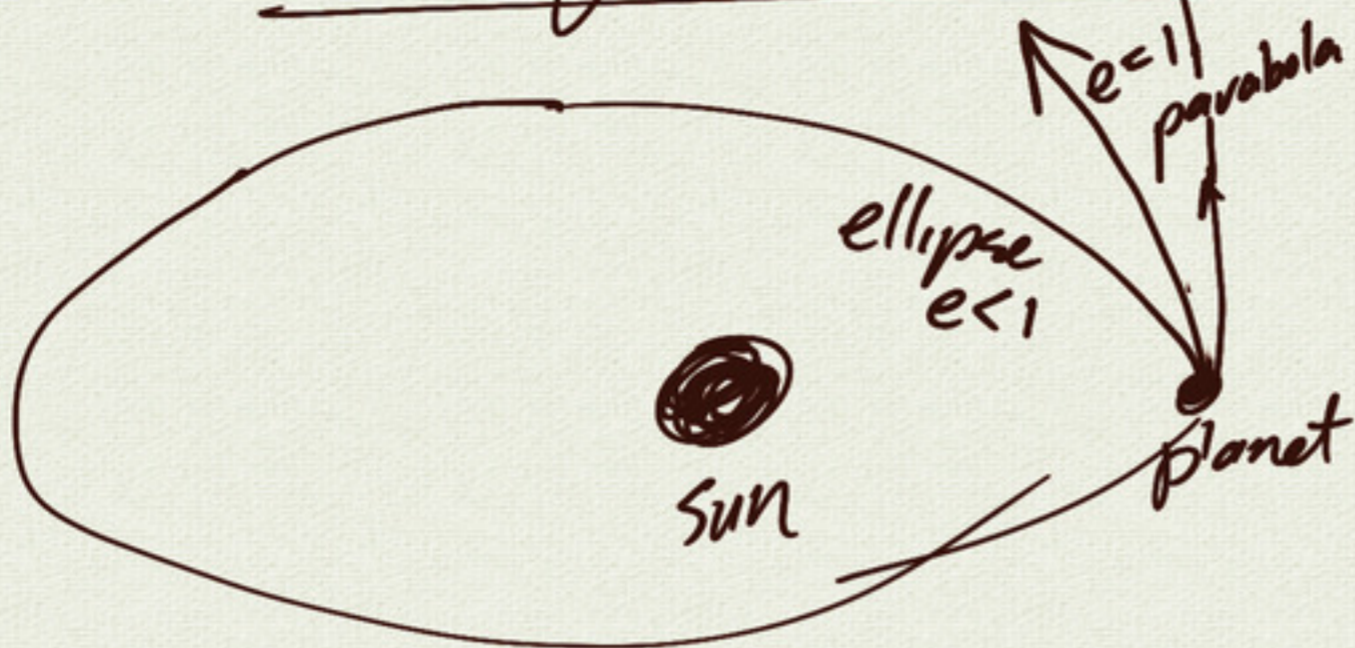


5.3 Hyperbolas

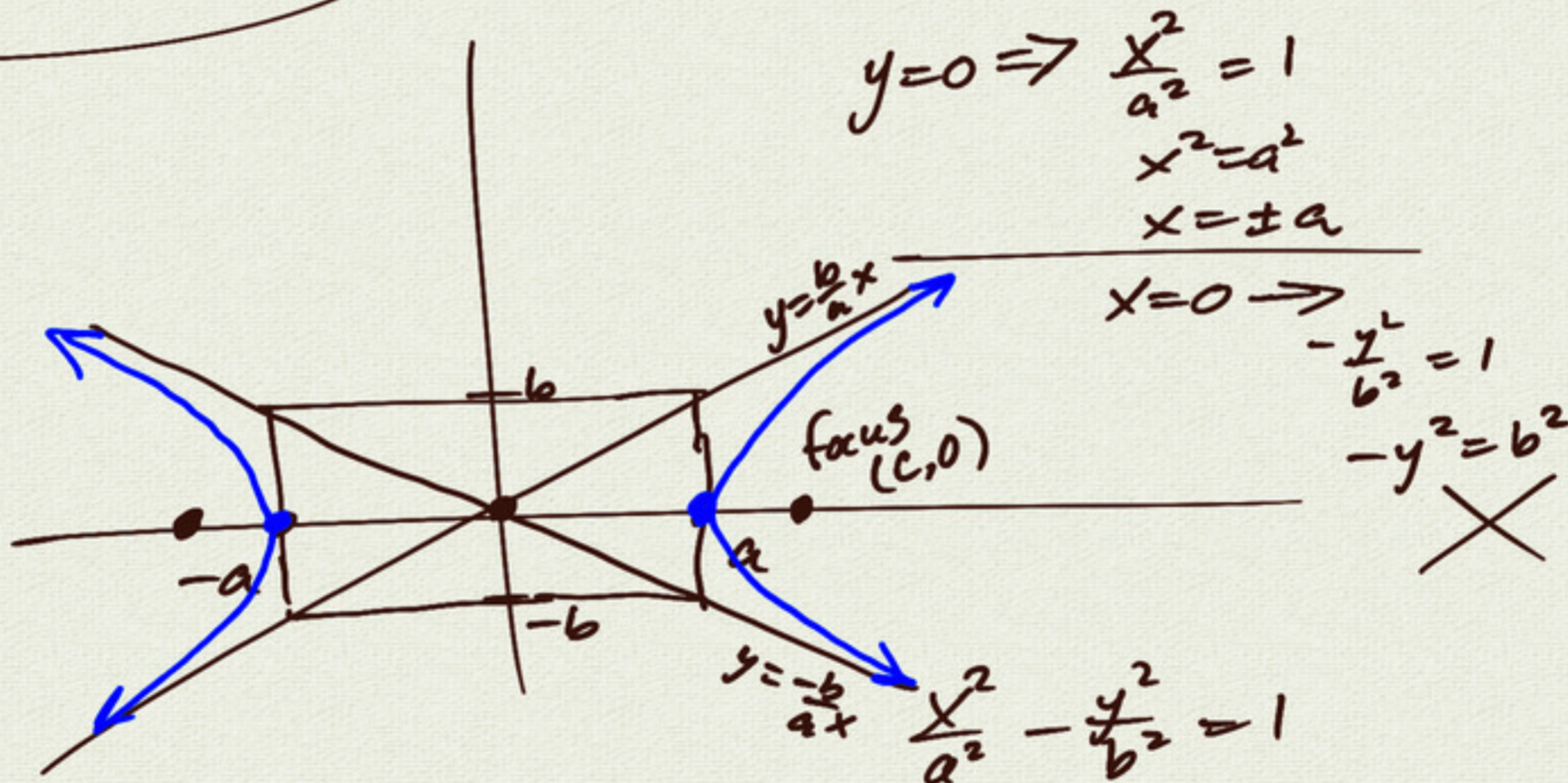


ellipse

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$$

hyperbola

$$\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$$



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

eccentricity: $e = \frac{c}{a}$

$$\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$$

$$\frac{x^2}{a^2} = \frac{y^2}{b^2} + 1$$

$x, y \rightarrow \infty$

$$\frac{x^2}{a^2} \approx \frac{y^2}{b^2}$$

$$y^2 \approx \frac{b^2}{a^2} x^2$$

$$y \approx \pm \frac{b}{a} x$$

translate:
center (h, k)

$$\frac{(x-h)^2}{a^2} - \frac{(y-k)^2}{b^2} = 1$$

hyperbola standard form

example:

