

## AM214-2023: LECTURE 1

# APPLIED MATHS 214

## MATRIX METHODS

Web site: <http://appliedmaths.sun.ac.za/>

TW214/

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CONTENT:

$$A = LU$$

$$A = QR$$

$$A = S \Lambda S^{-1}$$

$$A = U \Sigma V^T \quad \text{SVD}$$

## VECTORS

$$\underline{a} = \begin{bmatrix} a_1 \\ a_2 \\ a_3 \end{bmatrix}$$

Transpose

$$\underline{a}^T = [a_1 \ a_2 \ a_3]$$

Dot product:

$$\underline{a} \cdot \underline{b} = a_1 b_1 + a_2 b_2 + a_3 b_3 = ab \cos \theta$$

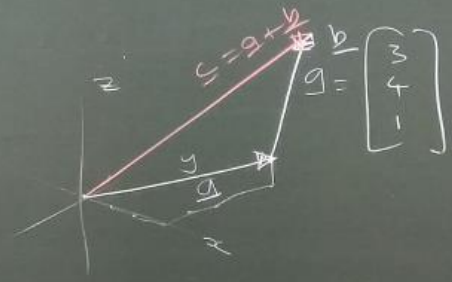
$$\underline{a}^T \underline{b} = [a_1 \ a_2 \ a_3] \begin{bmatrix} b_1 \\ b_2 \\ b_3 \end{bmatrix} = a_1 b_1 + a_2 b_2 + a_3 b_3$$

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$$\underline{b} \cdot \underline{a} = \underline{a} \cdot \underline{b} = \underline{a} \cdot \underline{b}$$

$$\underline{c} = \underline{a} + \underline{b}$$

$$\begin{bmatrix} 3 \\ 4 \\ 1 \end{bmatrix} + \begin{bmatrix} -1 \\ 2 \\ 4 \end{bmatrix} = \begin{bmatrix} 2 \\ 6 \\ 5 \end{bmatrix}$$



$$\underline{b} = \lambda \underline{a}$$

$$\underline{g} = g_1 \underline{i} + g_2 \underline{j} + g_3 \underline{k} = a_1 \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix} + a_2 \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix} + a_3 \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}$$

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$$= \begin{bmatrix} a_1 \\ 0 \\ 0 \end{bmatrix} + \begin{bmatrix} 0 \\ a_2 \\ 0 \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \\ a_3 \end{bmatrix} = \begin{bmatrix} a_1 \\ a_2 \\ a_3 \end{bmatrix}$$

Norm:

$$\underline{a} = \begin{bmatrix} a_1 \\ a_2 \\ a_3 \end{bmatrix}$$

$$\|\underline{a}\| = \sqrt{a_1^2 + a_2^2 + a_3^2} = a$$

$$\|\underline{a}\|^2 = \underline{a} \cdot \underline{a}$$

$$\hat{\underline{a}} = \frac{1}{a}(\underline{a}) = \frac{\underline{a}}{a}$$



# LINES IN $\mathbb{R}^3$

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$$\underline{r} = \begin{bmatrix} x \\ y \\ z \end{bmatrix}$$

position vector



$$\underline{r} = \underline{p} + t\underline{a}$$

$$t \in (-\infty, \infty)$$

