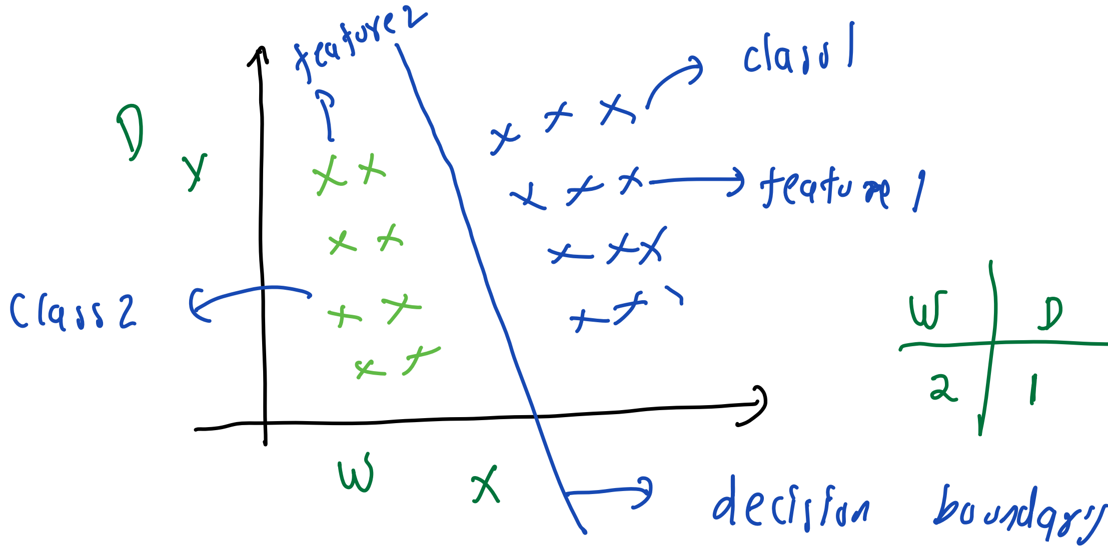
will start at 7:05 am

Linear Algebra 2



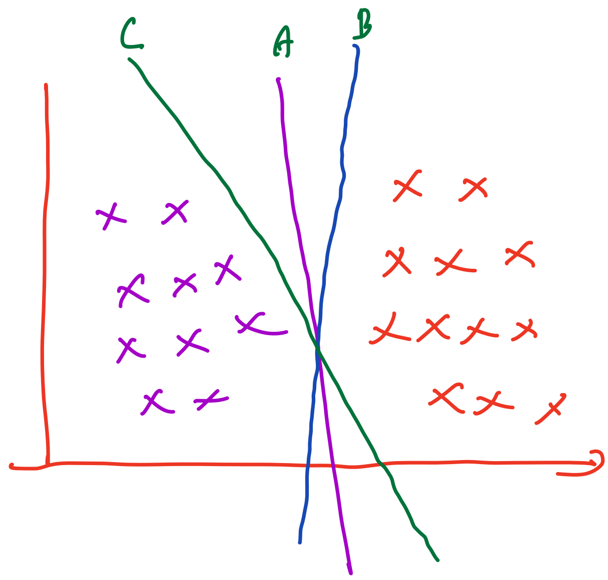
W	D	Type
2	1	"orange"

$y = mx + c$

Classification

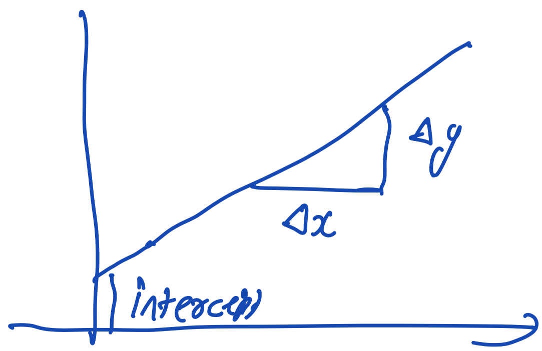
Q ⇒

Decision Boundary ?