$$-9x^2 - 18x + 16y^2 - 64y - 89 = 0$$

$$-9(x^2 + 2x + 1) + 16(y^2 - 4y + 4) = 89 - 9 + 64$$

$$-9(x+1)^2 + 16(y-2)^2 = 144$$

$$144 = 16 \cdot 9$$

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

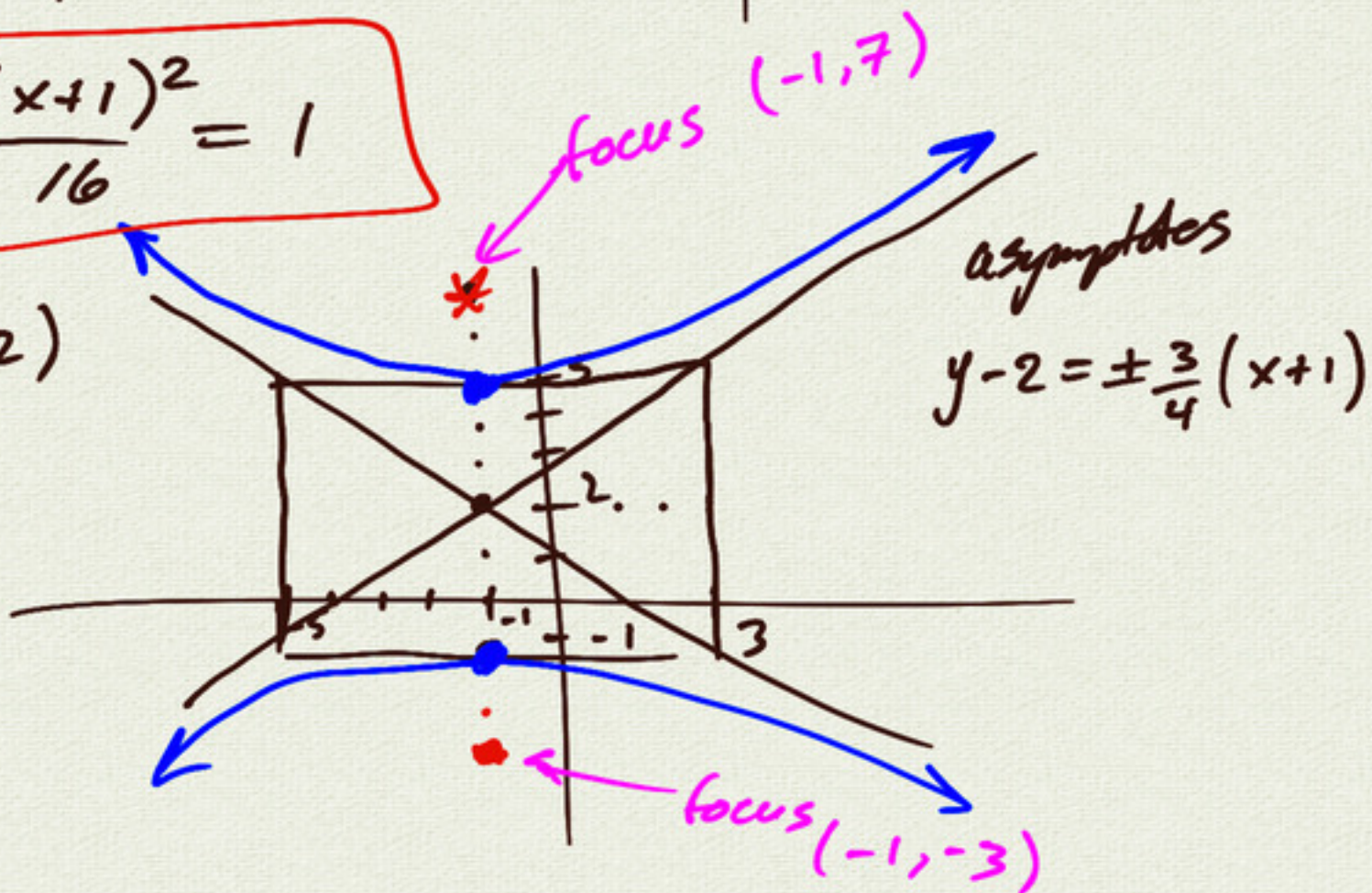
$$\frac{(y-2)^2}{9} - \frac{(x+1)^2}{16} = 1$$

