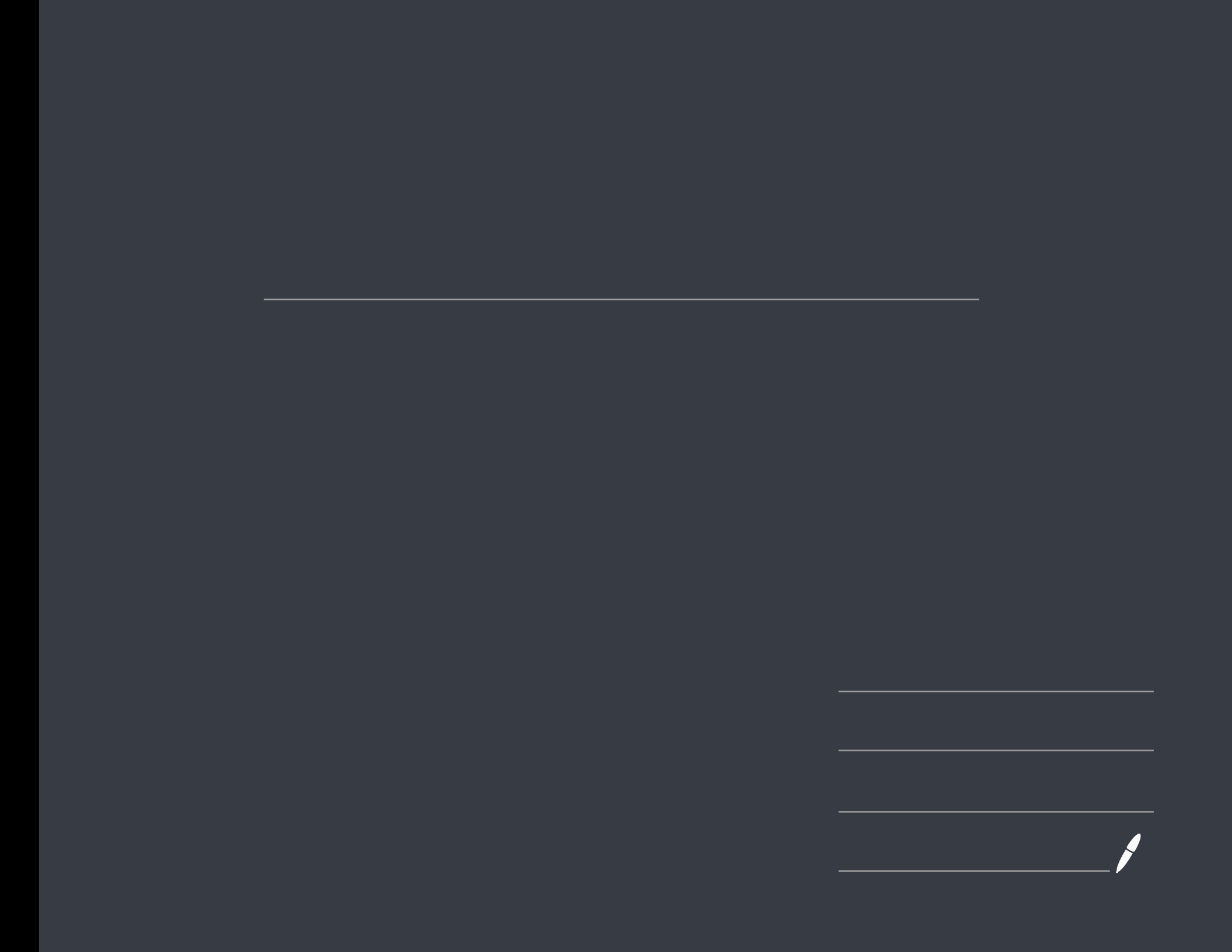
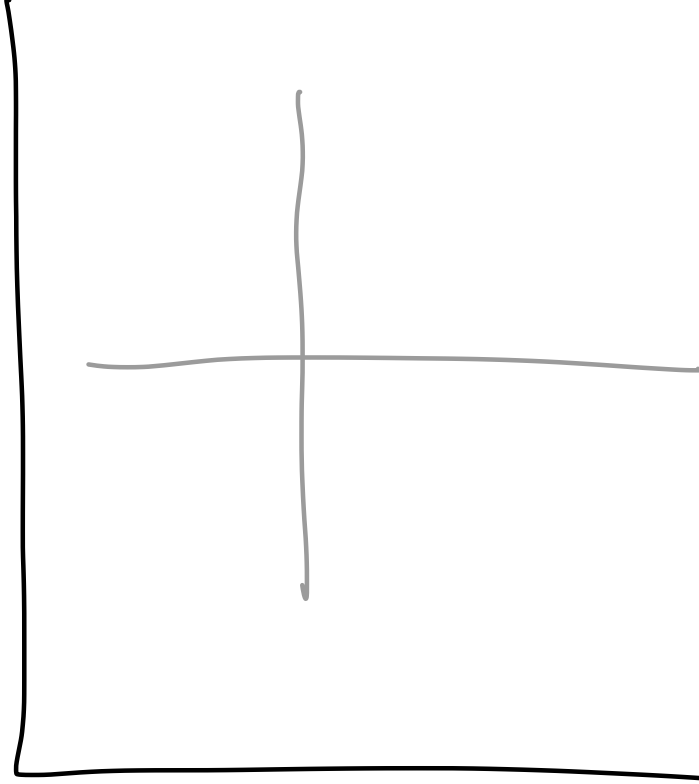


