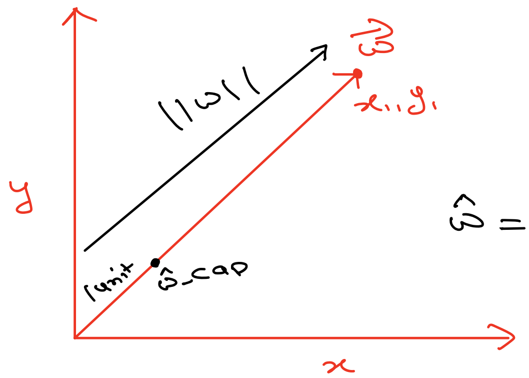
⇒ Revision

- ⇒ Relationship b/w $\vec{w}$ and Line
- ⇒ Trignometric Relation b/w angle and △ Traingle
- ⇒ Proyection of vector
- ⇒ Shifting the Line
- ⇒ Distance b/w line and origin
- ⇒ Distance b/w point and line

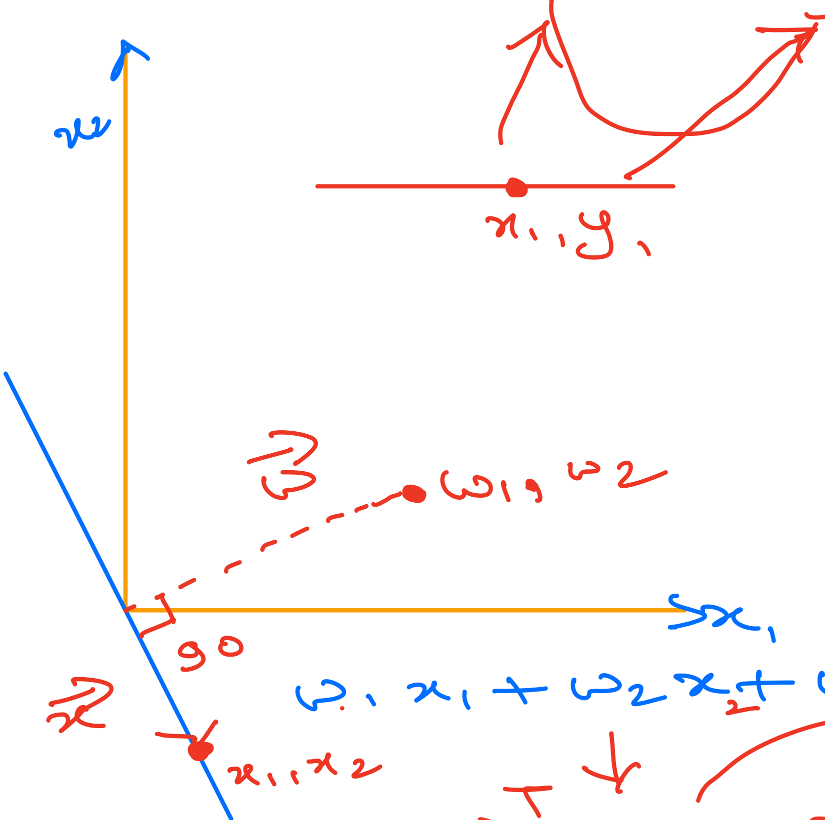
$w_1 x + w_2 y + w_0 =$



$\hat{w} = \frac{\vec{w}}{\|w\|}$

$\|w\| = 9$

$\vec{w} = 9 \times \hat{w}$



$w_1 x_1 + w_2 x_2 + w_0 = 0$

↓

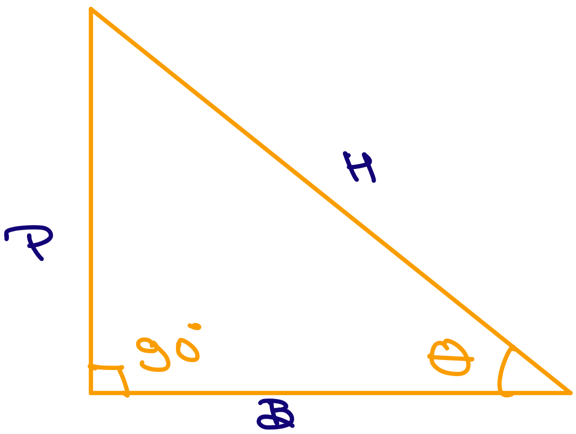
$w^T \cdot x = 0$

$\cos\theta = \frac{\vec{w} \cdot \vec{x}}{\|\vec{w}\| \|\vec{x}\|}$

