3. Scalars and Vectors

Scalar
↳ **Infn**

① Single numerical value

② Represents some magnitude/quantity
(has no direction)

Eg → Car Speed = 45 km/hr → magnitude

Temp in (°C) = 25°C

Applications (w.r.t Data Science)
(w.r.t Scalar)

Count (total No. of Records) → 5

Avg (feature f2) → ___ (a value)

→ Say you have a table
with 3 features
f_1 f_2 f_3 (ro)

$$\begin{bmatrix} - & - & - \\ - & - & - \\ - & - & - \\ - & - & - \\ - & - & - \end{bmatrix}$$ you have 5 records

Simple Linear Regression
↳ you have the equation

$y = mx + c$ → this can be a
Scalar quantity (intercept)

Slope
(this can't be
a scalar quantity)

cause this depends on the
boxed(data point (x))

Vector

↳ Numerical value
   (has both magnitude and direction) } (terms of Physics)

Eg → Speed of the car (45km/hr)
     and is moving in (East Direction)

Defn 2

A vector is an ordered list of no's
↳ it can represent a point in space
(or) quantity with both magnitude
and direction

Eg Say I have a data table called

Student marks

IQ	No: of Study hrs	Pass/ Fail
[90	3hrs]	Fail
[100	3hrs]	Pass

A vector representing person IQ and no. of study

$= [90 \ 3hrs]$

↓
This will be taken as a 2D vector → This can be interpreted as a vector

one more example
=

w.r.t Data Science → Physical direction

you dont have a direction
(as the way you do in Physics)

if you represent a vector in Data Science it
is a collection of values

A vector representing
person's weight over
time } → $[70, 72, 75, 73]$

4 Dimension

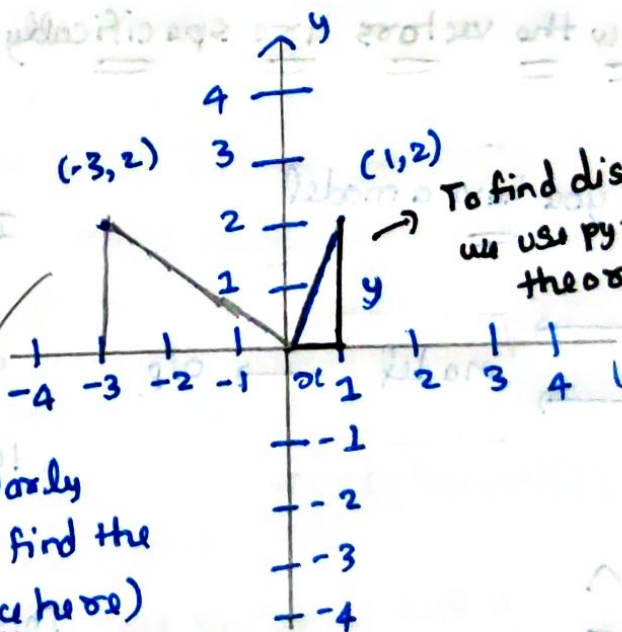Say I have a 2D vector

$$x = \begin{bmatrix} 1 \\ 2 \end{bmatrix}$$ --- we create
a co-ord
system →

Moving 1 unit
towards x axis

2 units

Another point

$$\begin{bmatrix} -3 \\ 2 \end{bmatrix}$$

(-3,2)

(1,2)

To find dist
we use pyth
theorem

(Similarly
we can find the
distance here)
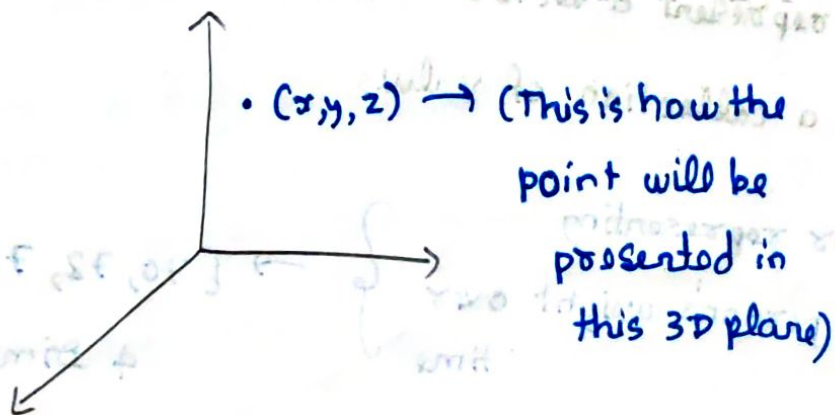
Dist b/w origin and vector