$$X = \begin{bmatrix} x_0 \\ \vdots \\ x_{n-1} \end{bmatrix} \qquad Y = \begin{bmatrix} y_1 \\ \vdots \\ y_{n-1} \end{bmatrix}$$



dot-product $X^T Y \qquad \langle X, Y \rangle$

$$x_0 y_0 + x_1 y_1 + \dots + x_{n-1} y_{n-1}$$

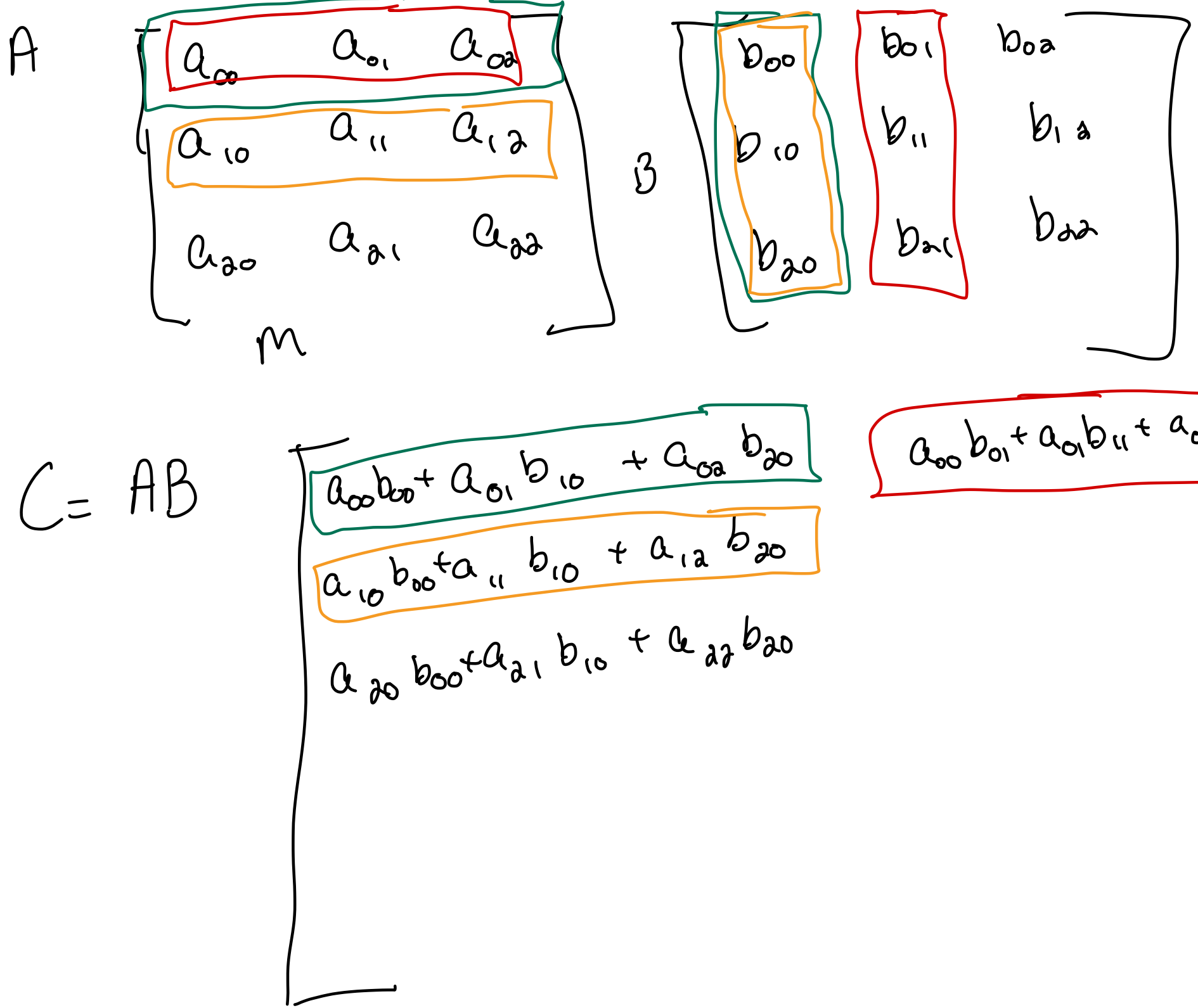
$$\sum_{i=0}^{n-1} x_i y_i$$