$\cos\theta = 0$

$\theta = 90°$

Trignometry of Angles

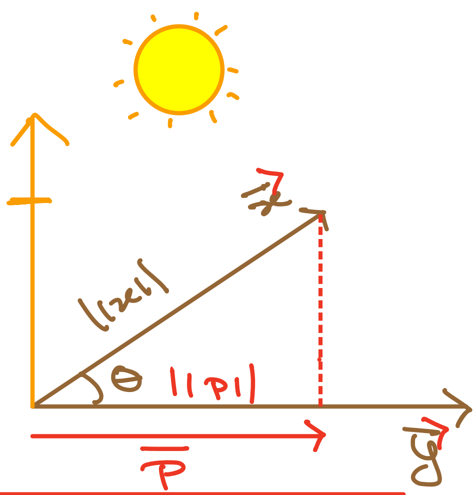


$$\tan\theta \Rightarrow \frac{P}{B}$$

$$\sin\theta \Rightarrow \frac{P}{H}$$

$$\cos\theta \Rightarrow \frac{B}{H}$$

Projection of Vector



① (trigo) $\cos\theta = \frac{\|P\|}{\|x\|}$

② (L.A) $\cos\theta = \frac{x^T y}{\|x\|\,\|y\|}$

$\boxed{\text{Projection of } \bar{x} \text{ on } \bar{y}}$

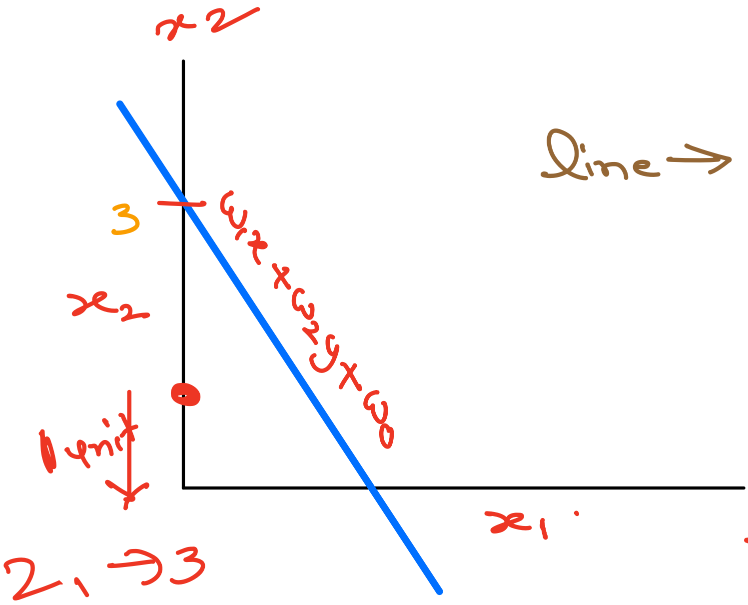
$$\Rightarrow \frac{x^T y}{\|x\|\,\|y\|} = \frac{\|P\|}{\|x\|}$$

