$A = \begin{bmatrix} a_1 \\ a_2 \\ a_3 \\ a_4 \end{bmatrix}$ $B = [b_1, b_2, b_3, b_4]$

$\vec{A} \cdot \vec{B} = a_1b_1 + a_2b_2 + a_3b_3 + a_4b_4$ (vector).

$AB = \begin{bmatrix} - & - & - \\ - & - & - \\ - & - & - \end{bmatrix}$ $* AB \neq BA$.

AB is define but BA isn't.

$A: 5 \times 3$ B 3×2.

$AB: 5 \times 2$ BA: DNE.

$Ax = B$

$x = B \cdot A^{-1}$.

A $\begin{matrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \end{matrix}$. X $\begin{matrix} x_1 \\ x_2 \\ x_3 \end{matrix}$

$$AX = \begin{bmatrix} a_{11}x_1 + a_{12}x_2 + a_{13}x_3 \\ a_{21}x_1 + a_{22}x_2 + a_{23}x_3 \end{bmatrix}.$$

$$= x_1 \begin{bmatrix} a_{11} \\ a_{12} \end{bmatrix} + x_2 \begin{bmatrix} a_{12} \\ a_{22} \end{bmatrix} + x_3 \begin{bmatrix} a_{13} \\ a_{23} \end{bmatrix}.$$

AX is a linear combination of each entries of A

$A = [a_1, a_2 \cdots a_n]$ $a_1, a_2 \cdots a_n$ are columns of A.

$x = \begin{bmatrix} x_1 \\ x_2 \\ \vdots \\ x_n \end{bmatrix}$ $AX = a_1x_1 + a_2x_2 \cdots + a_nx_n$.

$= \vec{a_1}x_1 + \vec{a_2}x_2 + \cdots + \vec{a_n}x_n$.

$A = [\bar{a}_1, \bar{a}_2 \cdots \bar{a}_n]$. $\bar{a}$: the column $\begin{bmatrix} \\ \\ \end{bmatrix}$.

$Ae_j = [\bar{a}_1, \bar{a}_2 \cdots \bar{a}_n] = \bar{a}_j$

$x = [x_1, x_2 \cdots x_n]$ $1 \times n$.

A has the size $n \times k$.

$XA \Rightarrow 1 \times k$ with the row of kn.

e.g. $x = [x_1, x_2, x_3]$ $A = \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \\ a_{31} & a_{32} \end{bmatrix}$

$XA = [x_1 a_{11} + x_2 a_{21} + x_3 a_{31}, x_1 a_{12} + x_2 a_{22} + x_3 a_{33}]$.

$= x_1 [a_{11}, a_{12}] + x_2 [a_{21}, a_{22}] + x_3 [a_{31}, a_{32}]$.

the row is the linear combination of row of a with coefficient given by the entries of X.