ASSIGNMENT 2

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Download all latex-tikz codes from

https://github.com/vishwahurakadli/EE3900/blob/main/Assignment_1/Assignment_2.tex

1 Problem

(Matrix-2.52)

If $\mathbf{A} = \begin{pmatrix} -2 \\ 4 \\ 5 \end{pmatrix}$, $\mathbf{B} = \begin{pmatrix} 1, 3, -6 \end{pmatrix}$, verify that $(\mathbf{AB})^\top = \mathbf{B}^\top \mathbf{A}^\top$

2 Solution

Calculating transpose of matrix multiplication on LHS

Matrix multiplication of AB is given by

$$\mathbf{AB} = \begin{pmatrix} -2 \\ 4 \\ 5 \end{pmatrix} \begin{pmatrix} 1, 3, -6 \end{pmatrix} \tag{2.0.1}$$

$$\implies \mathbf{AB} = \begin{pmatrix} -2 \times 1 + 4 \times 3 + 5 \times (-6) \end{pmatrix} = \begin{pmatrix} -20 \end{pmatrix} \tag{2.0.2}$$

As there is only one element in matrix AB and it is square matrix, therefore transpose of matrix AB is AB itself

$$(\mathbf{AB})^\top = \begin{pmatrix} -20 \end{pmatrix} \tag{2.0.3}$$

Calculating multiplication of transpose of matrices

Transpose of matrices

$$\mathbf{A}^\top = \begin{pmatrix} -2, 4, 5 \end{pmatrix} \tag{2.0.4}$$

$$\mathbf{B}^\top = \begin{pmatrix} 1 \\ 3 \\ -6 \end{pmatrix} \tag{2.0.5}$$

Now

$$\mathbf{B}^\top \mathbf{A}^\top = \begin{pmatrix} 1 \times -2 + 3 \times 4 + (-6) \times 5 \end{pmatrix} \tag{2.0.6}$$

$$\mathbf{B}^\top \mathbf{A}^\top = \begin{pmatrix} -20 \end{pmatrix} \tag{2.0.7}$$

$$\implies (\mathbf{AB})^\top \tag{2.0.8}$$

Therefore $(\mathbf{AB})^\top = \mathbf{B}^\top \mathbf{A}^\top$