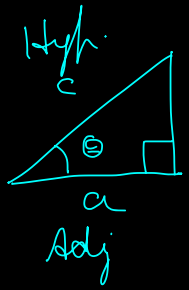
Trigonometry



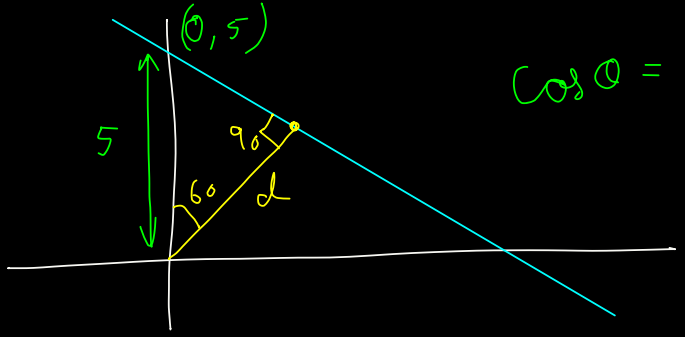
$$c = \sqrt{a^2 + b^2}$$

$$\cos\theta = \frac{\text{Adj}}{\text{Hyp}} \Rightarrow \text{Adj} = \text{Hyp} \cdot \cos\theta$$

$$a = c\cos\theta$$

$$\sin\theta = \frac{\text{Opp}}{\text{Hyp}}$$

$$\tan\theta = \frac{\text{Opp}}{\text{adj}}$$

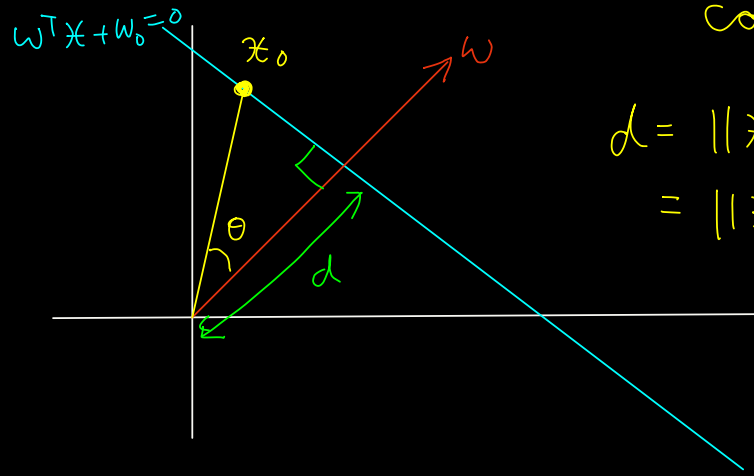


$$\cos\theta = \frac{d}{5}$$

$$d = 5\cos 60$$

$$= 5\left(\frac{1}{2}\right)$$

$$= 2.5$$



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

$$d = \|x_0\| \cos\theta$$

$$= \|x_0\| \left(\frac{w^T x_0}{\|w\| \, \|x_0\|} \right)$$

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

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

$$w^T x_0 = -w_0$$

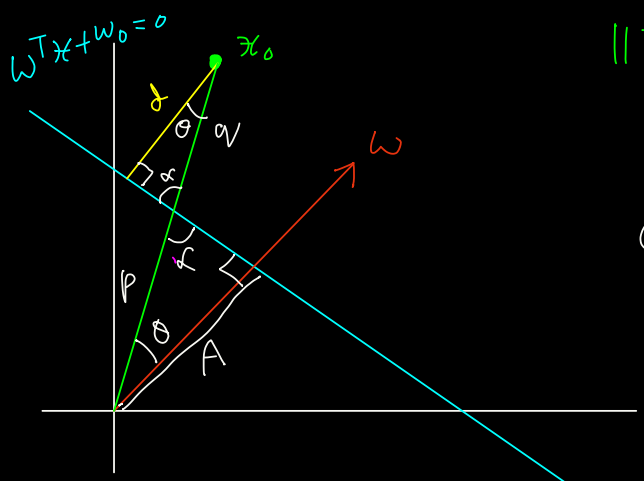
From x_0 and w, what is $\cos\theta = \frac{w^T x_0}{\|w\| \, \|x_0\|}$

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

"sign" indicates which side the origin it

"Distance of origin (0,0) from the line (dec. boun) is $\frac{-w_0}{\|w\|}$"

Given a general point "x", how far is this from the line $w^T x + w_0 = 0$ find "d"