$$\frac{x^T \hat{y}}{\cancel{\|x\|}} = \frac{\|P\|}{\cancel{\|x\|}}$$

$$\boxed{\|P\| \Rightarrow x^T \hat{y}}$$

$x \cdot \hat{z}$

Shifting lines



line → $\boxed{w_1x_1 + w_2x_2 + w_0 = 0}$

← 1 unit

x ↑

Shifting Origin

Shift line by a units to → $\boxed{w_1(x_1 - a) + w_2x_2 + w_0}$

Shift line by a units to ← $\boxed{w_1(x_1 + a) + w_2x_2 + w_0}$

Shift line by a units to ↑ $\boxed{w_1x_1 + w_2(x_2 - a) + w_0}$

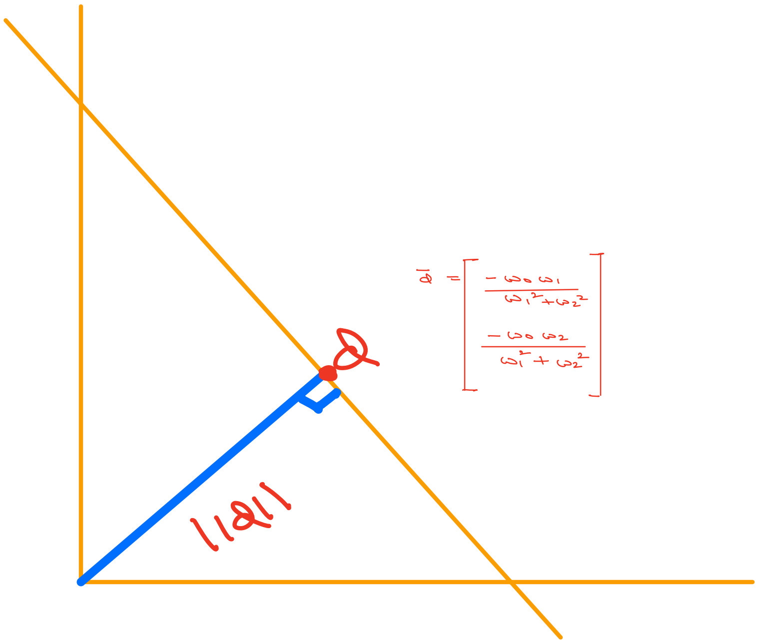
Shift line by a units to ↓ $\boxed{w_1x_1 + w_2(x_2 + a) + w_0}$

$$w_1(x_1 + a) + w_2(x_2 + b) + w_0 = 0$$

$$w_1x_1 + w_1a + w_2x_2 + w_2b + w_0$$

$$w_1x_1 + w_2x_2 = -w_0 - w_1a - w_2b$$

Distance between origin and Line



For eq^n $\quad ax + by + c = 0$

$$\text{distance} = \frac{c}{\sqrt{a^2+b^2}}$$

$$||d|| = ?\ \frac{-w_0}{||w||}$$

why distance is Negative ?

$$\bar{d} = \begin{bmatrix} \dfrac{-w_0 w_1}{w_1^2+w_2^2} \\ \\ \dfrac{-w_0 w_2}{w_1^2+w_2^2} \end{bmatrix}$$

$$||d|| = \frac{w_0}{||\vec{w}||}$$

Distance between point and Line ←

$$ax + by + c = 0$$

$$(x_1, y_1)$$

$$d = \frac{|ax_1 + by_1 + c|}{\sqrt{a^2 + b^2}}$$ ← $x_1, y = 0, 0$

$d \Rightarrow$ l.A ?

