6/14 M: 9:30 - 10:30 ①
W: 2:30 - 3:30

Announcement

Midterm 1: 7/11
Midterm 2: 7/28
} ← in quiz section

Final: 8/18 ← in class

Quiz section is in CDH 101

First homework due Friday.

MSC exists 11-6 M-Th. now today and 7/4.

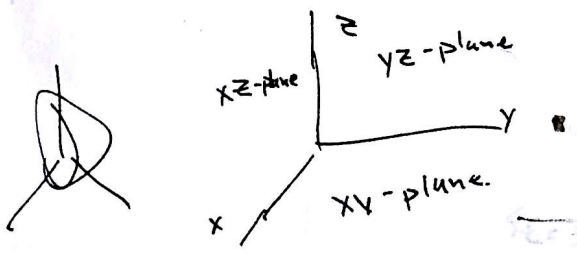
Plan

- ~~Introduction~~
- Syllabus
- Decide office hours
- 12.1 / 12.2

Course Outline

- chapter 12 - Vectors and 3rd dimension (proj, dot/cross)
- chapter 10/13 - Curves, $\mathbb{R} \to \mathbb{R}^3$ (para, polar, velocity, accel)
- Chapter 14 - surfaces, (partial der, max/min)
- Chapter 15 - Volumes under surfaces
- Taylor Notes: Taylor Polynomials and Series

12.1 3d coordinate system.



right hand rule:

x - pointer
y - middle
z - thumb.

there are 3 special planes.

We can project

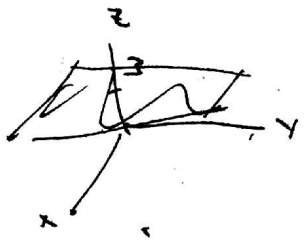
Let $P=(a,b,c)$ then $(a,b,0)$ is the projection onto the xy-plane.

Similar for others.

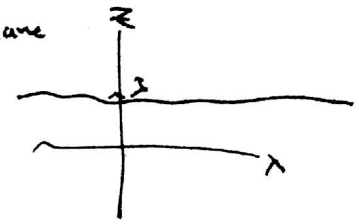
Drawing time!

(a) $z=3$

$\{(x,y,z) : z=3\}$



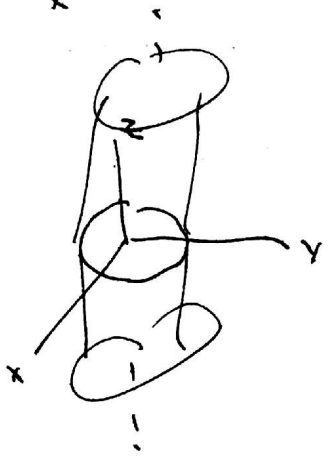
projection onto xz-plane ⟹



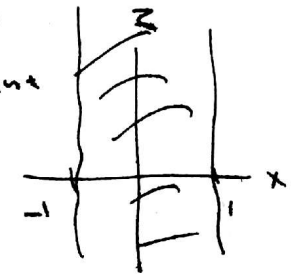
ask

(b) $x^2+y^2=1$

$\{(x,y,z) : x^2+y^2=1\}$

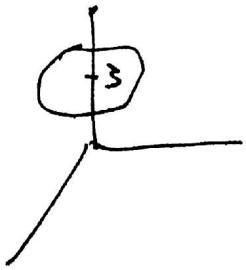


⟹ projection onto xz-plane



(c) $x^2+y^2=1,\ z=3$

$\{(x,y,z) : x^2+y^2=1,\ z=3\}$



In general each new equation drops dimension by 1.

~~Planes require 1 equation~~

~~lines require 2 i.e~~

Planes require 1 equation $x+y+z=1$;

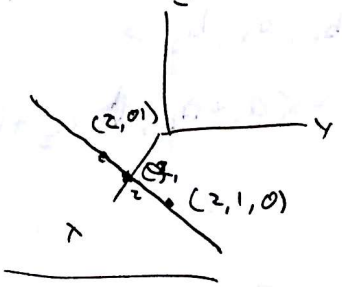
Like require 2 equations

linear

Lines require 2 equations or 2 points to specify.

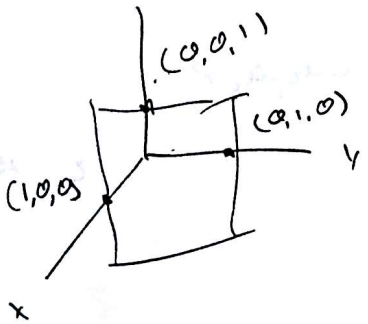
$x = 2,\ y+z = 1$ → $y = 1-z$ → one parameter

$\{(2, 1-z, z) : z \in \mathbb{R}\}$



Planes require 1 equation or 3 points to specify.

$x+y+z=1$ → $z = 1-x-y$



→ $\{(x, y, 1-x-y) : x, y \in \mathbb{R}\}$.

ask

xy-plane : $z=0$

xz-plane : $y=0$

yz-plane : $x=0$.

Distance

$$\text{dist}\left((x_1,y_1,z_1),(x_2,y_2,z_2)\right) = \sqrt{(x_1-x_2)^2+(y_1-y_2)^2+(z_1-z_2)^2}$$

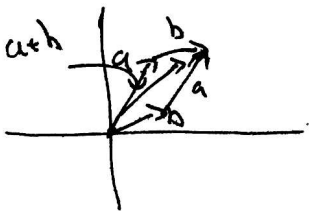
12.2 Vectors

Vectors are a really flexible idea. In physics, ~~they have points~~ they are a direction and magnitude.

Vectors are points that you can add and scalar multiply.

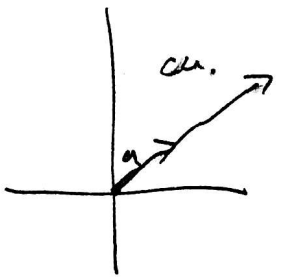
add $\langle a_1,a_2,a_3\rangle + \langle b_1,b_2,b_3\rangle$

component-wise $= \langle a_1+b_1, a_2+b_2, a_3+b_3\rangle$



scalar multiply

$$c\cdot\langle a_1,a_2,a_3\rangle = \langle ca_1, ca_2, ca_3\rangle$$



2 vectors are parallel if they are scalar multiples of one another.

subtraction.

Vectors are a really flexible idea.

There are 3 special vectors.

$\hat{i} = \langle 1, 0, 0 \rangle$

$\hat{j} = \langle 0, 1, 0 \rangle$

$\hat{k} = \langle 0, 0, 1 \rangle$.

Length of vectors.

the length or norm of a vector $v = \langle a_1, a_2, a_3 \rangle$

is

$$|v| = \sqrt{a_1^2 + a_2^2 + a_3^2}.$$

A vector is a unit vector if it has length 1.

The normalization of a vector v is

$$\frac{v}{|v|}.$$