$y = mx + c$

$m = \frac{\Delta y}{\Delta x}$



Q ⇒ Find the value of m if $y = mx + c$ is parallel to $0.5y - x = 0$

$0.5y = x$

$y = \frac{\cancel{1.0}^{2}}{\cancel{0.5}} x$

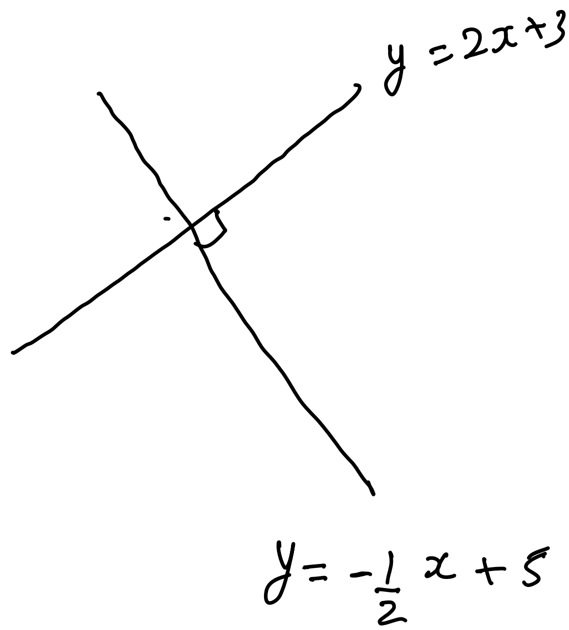
$y = 2x + 0$

$m = 2$

⇒ Perpendicular line

$m_1 \times m_2 = -1$

$$\boxed{m_2 = -\frac{1}{m_1}}$$



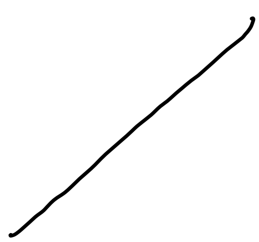
(1) $y = mx + c$

$mx - 1y + c = 0$

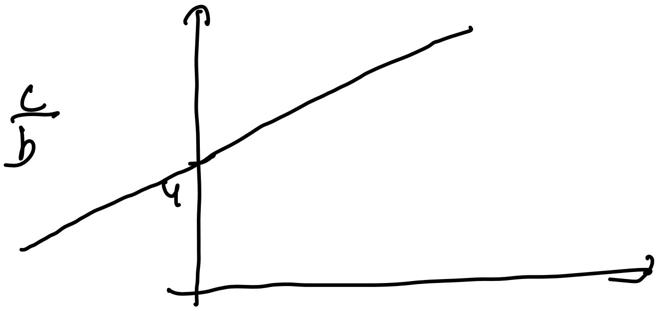
(2) $ax + by + c = 0$

$2x + 3y + 4 = 0$

$by = -ax - c$



$y = -\frac{a}{b}x - \frac{c}{b}$



$2x + 3y + 4 = 0$

$3y = -2x - 4$

$y = -\frac{2}{3}x - \frac{4}{3}$

Q ⇒ What is the slope & intercept of

$3x + 2y + 5 = 0$

$2y = -3x - 5$

$y = \frac{-3}{2}x - \frac{5}{2}$

$ax + by + c = 0$

$w_1 x + w_2 y + w_0 = 0 \Rightarrow$ line

$w_1 x_1 + w_2 x_2 + w_3 z + w_0 = 0 \Rightarrow$ plane

$w_1 x_1 + w_2 x_2 + w_3 x_3 + \cdots \; w_n x_n + w_0 = 0$

$\Downarrow$

hyperplane

$\Rightarrow$ Vector

$$\begin{bmatrix} A \\ B \\ C \\ D \end{bmatrix} \Rightarrow [A \;\; B \;\; C \;\; D] \times$$

$$w_1 x_1 + w_2 x_2 + w_3 x_3 + \cdots\cdots w_n x_n + w_0 = 0$$

$$\begin{bmatrix} w_1 \\ w_2 \\ \vdots \\ w_n \end{bmatrix}_{n \times 1} = \vec{w} \qquad \begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ \vdots \\ x_n \end{bmatrix}_{n \times 1} = \vec{x}$$

