Equation of Line, 3D plane and hyperplane (n Dimension)

$$y = mx + c$$

slope value

Intercept

m = slope

c = Intercept
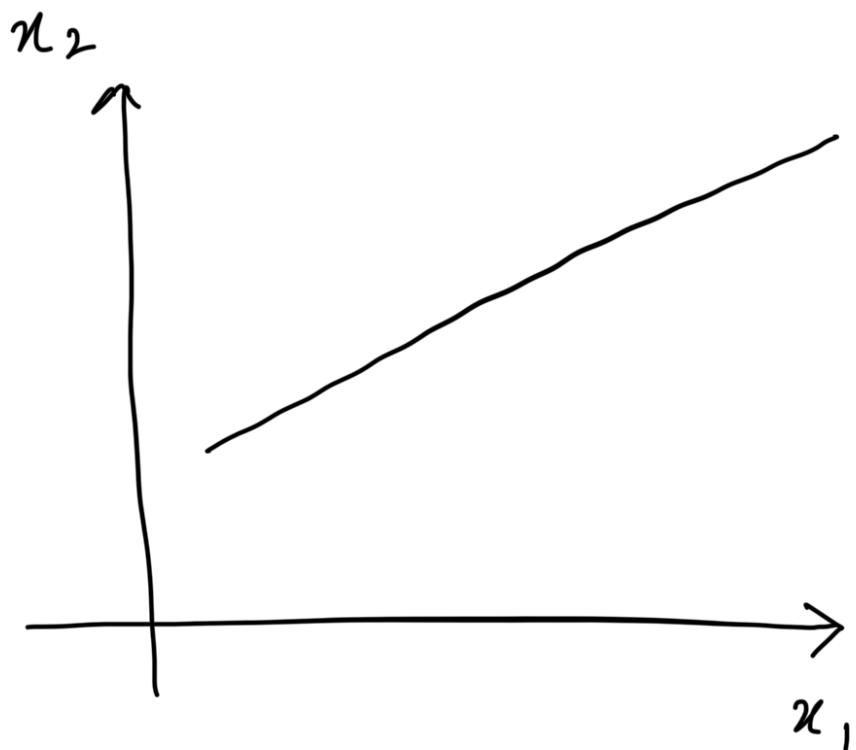
slope is nothing but for a unit moment is x axis

