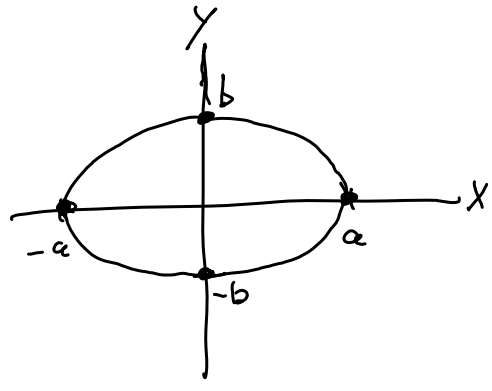


# 2.6 Quadratic Surfaces

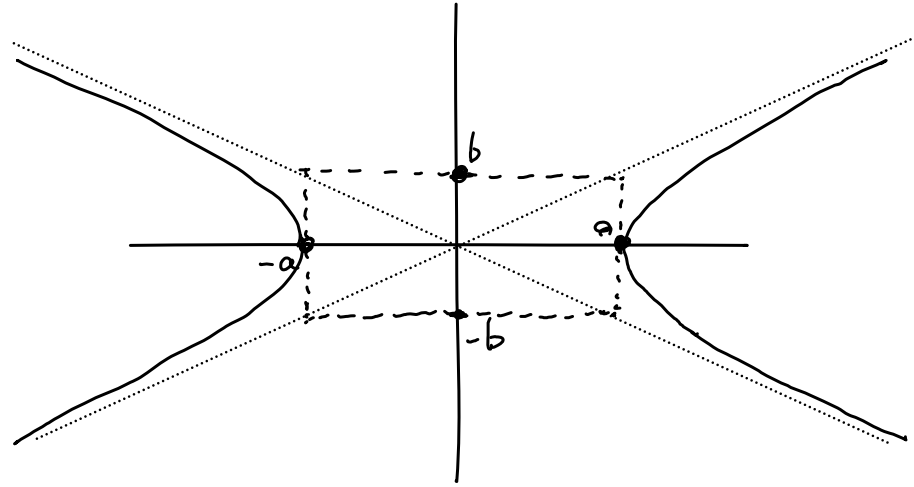
## Review of 2D conic sections

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

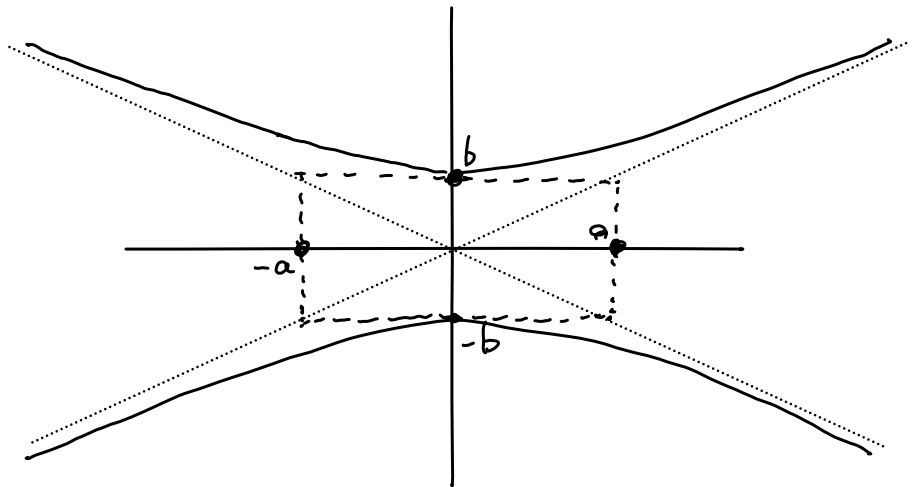


Hyperbolas

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



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



A 3-dimensional quadric surface is given by a linear equation in  $x, x^2, y, y^2, z, z^2$ .