center: $(-1, 2)$

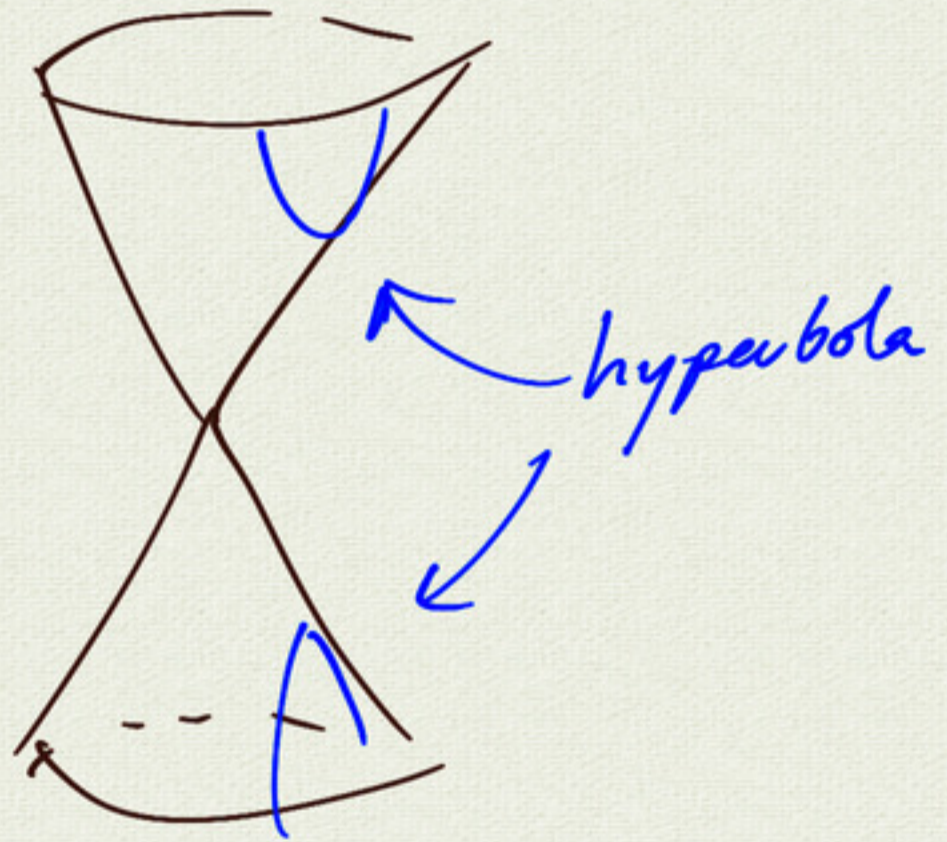
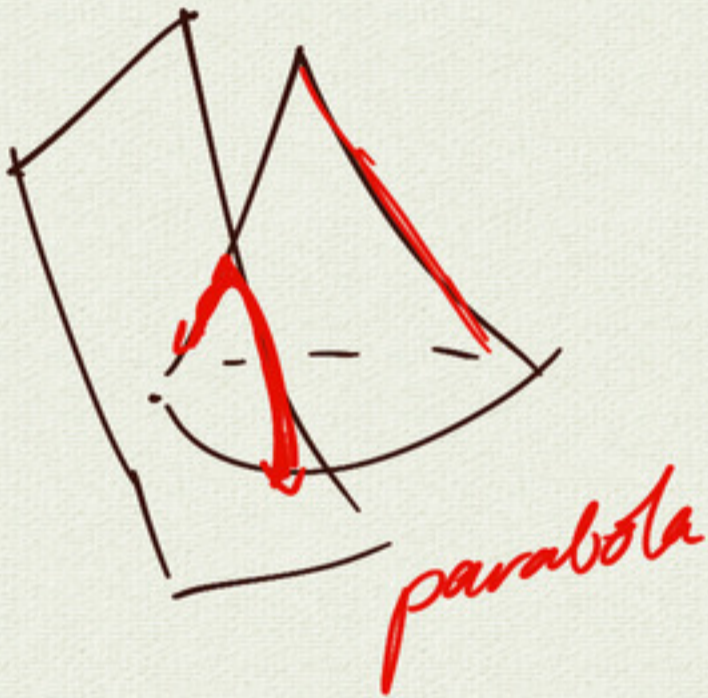