$$A \in \mathbb{R}^{n \times m}, \quad X \in \mathbb{R}^{m}$$

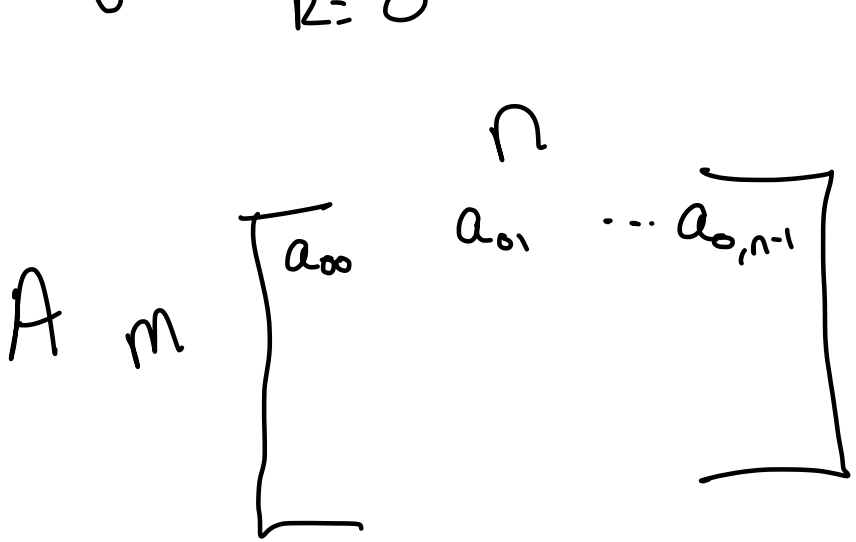
$$A = \begin{bmatrix} a_{00} & \cdots & a_{0,m-1} \\ a_{1,0} & & \vdots \\ \vdots & & \\ a_{n-1,0} & \cdots & a_{n-1,m-1} \end{bmatrix} \qquad X = \begin{bmatrix} x_0 \\ \vdots \\ x_{m-1} \end{bmatrix}$$

