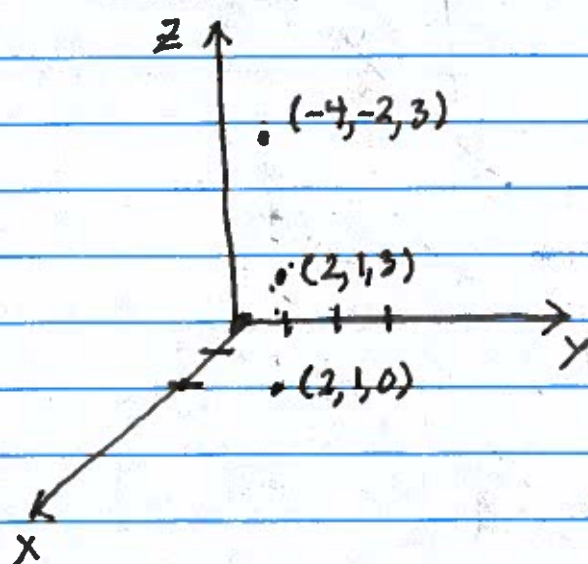


Lecture #4: Three-Dimensional Coordinate System

Coordinate Axes:



$$(x, y, z) \in \mathbb{R}^3$$



point in space

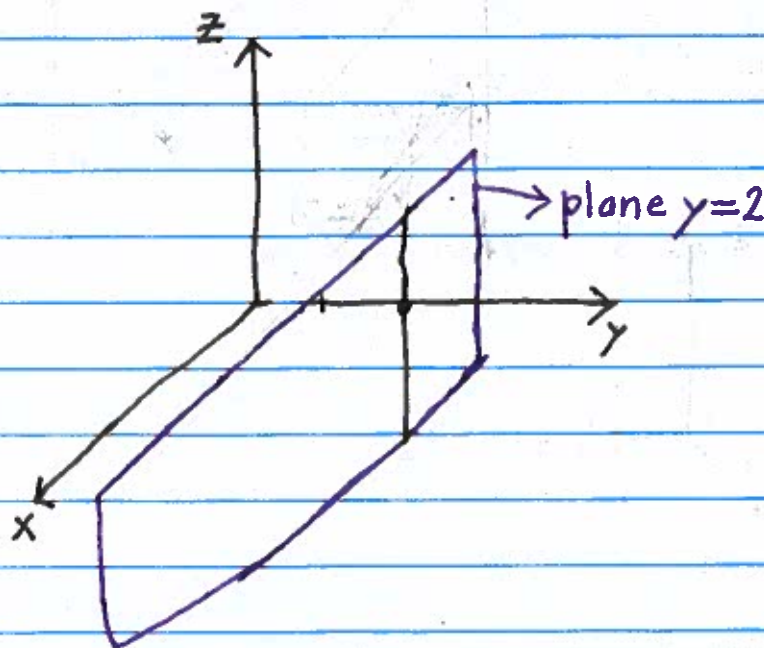
Surfaces:

$$f(x, y, z) = \text{constant (implicit form)}$$

all x, y, z that satisfy equation

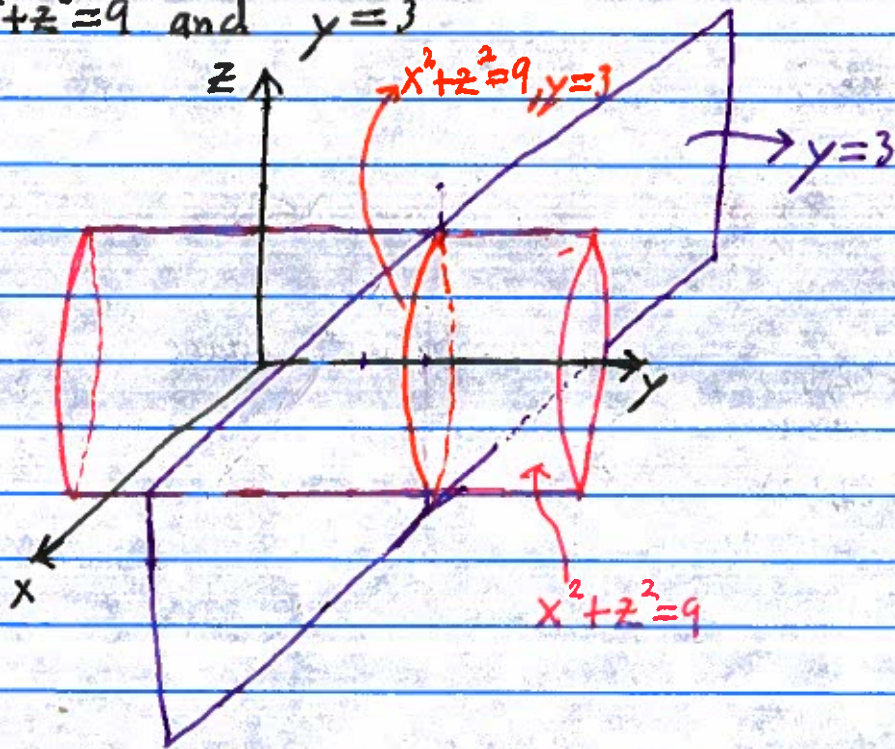
Example:

