

## 10.6 Cylinders and Quadratic Surfaces

Ex  $x^2 + y^2 = 1$  in  $\mathbb{R}^3$        $x^2 + z^2 = 1$  in  $\mathbb{R}^3$       circular cylinders

Ex  $y = x^2$  in  $\mathbb{R}^3$        $y = z^2$  in  $\mathbb{R}^3$       parabolic cylinders

Ex  $x^2 + y^2 + z^2 = R^2$  sphere.  
 $(x-a)^2 + (y-b)^2 + (z-c)^2 = R^2$  center  $(a, b, c)$

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

Ex  ~~$x^2 + y^2 + z^2 = 1$~~   $z = x^2 + y^2$  paraboloid.

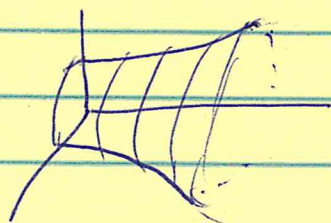
Ex  $x^2 + y^2 - z^2 = 1$  One sheeted hyperboloid.

Consider levels  $z=0, z=1, z=2, z=-1$

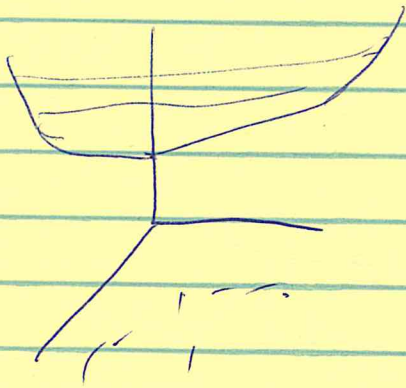
slices:  $x=0$   
 $y=0$



Ex  $x^2 - y^2 + z^2 = 1$



Ex  $-x^2 - y^2 + z^2 = 1$



$z=0 \rightarrow$  no solution

$z=1 \rightarrow (0,0)$

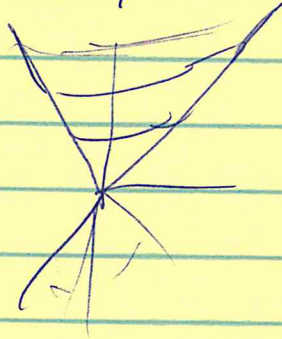
$z=2$  circle

$z=-1$

$z=-2$

Two sheeted hyperboloid.

Ex  $-x^2 - y^2 + z^2 = 0$



Cone!