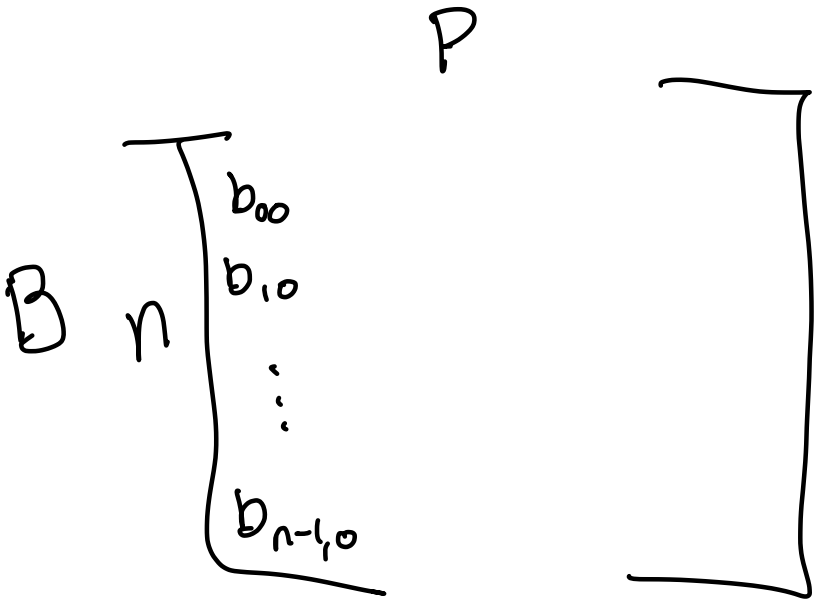
$$b = Ax = \begin{bmatrix} a_{00}x_0 + a_{0,1}x_1 + \cdots + a_{0,m-1}x_{m-1} \\ \vdots \\ a_{n-1,0}x_0 + a_{n-1,1}x_1 + \cdots a_{n-1,m-1}x_{m-1} \end{bmatrix} \in \mathbb{R}^{n}$$

$$b_i = \sum_{j=0}^{m-1} a_{ij}x_j = \langle a_{i,:}, x \rangle$$

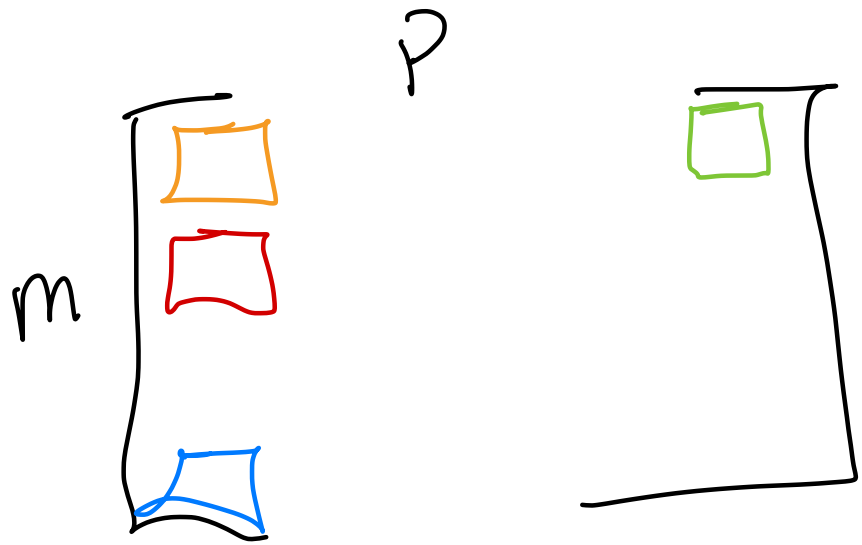

A
a_{00} a_{01} a_{02}
a_{10} a_{11} a_{12}
a_{20} a_{21} a_{22}
m
B
b_{00} b_{01} b_{02}
b_{10} b_{11} b_{12}
b_{20} b_{21} b_{22}
C = AB
$a_{00}b_{00} + a_{01}b_{10} + a_{02}b_{20}$
$a_{00}b_{01} + a_{01}b_{11} + a_{02}b_{21}$
$a_{10}b_{00} + a_{11}b_{10} + a_{12}b_{20}$
$a_{20}b_{00} + a_{21}b_{10} + a_{22}b_{20}$