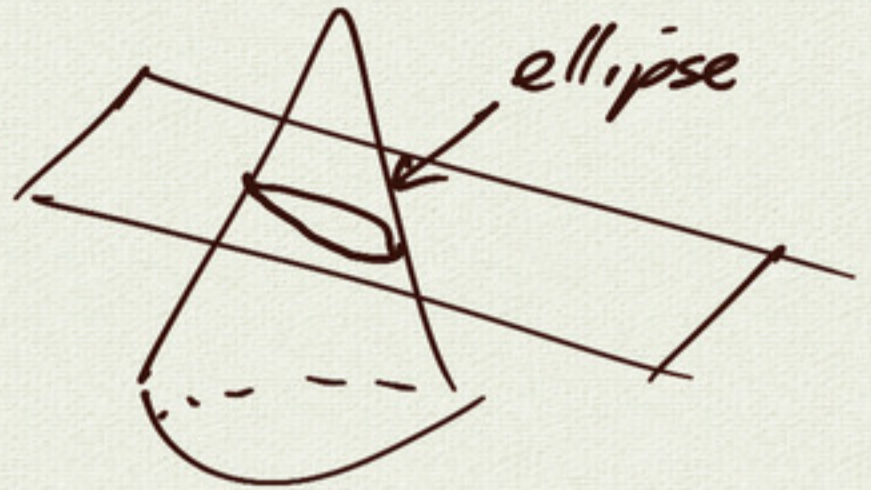
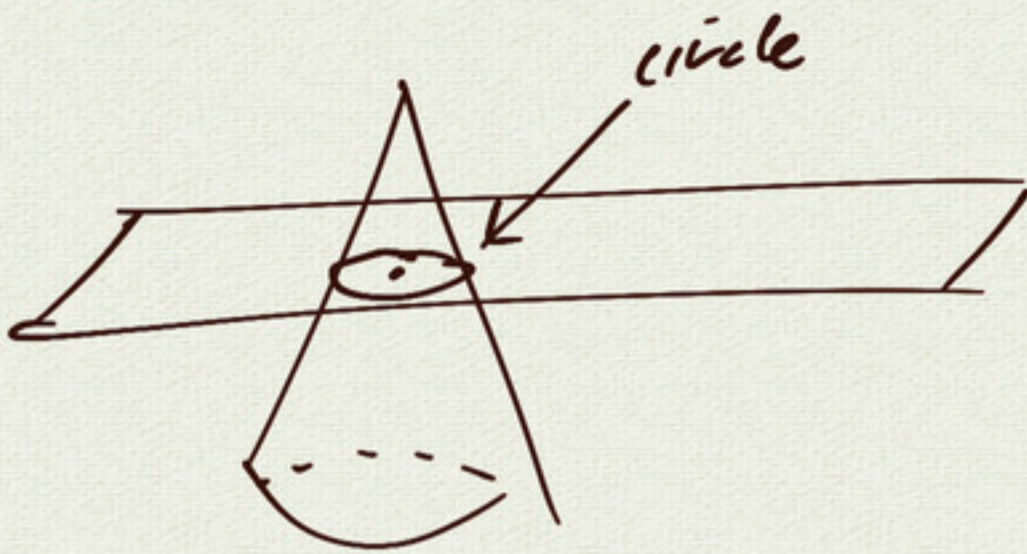
$$c^2 = a^2 + b^2$$
$$= 25$$

