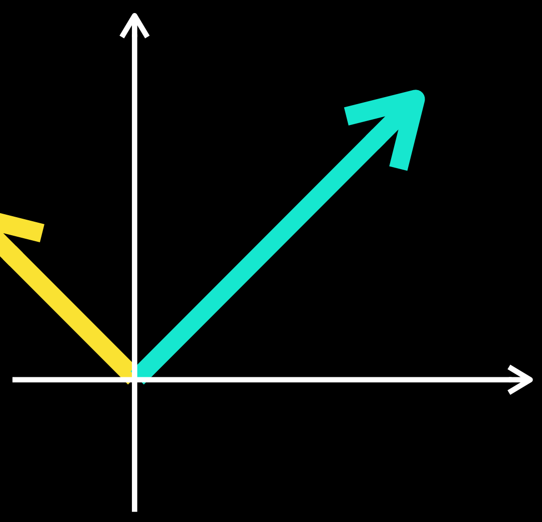
Matrices

Linear Algebra Essentials

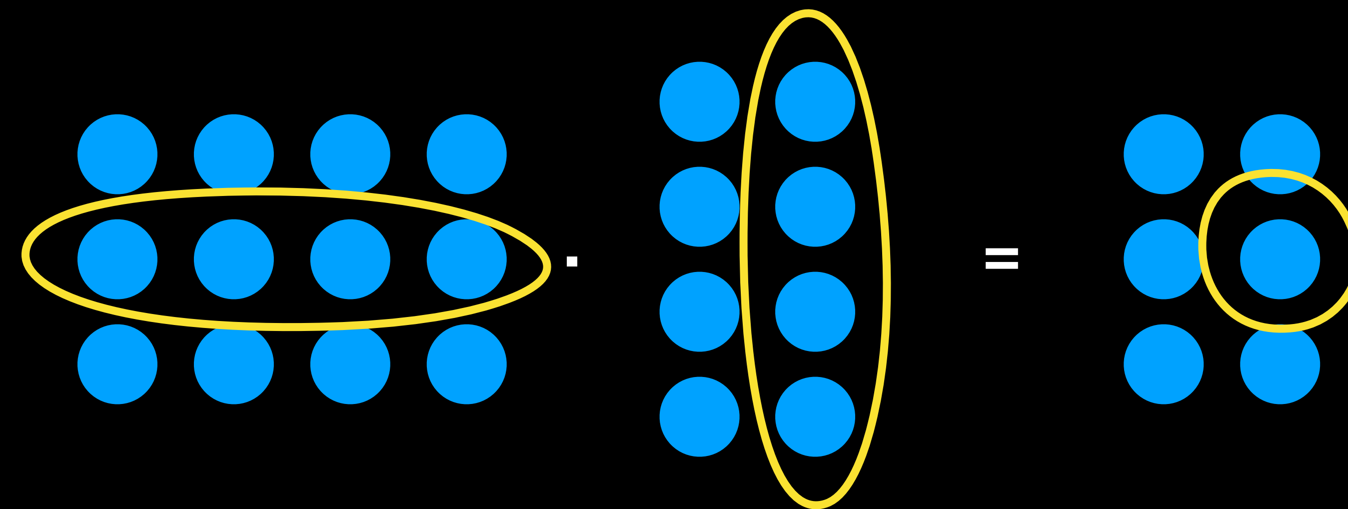


$$\begin{cases} a_{11}x_1 + a_{12}x_2 = b_1 \\ a_{21}x_1 + a_{22}x_2 = b_2 \end{cases}$$

$$\begin{cases} [a_{11}, a_{12}] \cdot \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = b_1 \\ [a_{21}, a_{22}] \cdot \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = b_2 \end{cases}$$

$$\begin{bmatrix} [a_{11} \; a_{12}] \\ [a_{21} \; a_{22}] \end{bmatrix} \cdot \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} b_1 \\ b_2 \end{bmatrix}$$

$$A\vec{x} = \vec{b}$$



$$A_{(n \times \underline{m})} \cdot B_{(\underline{m} \times k)} = C_{(n \times k)}$$