$$C_{ij} = \sum_{k=0}^{n-1} a_{ik} b_{kj}$$





$C = AB$

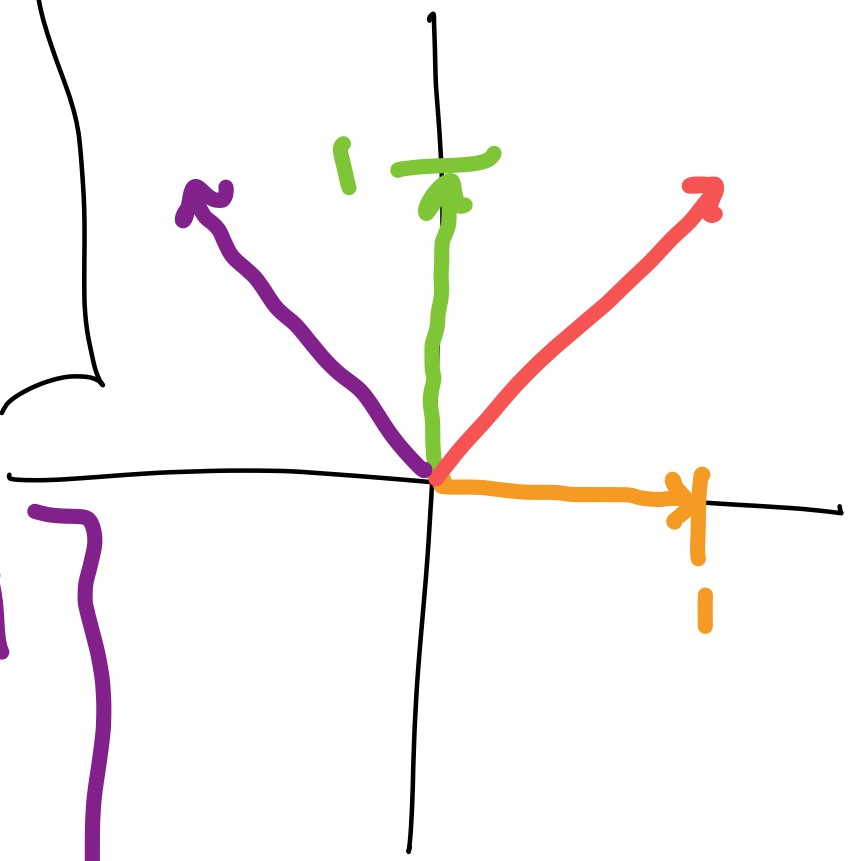


$i=0, j=0$

$i=1, j=0$

$i=m-1, j=0$

$$w = \begin{bmatrix} 1 \\ 0 \end{bmatrix} \qquad z = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$$



$$v = \begin{bmatrix} 1 \\ 1 \end{bmatrix} \qquad q = \begin{bmatrix} -1 \\ 1 \end{bmatrix}$$

$$\langle w, v \rangle = 1 * 1 + 1 * 0 = 1$$

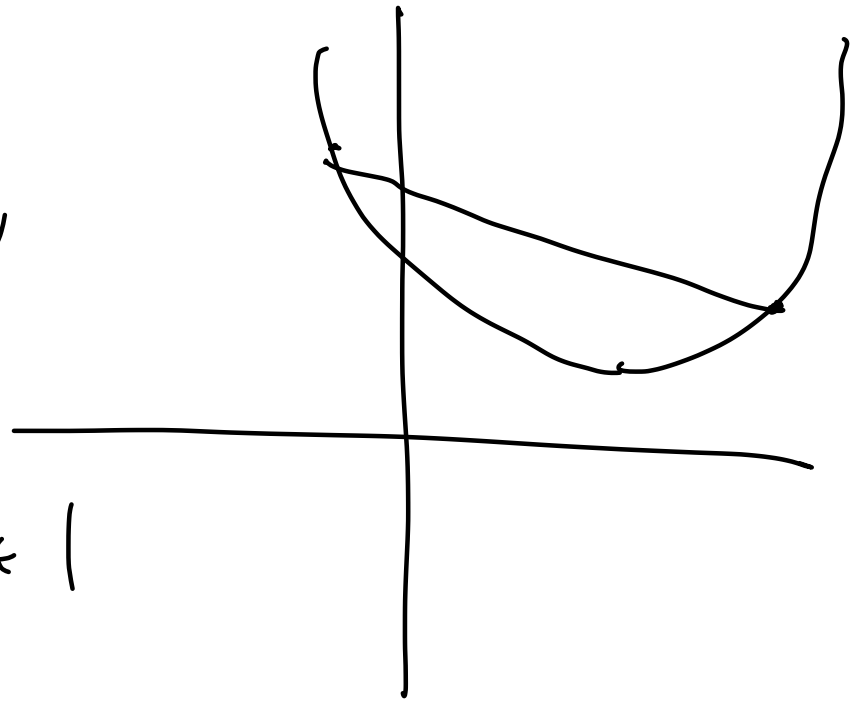
$$\langle q, z \rangle = 1 \qquad \langle q, w \rangle = -1$$