$$c = 5$$

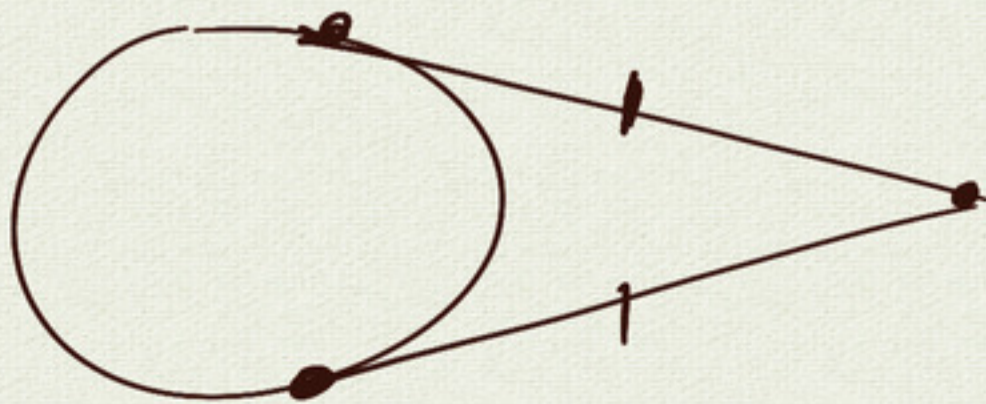
$$e = \frac{c}{a} = \frac{5}{3}$$



Conic sections



Dandelin



two
tangent
spheres