what is the unit
movement is the
y axis

x_2

x_1

$$w_1 x_1 + w_2 x_2 + b = 0$$

$$w^T x + b = 0$$

$\parallel$
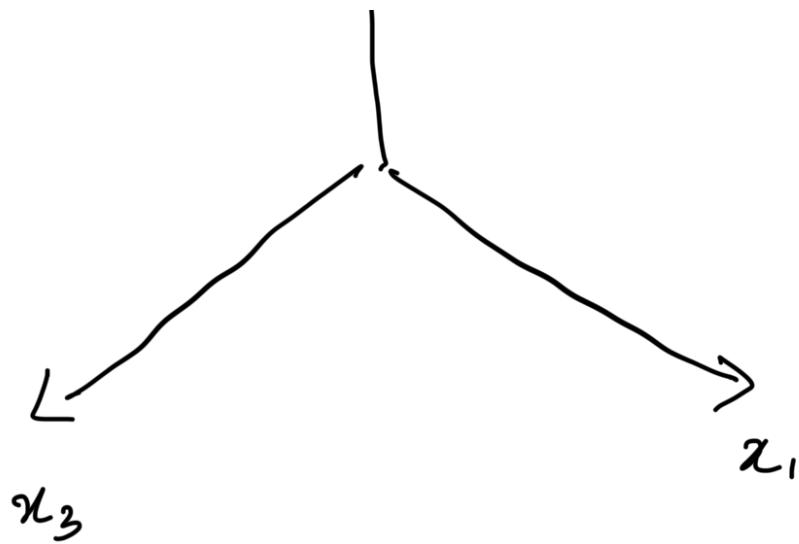
Equation of a straight line

x_2

a plane

x_2

x_3 x_1

$$w_1 x_1 + w_2 x_2 + w_3 x_3 + b = 0$$

$$w^T x + b = 0$$
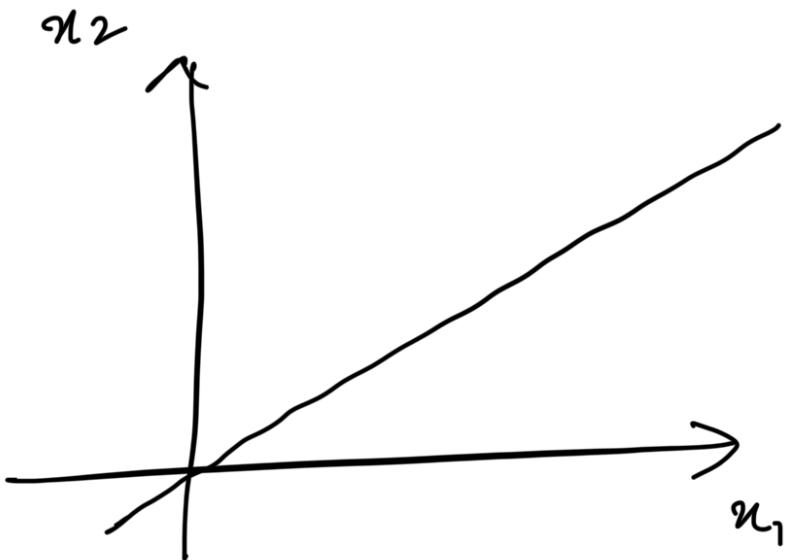
$$w = \begin{bmatrix} w_1 \\ w_2 \\ w_3 \end{bmatrix} \cdot \quad x = \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}$$

n- Dimension plane

$$w_1 x_1 + w_2 x_2 + w_3 x_3 + \cdots \cdots + w_n x_n + b = 0$$

$$\boxed{w^T x + b = 0},$$

here , my origin passes thru

0 . then my equation
would be

$$w_1 x_1 + w_2 x_2 = 0$$

$$\boxed{w^T x = 0}$$

Equation of a straigt line

passing thru an origin is
given by

$$w^T x = 0$$

Equation of a plane

$$\Pi_n : \quad w^T x = 0$$

$$\begin{bmatrix} w_1 \\ w_2 \\ w_3 \\ \vdots \\ w_n \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ \vdots \\ x_n \end{bmatrix}$$

w

$$\omega \cdot x = \omega^T x = \|\omega\| \|x\| \cos\theta = 0$$

$$\theta = 90$$

$$\downarrow$$

$$\cos\theta = 0$$

π

x can be at any point

ω

what else plane we
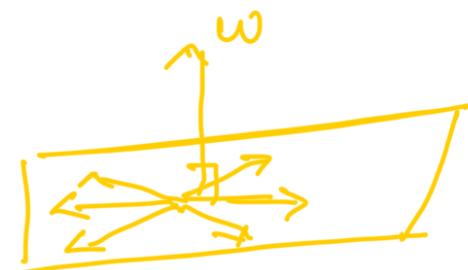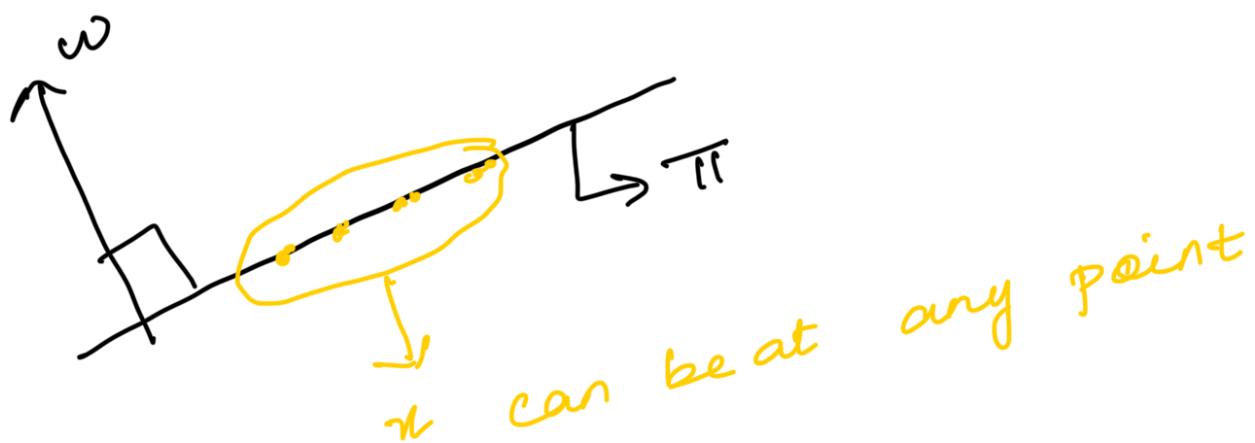
$$w^T x = 0$$

are creating it will be always be perpendicular in 3D plane.

Mathametically we can represent as

$$\boxed{w \perp \pi}$$