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6. The matrix **M** is given by

$$\mathbf{M} = \begin{pmatrix} 3 & 0 & 1 \\ 1 & 2 & 2 \\ 4 & 0 & 3 \end{pmatrix}$$

(a) (i) Show that 5 is an eigenvalue of **M**.

(ii) Find the other two eigenvalues of **M**.

(5)

(b) Find an eigenvector corresponding to the eigenvalue 5

(3)

The transformation represented by the matrix **M** maps the straight line l_1 onto the straight line l_2

The equation of l_1 is $(\mathbf{r} - \mathbf{a}) \times \mathbf{b} = \mathbf{0}$ where $\mathbf{a} = 2\mathbf{i} + \mathbf{j} - 3\mathbf{k}$ and $\mathbf{b} = \mathbf{i} + 2\mathbf{j} - \mathbf{k}$

(c) Find an equation for the line l_2, giving your answer in the form $(\mathbf{r} - \mathbf{c}) \times \mathbf{d} = \mathbf{0}$ where **c** and **d** are constant vectors.

(5)

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Q6