

Books, watches, notes or cell phones are not allowed. The only calculators allowed are the Sharp EL-531**. You must show all your work, the correct answer is worth 1 mark the remaining marks are given for the work.

Question 1. Consider the matrices

$$A = \begin{bmatrix} 3 & 0 \\ -1 & 2 \\ 1 & 1 \end{bmatrix}, B = \begin{bmatrix} 4 & -1 \\ 0 & 2 \end{bmatrix}, C = \begin{bmatrix} 1 & 4 & 2 \\ 3 & 1 & 5 \end{bmatrix}, D = \begin{bmatrix} 1 & 5 & 2 \\ -1 & 0 & 1 \\ 3 & 2 & 4 \end{bmatrix}, E = \begin{bmatrix} 6 & 1 & 3 \\ -1 & 1 & 2 \\ 4 & 1 & 3 \end{bmatrix}$$

In each part, compute the given expression (where possible).

- (2 marks) $E - \text{trace}(E)A$ *not defined since can only subtract matrices of the same dimension*
- (3 marks) $(A^T D)E$
- (2 marks) BA *not defined since #col of B \neq #rows of A.*

$$(A^T D)E$$

$$= \left(\begin{bmatrix} 3 & -1 & 1 \\ 0 & 2 & 1 \end{bmatrix} \begin{bmatrix} 1 & 5 & 2 \\ -1 & 0 & 1 \\ 3 & 2 & 4 \end{bmatrix} \right) \begin{bmatrix} 6 & 1 & 3 \\ -1 & 1 & 2 \\ 4 & 1 & 3 \end{bmatrix}$$

$$= \begin{bmatrix} 7 & 17 & 9 \\ 1 & 2 & 6 \end{bmatrix} \begin{bmatrix} 6 & 1 & 3 \\ -1 & 1 & 2 \\ 4 & 1 & 3 \end{bmatrix}$$

$$= \begin{bmatrix} 61 & 33 & 82 \\ 28 & 9 & 25 \end{bmatrix}$$

Question 2. (4 marks) Using the matrices from Question 1., solve for X , if possible.

$$\text{trace}(D)X + 2B = CA$$

$$5X + 2B = CA \quad \text{since } \text{trace}(D) = 1 + 0 + 4 = 5$$

$$5X = CA - 2B$$

$$5X = \begin{bmatrix} 1 & 4 & 2 \\ 3 & 1 & 5 \end{bmatrix} \begin{bmatrix} 3 & 0 \\ -1 & 2 \\ 1 & 1 \end{bmatrix} - 2 \begin{bmatrix} 4 & -1 \\ 0 & 2 \end{bmatrix}$$

$$5X = \begin{bmatrix} 1 & 10 \\ 13 & 7 \end{bmatrix} - 2 \begin{bmatrix} 4 & -1 \\ 0 & 2 \end{bmatrix}$$

$$5X = \begin{bmatrix} -7 & 12 \\ 13 & 3 \end{bmatrix}$$

$$X = \frac{1}{5} \begin{bmatrix} -7 & 12 \\ 13 & 3 \end{bmatrix}$$