$$hyp = \sqrt{(OA)^2 + (AB)^2}$$
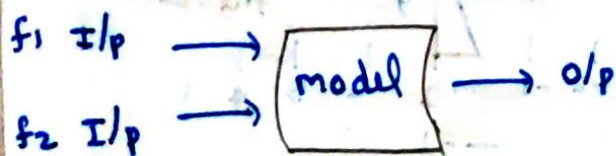
$$= \sqrt{(1)^2 + (4)} \rightarrow (2)^2 = 4$$

$$= \sqrt{5} = OB$$

Suppose say I take a 3D vector

$$C = \begin{bmatrix} x \\ y \\ z \end{bmatrix} \longrightarrow$$ we represent this on a 3D plane
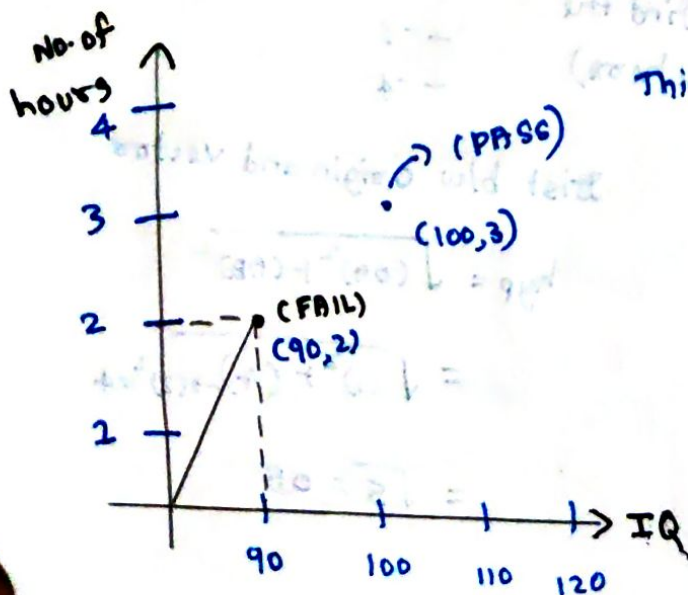
• $(x, y, z) \rightarrow$ (This is how the point will be presented in this 3D plane)

how the vectors are specifically related to Data Science

Say you have a model

f_1 I/p $\longrightarrow$
f_2 I/p $\longrightarrow$ [model] $\longrightarrow$ o/p

IQ	No. of hours	Pass/ fail
90	2	Fail ⇒ 0
100	3	Pass ⇒ 1

This will get converted to 2D Vector

$\begin{bmatrix} 90 & 2 \end{bmatrix}$

$\begin{bmatrix} 100 & 2 \end{bmatrix}$ → This will be represented in a 2D plane

Every records can be represented in the form of vectors

No. of hours

(PASS)
• (100,3)

(FAIL)
• (90,2)

$\longrightarrow$ IQ

90   100   110   120

→ PASS

→ Every point can be represented in the form of vectors

→ This line is found by the eqn $\boxed{y = mx + c}$

↳ we draw a best fit line so that points which lie on the right side belong to pass those on the left → FAIL

fail

Suppose say in future we get a line like this then we can assure that this line will (FAIL)

Suppose say in my table I have 5 features

f_1 f_2 f_3 f_4 f_5

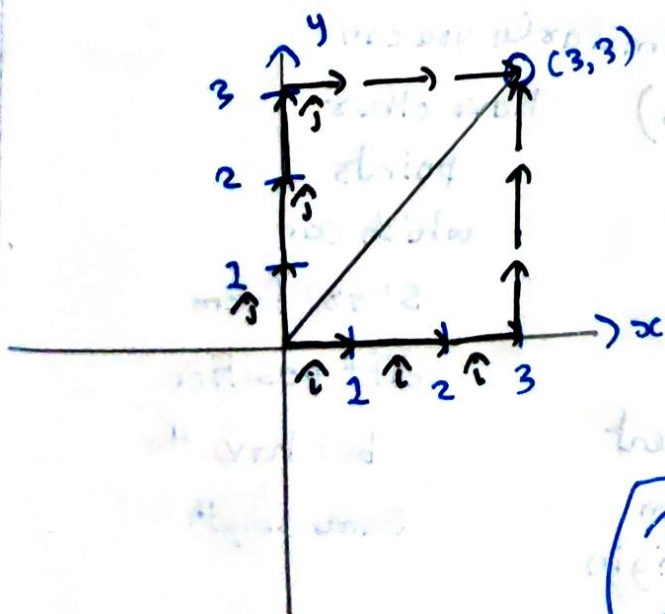(a single point can also be placed which has all these 5 dimensions within it)

(3,3)