$\vec{w} \in R^n$ $\qquad\qquad$ $\vec{x} \in R^n$

$\Downarrow$ Transpose

$$[w_1 \ w_2 \ \cdots\cdots \ w_n]_{1 \times n}$$

$$[w_1, w_2 \ \cdots\cdots \ w_n] * \begin{bmatrix} x_1 \\ x_2 \\ \cdots \\ \cdots \\ x_n \end{bmatrix} + w_0 = 0$$

$$\boxed{\vec{w}^{\,T} \cdot \vec{x} + w_0 = 0}$$

x_1 weight	x_2 diameter	x_3 Color	x_4 taste	type
2	1	Red	sweet	orange
4	2	green	sour	santra

$$m_1 x_1 + m_2 x_2 + m_3 x_3 + m_4 x_4 + w_0 = y$$

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

$$\Downarrow$$

$$w_1 x_1 + w_2 x_2 + w_3 x_3 + \dots + w_n x_n + w_0 = 0$$

$$\Downarrow$$

Dot product
(inner product)

Dot Product

$\vec{a}$ & $\vec{b}$

$$\vec{a} \cdot \vec{b} = a_1 b_1 + a_2 b_2 + a_3 b_3 + \dots + a_n b_n$$

$$\vec{a} \cdot \vec{b} = \sum_{i=1}^{n} a_i b_i$$

$\langle \vec{a}, \vec{b} \rangle$

Q ⇒ Find the dot product of
[1, 2, 3] & [-1, 2, 5]