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

$$d = q\cos\theta \quad -(1)$$

$$\|x_0\| = p + q$$

$$A = \frac{-w_0}{\|w\|} \quad \text{(done above)}$$

$$\cos\theta = \frac{A}{p} \longrightarrow p = \frac{A}{\cos\theta}$$

$$q = \|x_0\| - p$$

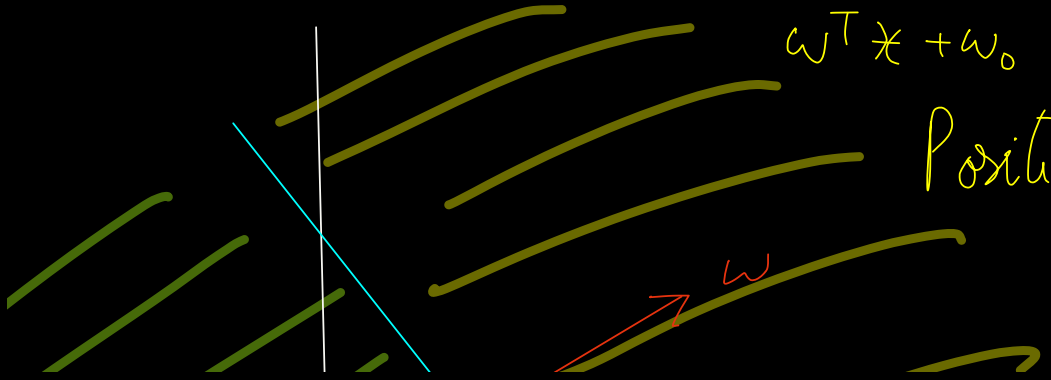
$$= \|x_0\| - \frac{A}{\cos\theta} \quad -(2)$$

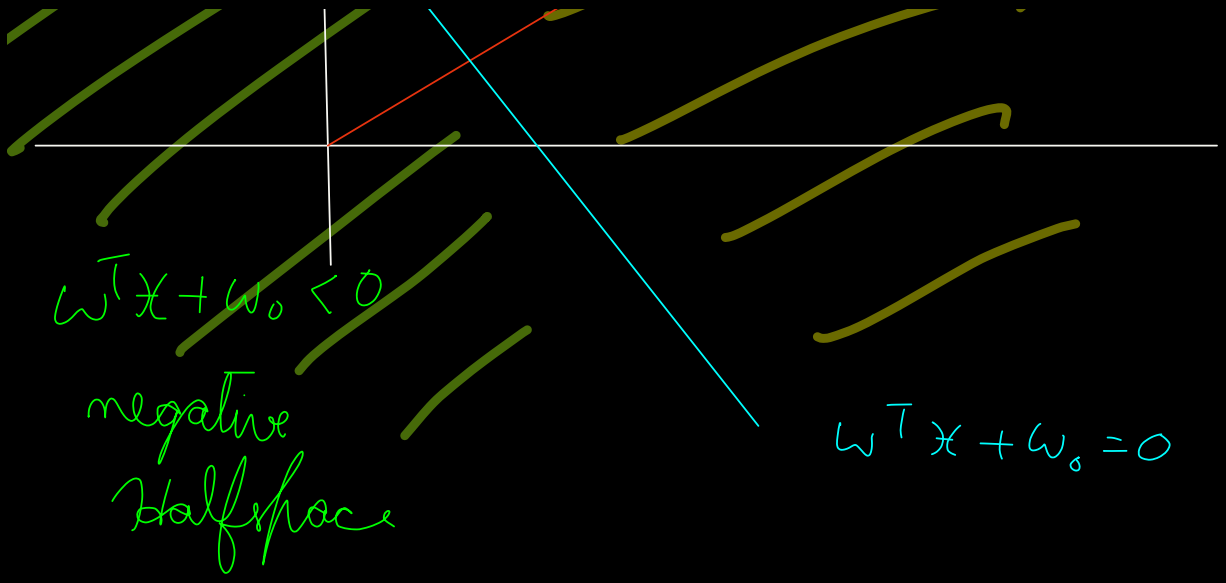
$$d = \left(\|x_0\| - \frac{A}{\cos\theta}\right)\cos\theta$$

$$= \|x_0\|(\cos\theta) - A$$

$$= \|x_0\|\left(\frac{w^T x_0}{\|w\|\,\|x_0\|}\right) - \left(\frac{-w_0}{\|w\|}\right)$$

$$\boxed{d = \frac{w^T x_0 + w_0}{\|w\|}}$$




$w^T x + w_0 < 0$
negative
halfspace
$w^T x + w_0 = 0$