$$y=2 \quad (\{(x, y, z) : y=2\})$$



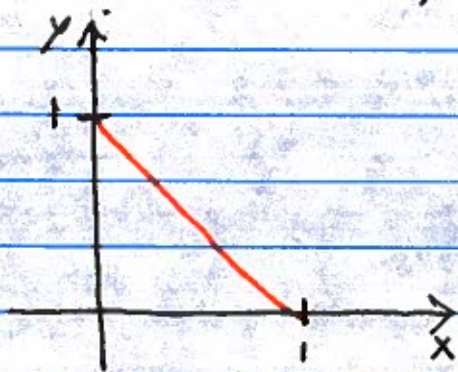
Example:

$$x^2 + z^2 = 9 \text{ and } y = 3$$

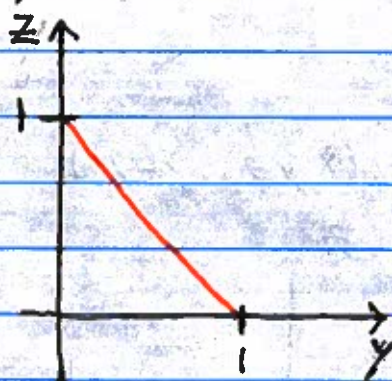


Example:

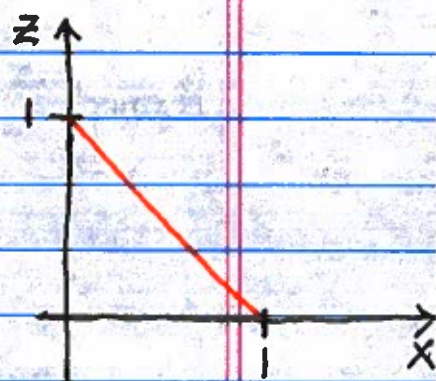
Sketch the surface $x + y + z = 1$, in the first octant.



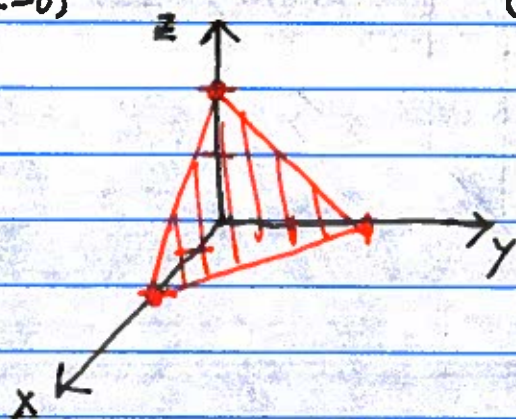
($z=0$)



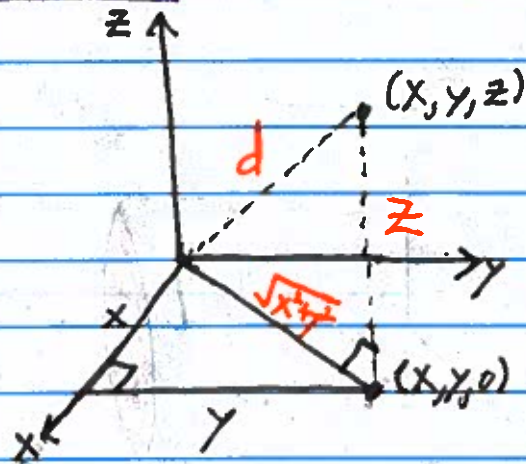
($x=0$)



($y=0$)



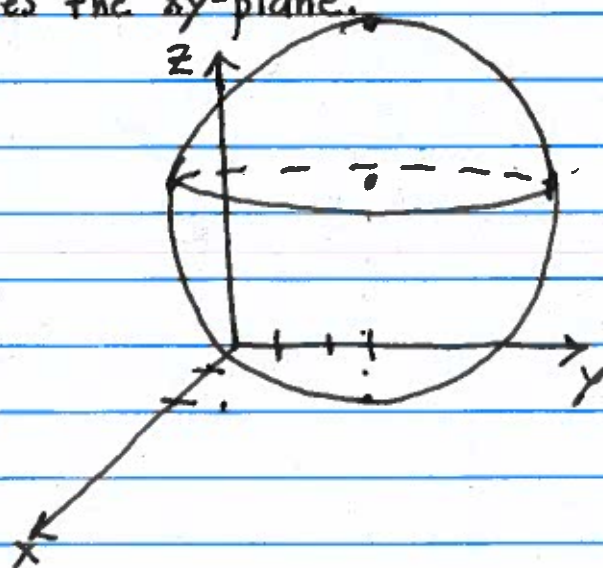
Distance:



$$\begin{aligned}d^2 &= (\sqrt{x^2 + y^2})^2 + z^2 \\ \Rightarrow d^2 &= x^2 + y^2 + z^2 \\ \Rightarrow d &= \sqrt{x^2 + y^2 + z^2}\end{aligned}$$

Example:

Find the equation of a sphere with center $(2, 3, 6)$ that touches the xy -plane.



$$(x-2)^2 + (y-3)^2 + (z+6)^2 = 36$$

Example:

$$4 \leq x^2 + z^2 \leq 9$$

