

## Topic X1 Matrices (Post-TT A) [40]

1.

The matrices **A** and **B** are given by  $A = \begin{pmatrix} 2 & a \\ 0 & 1 \end{pmatrix}$  and  $B = \begin{pmatrix} 2 & a \\ 4 & 1 \end{pmatrix}$ . **I** denotes the  $2 \times 2$  identity matrix.

Find

(i)  $A + 3B - 4I$ , [3]

(ii)  $AB$ . [2]

2.

Find the determinant of the matrix  $\begin{pmatrix} a & 4 & -1 \\ 3 & a & 2 \\ a & 1 & 1 \end{pmatrix}$ . [3]

3.

The matrices **A**, **B** and **C** are given by  $A = \begin{pmatrix} 3 \\ 1 \\ 2 \end{pmatrix}$ ,  $B = \begin{pmatrix} 4 \\ 0 \\ 3 \end{pmatrix}$  and  $C = (2 \quad 4 \quad -1)$ . Find

(i)  $A - 4B$ , [2]

(ii)  $BC$ , [4]

(iii)  $CA$ . [2]

4.

At the beginning of the year John had a total of £2000 in three different accounts. He has twice as much money in the current account as in the savings account.

- The current account has an interest rate of 2.5% per annum.
- The savings account has an interest rate of 3.7% per annum.
- The supersaver account has an interest rate of 4.9% per annum.

John has predicted that he will earn a total interest of £92 by the end of the year.

(i) Model this situation as a matrix equation. [2]

(ii) Find the amount that John had in each account at the beginning of the year. [2]

(iii) In fact, the interest John will receive is £92 to the nearest pound. Explain how this affects the calculations. [2]

5. Find any invariant lines of the matrix  $\begin{pmatrix} -1 & 1 \\ -4 & 3 \end{pmatrix}$ . [7]

6.

The matrix **C** is given by  $C = \begin{pmatrix} 3 & 2 \\ 1 & 1 \end{pmatrix}$ .

(i) Draw a diagram showing the image of the unit square under the transformation represented by **C**. [3]

The transformation represented by **C** is equivalent to a transformation **S** followed by another transformation **T**.

(ii) Given that **S** is a shear with the **y**-axis invariant in which the image of the point (1, 1) is (1, 2), write down the matrix that represents **S**. [2]

(iii) Find the matrix that represents transformation **T** and describe fully the transformation **T**. [6]