$1 * -1 + 2 * 2 + 3 * 5$

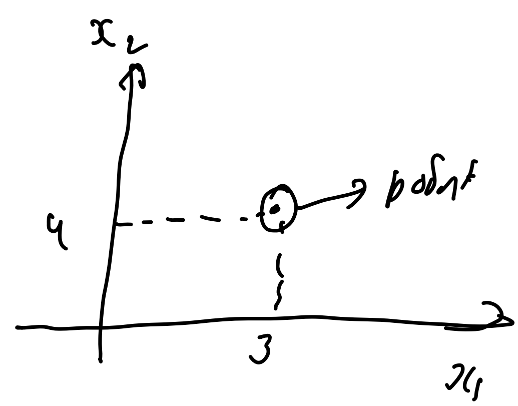
$-1 + 4 + 15$

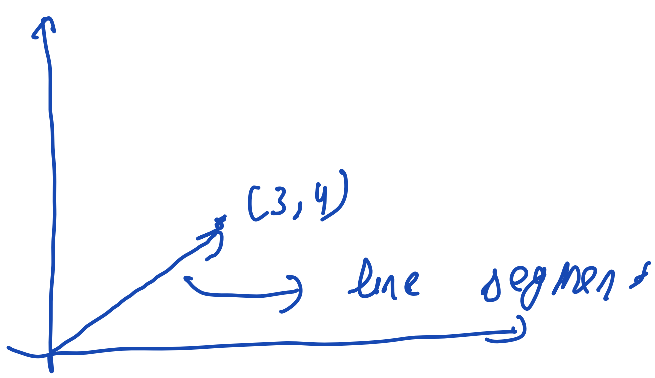
$\Rightarrow 18$

Geometric Intuition of Vector

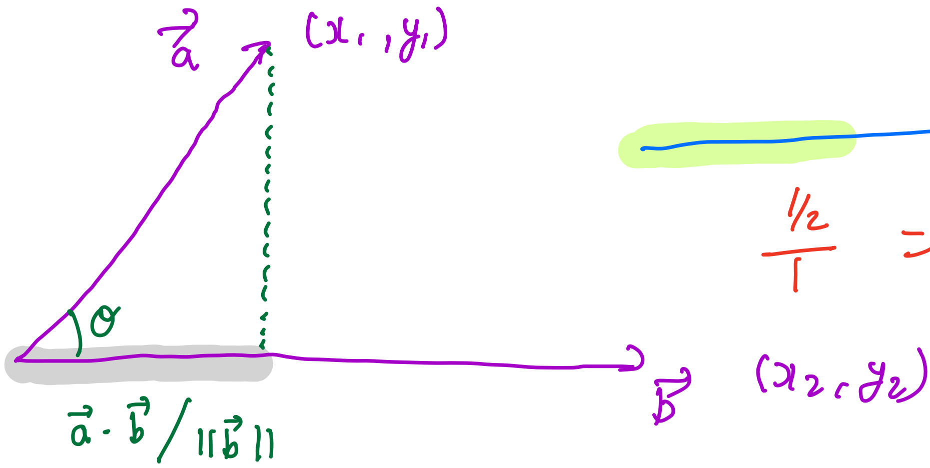
$\vec{x} = [x_1, x_2]$

$\vec{x} = [3, 4]$





Geometric Meaning of Dot Product

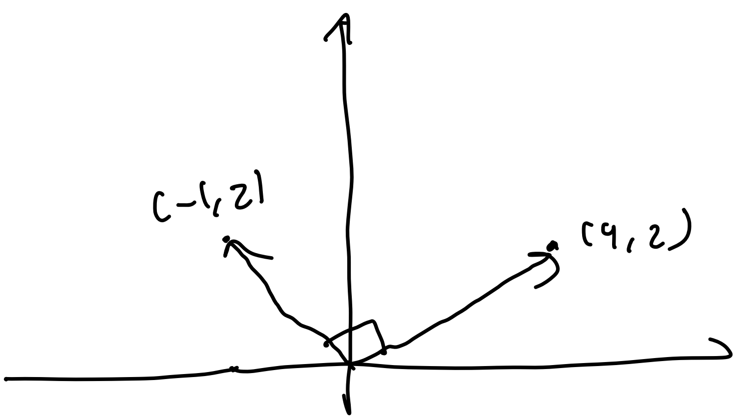


$\frac{1/2}{1} = \frac{1}{2}$

$\vec{a} \cdot \vec{b} = \vec{b} \cdot \vec{a}$

Q ⇒ What is the dot product of
(-1, 2) & (4, 2)

$-1 * 4 + 2 * 2 = 0$



if $\vec{a} \perp \vec{b}$

$\vec{a} \cdot \vec{b} = 0$

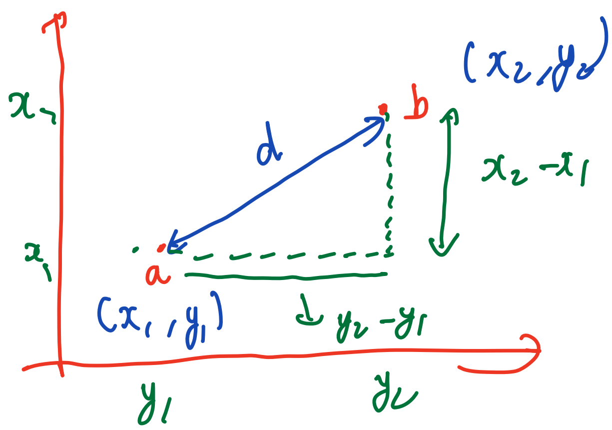
Break : 8:05 am

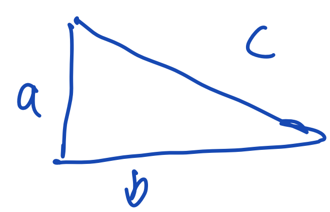
sat : 7/8 am - 10am
sun : 7/8 am - 10am

Thurs : 9pm - 11 pm

Distance b/w 2 points

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

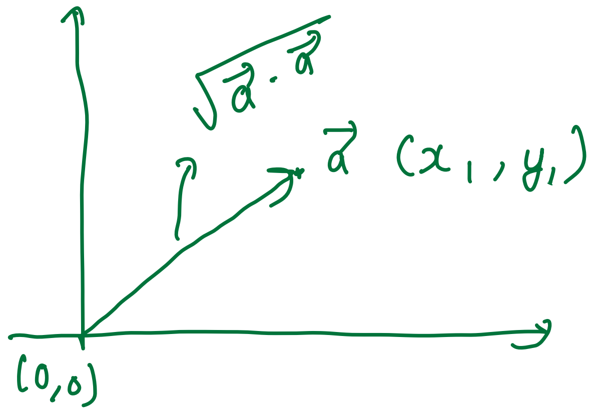




$$c = \sqrt{a^2 + b^2}$$

$$d = \sqrt{x_1^2 + y_1^2}$$

$$d^2 = [x_1 \;\; y_1] * \begin{bmatrix} x_1 \\ y_1 \end{bmatrix}$$



$$(x_1, y_1) \cdot (x_1, y_1)$$

$$\|\vec{a}\| = \sqrt{\vec{a} \cdot \vec{a}}$$

Norm or Magnitude

Q⇒ Find the distance b/w $(3,4)$ & $(7,7)$

$$\sqrt{(4)^2 + (3)^2}$$

$$= \sqrt{16+9} = \sqrt{25} = 5$$

Q ⇒ Find the difference b/w the norm of (6, 8) & magnitude of (3, 4)