$$\vec{a}_{i\ row} \cdot \vec{b}_{j\ column} = c_{ij}$$

Matrix operations

A + B = C $\qquad a_{ij} + b_{ij} = c_{ij}$

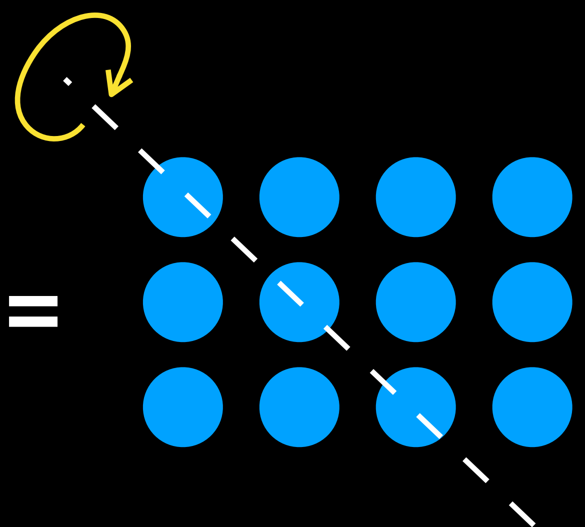
λA = C $\qquad \lambda a_{ij} = c_{ij}$

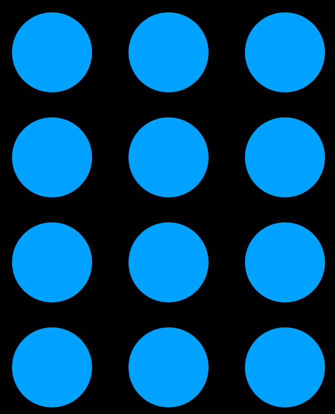
Commutativity w.r.t. addition and multiplication by scalar

A + B = B + A

λA = Aλ

Matrix transpose

A = 

A^{T} = 

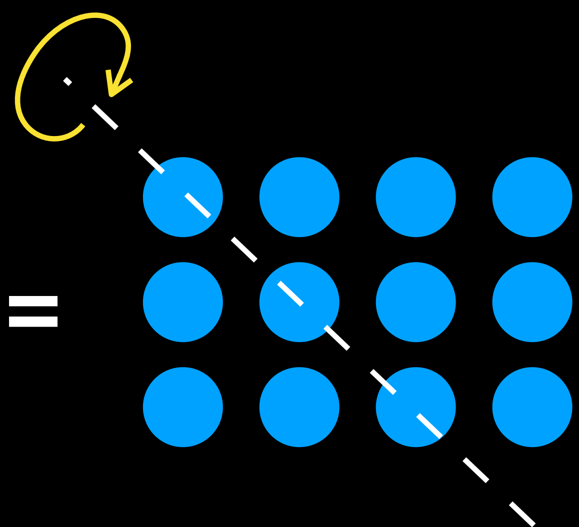
$$a_{ij} = a^t_{ji}$$

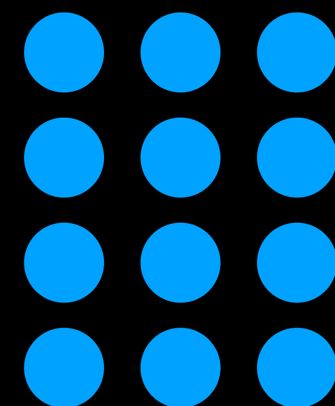
$$(A^T)^T = A$$

$$(A + B)^T = A^T + B^T$$

$$(\lambda A)^T = \lambda A^T$$

Matrix transpose

A = 

A$^{\mathbf{T}}$ **=** 

$$a_{ij} = a^{t}_{ji}$$

$$(AB)^T = B^T A^T$$

$$(AB) = C$$

$$(AB)^T :$$

$$(\vec{a}_{i\ row} \cdot \vec{b}_{j\ column})^T = (c_{ij})^T = c_{ji}$$

$$B^T A^T :$$

$$(\vec{b}_{i\ column} \cdot \vec{a}_{j\ row}) =$$

$$(\vec{a}_{j\ row} \cdot \vec{b}_{i\ column}) = c_{ji}$$