x

x

x

x

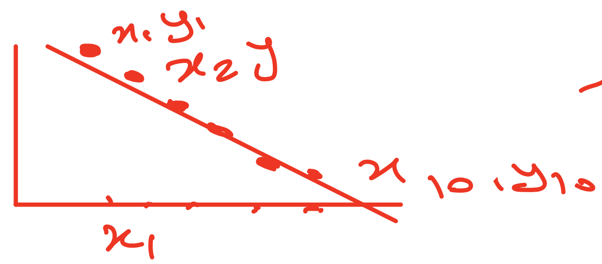
x

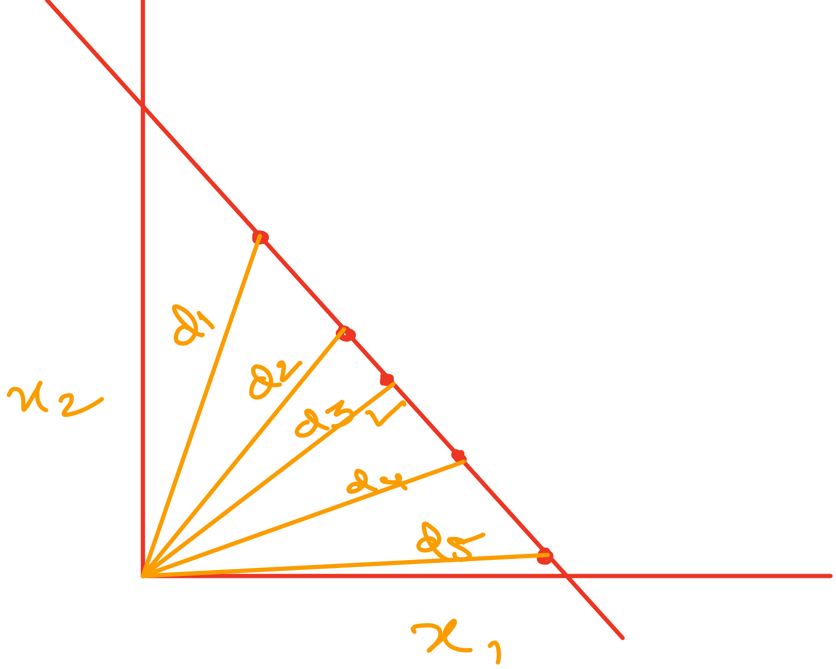
$$w_1 x + w_2 y + w_0$$

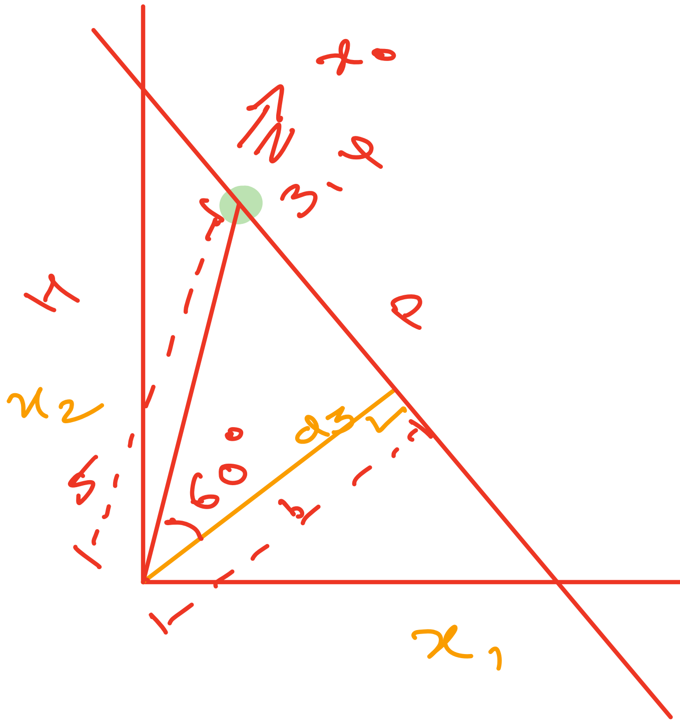
$$y = (-w_0 - w_1 x)/w_2$$

$10 \to x$

$10 \to$





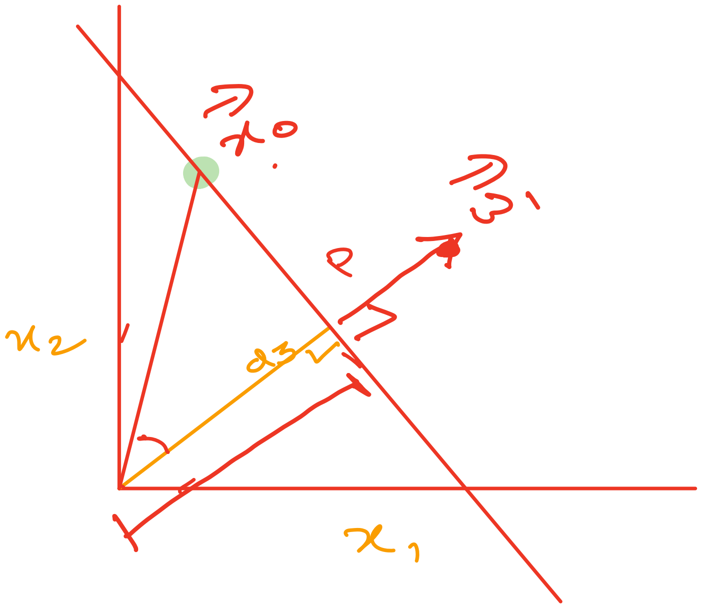


$$\cos\theta = \frac{d}{5}$$

$$d = 5 \times \cos 60$$

$$\Rightarrow 5 \times \frac{1}{2}$$

$$\Rightarrow 2.5$$



$$\cos\theta = \frac{d}{\|x_0\|}$$

$w_1x_1 + w_2x_2 + w_0 = 0$

$$w^T x + w_0 = 0$$

$$w^T x_0 + w_0 = 0$$

$$w^T x_0 = -w_0 \quad (3)$$

$$\cos\theta = \frac{w^T x_0}{\|w\|\,\|x_0\|} \quad (2)$$

$$\cos\theta = \frac{d}{\|x_0\|} \quad (1)$$

$$\frac{d}{\cancel{\|x_0\|}} = \frac{w^T x_0}{\|w\|\,\cancel{\|x_0\|}}$$

$$d = \frac{w^T x_0}{\|w\|} \rightarrow \text{using } 3$$

$$\boxed{d = \frac{-w_0}{\|w\|}}$$

$2x + 3y - 4 = 0$

w_0