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2025. 1.8

Session 10 meaning of Matrix Multiplication

on x-y plane

$(AB)X = A(BX)$, Note $AB \neq BA$

$I_n = \begin{bmatrix} 1 & & 0 \\ & \ddots & \\ 0 & & 1 \end{bmatrix}$ $R = \begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} -y \\ x \end{bmatrix}$

rotated 90° anti clockwise

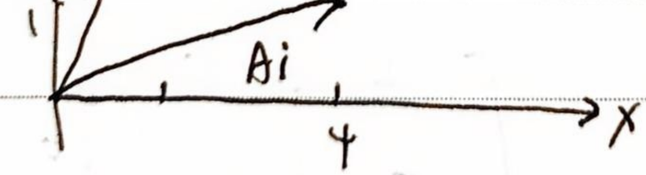
$R\vec{i} = \vec{j}$, $R\vec{j} = \vec{i}$ $R^2 = \begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix} \begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix} = \begin{bmatrix} -1 & 0 \\ 0 & -1 \end{bmatrix}$

$= -I_2$

Ex:

$\boxed{\vec{i} = \begin{pmatrix} 1 \\ 0 \end{pmatrix} \ \vec{j} = \begin{pmatrix} 0 \\ 1 \end{pmatrix}}$ $\vec{v} = \begin{pmatrix} a_1 \\ a_2 \end{pmatrix}$ $\vec{A} = \begin{pmatrix} 4 & 1 \\ 1 & 3 \end{pmatrix}$

$\vec{A} \cdot \vec{i} = \cancel{\begin{pmatrix} 1 \\ 0 \end{pmatrix}} \begin{pmatrix} 4 & 1 \\ 1 & 3 \end{pmatrix} \begin{pmatrix} 1 \\ 0 \end{pmatrix} = \begin{pmatrix} 4 \\ 1 \end{pmatrix}$ $\vec{A}\vec{j} = \begin{pmatrix} 1 \\ 3 \end{pmatrix}$



$\langle 4, 1 \rangle , \langle 1, 3 \rangle$

$= |Ai| \cdot |Aj| \cdot \sin\theta$

$\text{Area} = |\vec{A}| = \det(Ai, Aj)$

$= \begin{vmatrix} 4 & 1 \\ 1 & 3 \end{vmatrix} = 12 - 1 = 11$