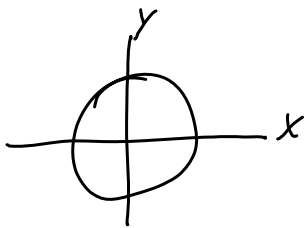
example

Sketch the quadric surface given by  $x^2 + y^2 - z^2 = 1$

fix  $z = k$

$$x^2 + y^2 = 1 + k^2$$

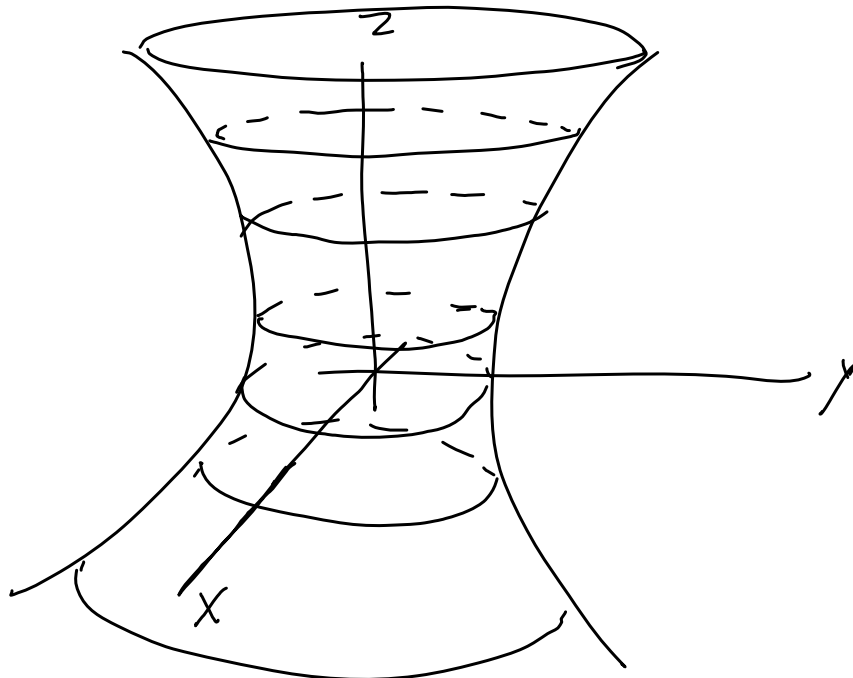
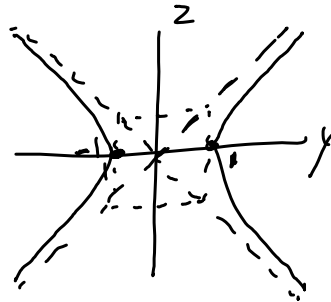
which is an ellipse parallel to the  $xy$ -plane centered at  $(0,0)$



In  $yz$ -plane

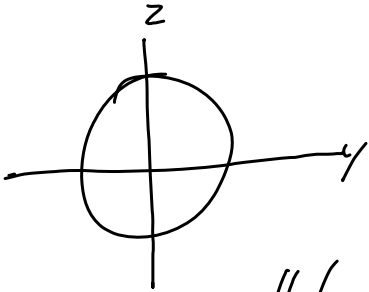
$$x = 0$$

$$y^2 - z^2 = 1$$



example Sketch the surface given by  $x^2 - y^2 - z^2 = 1$ .

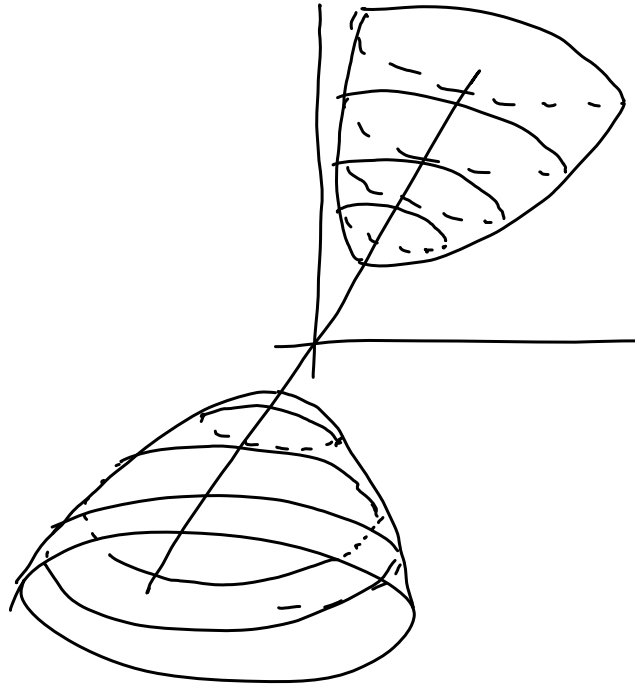
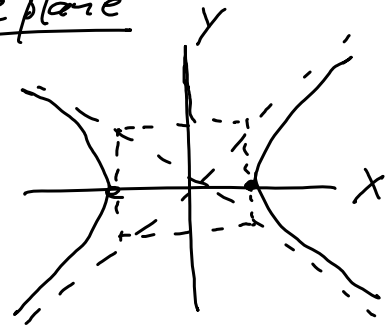
Let  $x = k$   
 $k^2 - 1 = y^2 + z^2$



Circles parallel to the yz-plane

In the xy-coordinate plane

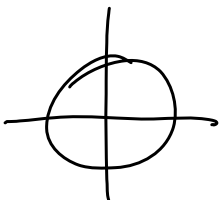
$z = 0$   
 $x^2 - y^2 = 1$



example sketch the surface given by  $z = \sqrt{x^2 + y^2}$

Let  $z = k \geq 0$

$k^2 = x^2 + y^2$



Circles parallel to the xy-plane

In the yz-coordinate plane

$x = 0$   
 $z = \sqrt{y^2}$   
 $z = |y|$

