[matrix]

* transpose matrix
* diagnal matrix $\begin{pmatrix} 1 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 3 \end{pmatrix}^p = \begin{pmatrix} 1^p & 0 & 0 \\ 0 & 2^p & 0 \\ 0 & 0 & 3^p \end{pmatrix}$
* inverse matrix $A \cdot B = B \cdot A = I_n \quad (B = A^{-1})$
  - A: nonsingular matrix = invertible matrix
  - B: inverse matrix

$$A^{-1} = \left(\frac{1}{\det(A)} \right) \mathrm{adj}(A)$$

有 or 無

$\det(A) \neq 0 = (\backslash\backslash\backslash) - (///)$

(determinent)

$\det(A) = |A|$

$\begin{bmatrix} \bullet & \triangle \\ \square & \star \end{bmatrix} = (\bullet\star - \triangle\square)$

adjoint matrix

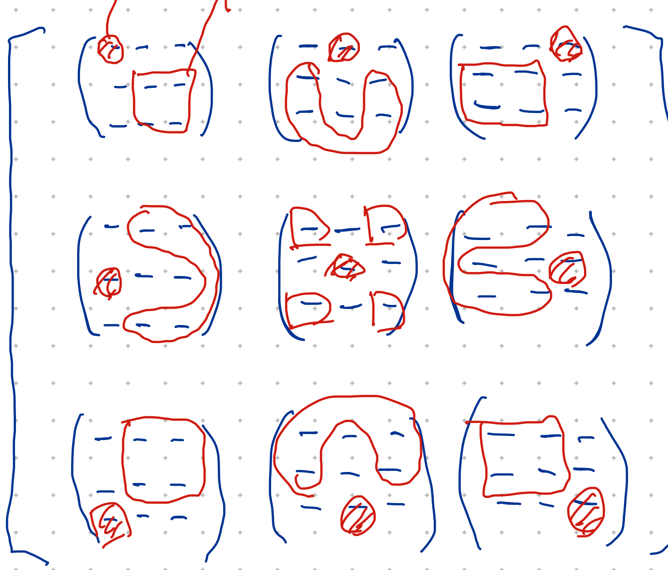
$\mathrm{adj}(A) = (\underline{\text{cofactor matrix}})^T$

$\Downarrow$

$C_{ij} = (-1)^{i+j} M_{ij}$

$= (-1)^{i+j} \det(\ )$

C =

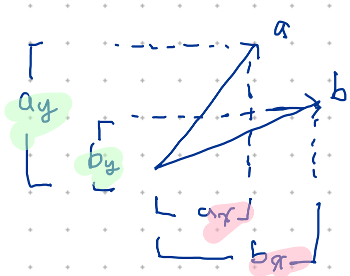


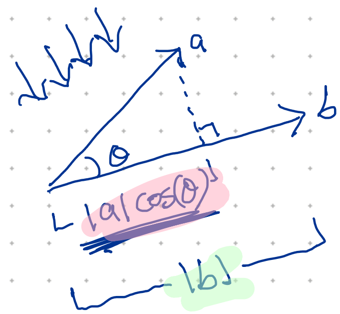
[matrix product]

Inner product
= dot product
= scalar product
= projection product

$$a^T b = a \cdot b = (a, b)$$

$$= a_x \cdot b_x + a_y \cdot b_y \qquad = |a| \times \cos(\theta) \times |b|$$





[eigenvalue eigenvector]

$Ax = \lambda x$

- λ : eigenvalue = characteristic value = latent root
- x : eigenvector = characteristic vector

* eigendecomposition ← $m \times m$ matrix

← linearly independent : basis

$$\begin{bmatrix} - & - \\ - & - \end{bmatrix} \Rightarrow \begin{bmatrix} - & - \\ - & - \end{bmatrix}\begin{bmatrix} 0 \\ 0 \end{bmatrix} = c\begin{bmatrix} 0 \\ 0 \end{bmatrix}$$

$$\begin{bmatrix} - & - \\ - & - \end{bmatrix}\begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \lambda_1 \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$ eigenvalue$_1$ · eigenvector$_1$

$$\begin{bmatrix} - & - \\ - & - \end{bmatrix}\begin{bmatrix} x_3 \\ x_4 \end{bmatrix} = \lambda_2 \begin{bmatrix} x_3 \\ x_4 \end{bmatrix}$$ eigenvalue$_2$ · eigenvector$_2$

$$= \begin{pmatrix} x_1 & x_3 \\ x_2 & x_4 \end{pmatrix}\begin{pmatrix} \lambda_1 & 0 \\ 0 & \lambda_2 \end{pmatrix}\begin{pmatrix} x_1 & x_3 \\ x_2 & x_4 \end{pmatrix}^{-1}$$

$$\begin{bmatrix} - & - \\ - & - \end{bmatrix}^{n} = \begin{pmatrix} x_1 & x_3 \\ x_2 & x_4 \end{pmatrix}\begin{pmatrix} \lambda_1 & 0 \\ 0 & \lambda_2 \end{pmatrix}^{n}\begin{pmatrix} x_1 & x_3 \\ x_2 & x_4 \end{pmatrix}^{-1}$$

$D(\lambda)$

$$Ax = \lambda x$$

$$Ax - \lambda x = \underline{(A - \lambda I)}x = 0 \qquad x = (A - \lambda I)^{-1} \cdot 0$$

$$\det(A - \lambda I) = \underline{|A - \lambda I| = 0} \qquad \because x \neq 0$$

Characteristic equation

we can take $\underline{\lambda}$ from characteristic equation

- $tr(A) = \sum_{i=1}^{m} \lambda_i$ (trace)
- $|A| = \det(A) = \prod_{i=1}^{m} \lambda_i$
- $|I + A| = \det(I + A) = \prod_{i=1}^{m} (1 + \lambda_i)$