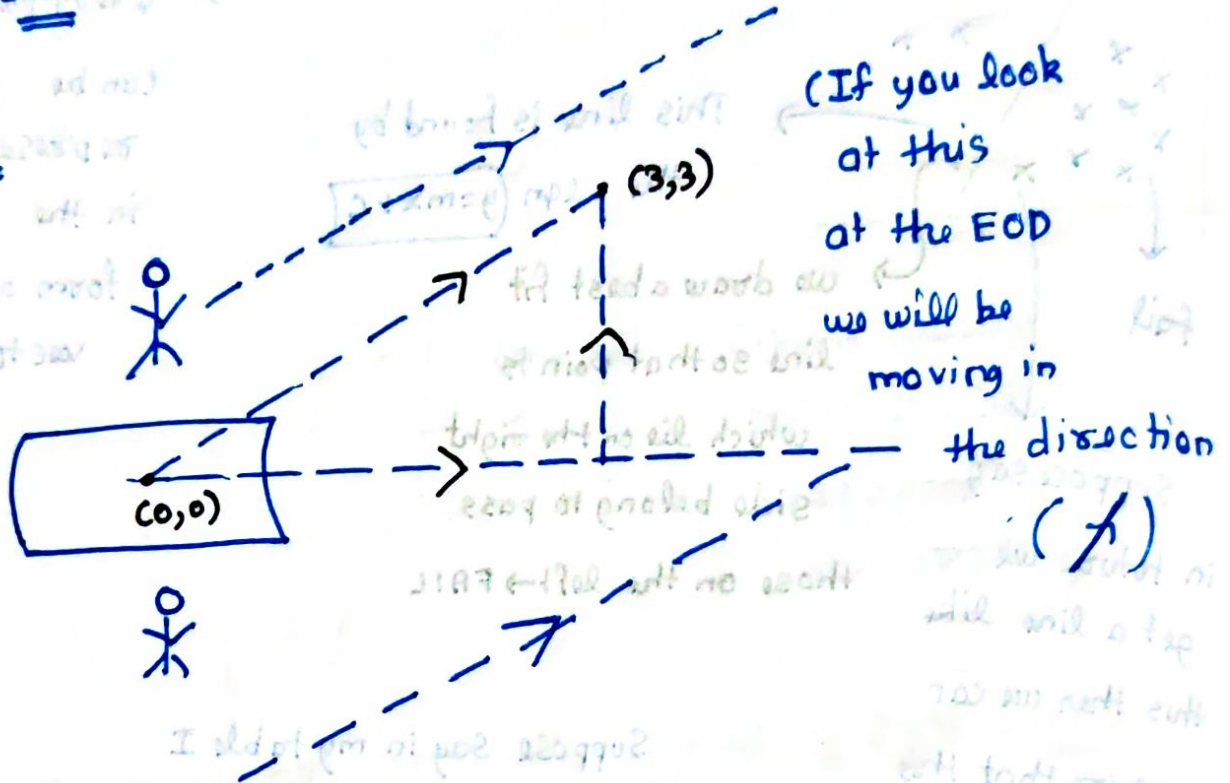Unit vector has a

$\boxed{\hat{u} = 1}$ → $\boxed{magnitude = 1}$

$\left. \begin{array}{c} \hat{i} \\ \hat{j} \end{array} \right\}$ ⇒ unit vector towards x and y axis ⇒ 1

w.r.t the coordinate system
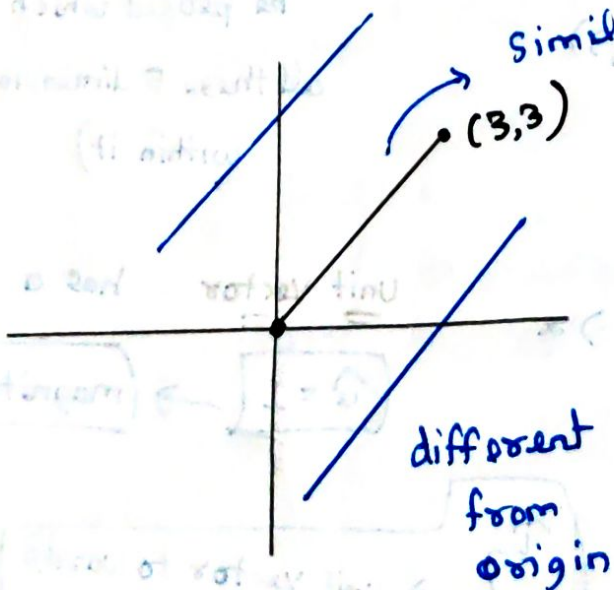
& also

Eg

(3,3)

(If you look
at this
at the EOD
we will be
moving in
the direction
(↗))

(0,0)

Similarly in
co-ord system

Similarly you can
have other
points
which can
start from
diff position
but have the
same length

(3,3)

different
from
origin

(wrt the co-ord system
it will also move in the
same direction only the
origin will be
different)