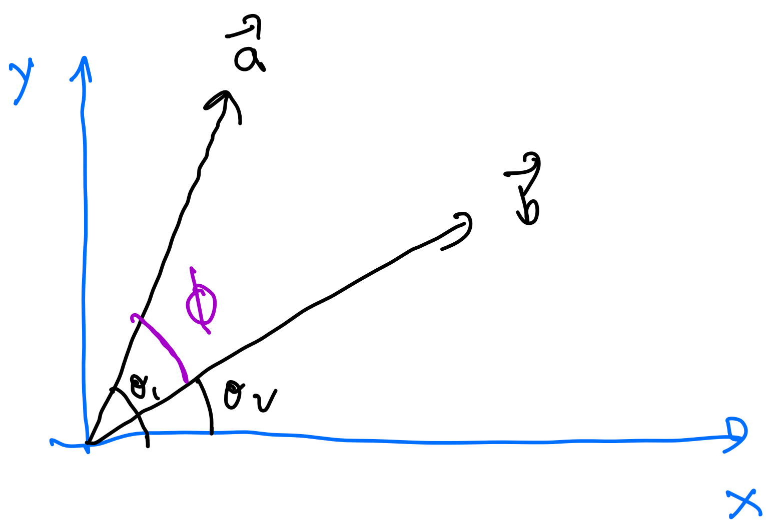
$\sqrt{36 + 64} \Rightarrow 10$

$\sqrt{9 + 16} \Rightarrow 5$

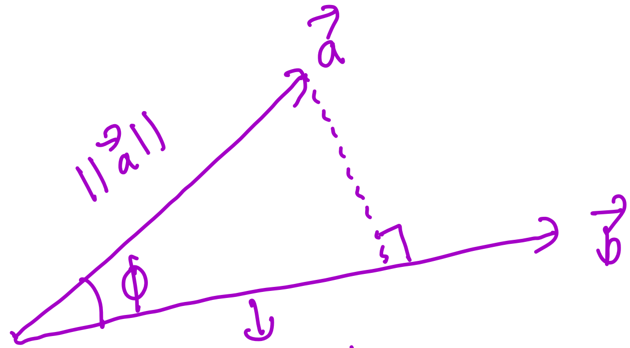
$10 - 5$

5

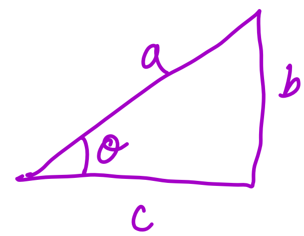
Angle b/w 2 vectors



$\phi = \theta_1 - \theta_2$



$$\frac{|\vec{a}\cdot\vec{b}|}{||\vec{b}||}$$



$$\cos\phi = \frac{|\vec{a}\cdot\vec{b}|}{||\vec{b}|| \cdot ||\vec{a}||}$$

$$\tan\theta = \frac{b}{c}$$

$$\cos\theta = \frac{c}{a}$$

Re cap

Line: $y = mx + c$

$ax + by + c = 0$

Hyperplane:

$$w_1 x_1 + w_2 x_2 + \dots w_n x_n + w_0 = 0$$

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

Vector :

$$\vec{x} = \begin{bmatrix} x_1 \\ x_2 \\ \vdots \\ x_n \end{bmatrix} \in R^n$$

$$\vec{x}^T = [\, x_1 \quad x_2 \quad x_3 \quad \ldots \quad x_n \,]$$

Dot product :

$$\vec{x} \cdot \vec{y} = \sum x_i y_i$$

$$\vec{x} \cdot \vec{x} = x_1^2 + x_2^2 = d^2$$

$$= \text{norm}^2$$

$$= \text{magnitude}^2$$

Distance :

$$(x_1, y_1) \qquad (x_2, y_2)$$

$$d = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$$

Angle :

$$\cos \phi = \frac{(\vec{a} \cdot \vec{b})}{\|\vec{a}\| \cdot \|\vec{b}\|}$$