$$\sum_{k=0}^{m-1} c_i \left(a_{ik} b_{kj} \right)$$

$$c_i \sum_{k=0}^{m-1} a_{ik} b_{kj}$$

optimization $(x-3)(x-3)$

$f(x) = (x-3)^2 + 1$

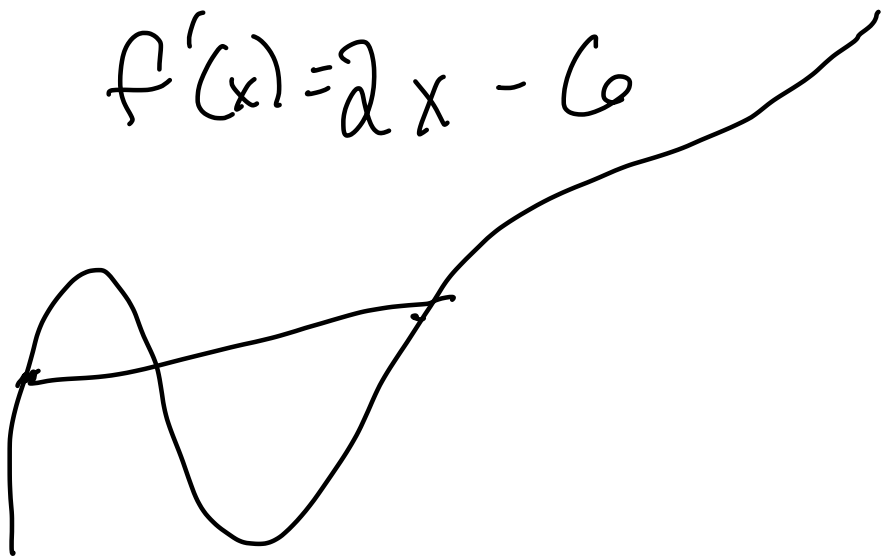


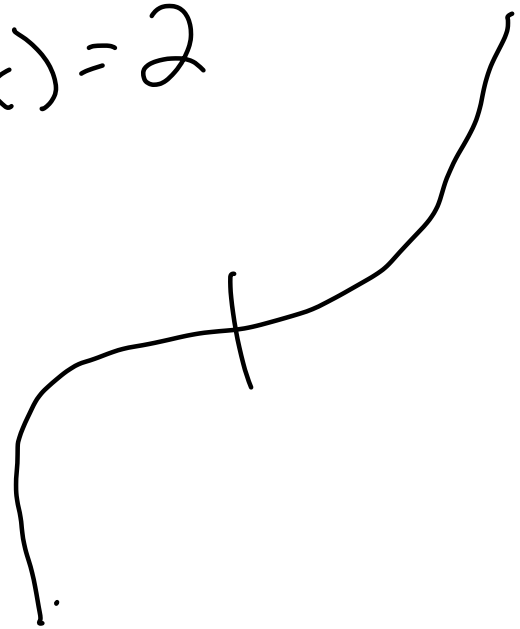
$x^2 - 3x - 3x + 9 + 1$

$x^2 - 6x + 9 + 1$

$f''(x) = 2$

$f'(x) = 2x - 6$





Taylor series

$$f(x) = f(a) + f'(a)(x-a) + \frac{f''(a)}{2!}(x-a)^2 + \cdots$$

$$f(x) - f(a) \approx f'(a)(x-a)$$

$$\frac{f(x+h) - f(x)}{h} \approx f'(x)$$

marginal probability: $p(A)$

joint prob: $p(A \text{ and } B)$ $p(A \cap B)$

red ∩ jack $2/52 \rightarrow 1/26$

conditional prob: $p(A \mid B) = \frac{P(A \cap B)}{P(B)}$

Bayes theorem

$$P(A|B) = \frac{P(B|A)\,P(A)}{P(B)}$$

prob + if actually uses = 99%

prob neg if actually not uses = 98%

prob uses: 0.1%

$$\text{prob}(\text{uses}|+) = \frac{p(+|\text{uses})\;p(\text{uses})}{p(+)}$$

$$p(+) = p(+|\text{use})\,p(\text{use}) + p(+|\text{don't use})\,p(\text{don't use})$$

$$\frac{(.99)(.001)}{(.99)(.001) + (.02)(.999)} = .047$$