2. **In this question you must show all stages of your working.**

Solutions relying entirely on calculator technology are not acceptable.

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

Given that **M** has exactly two distinct eigenvalues λ_1 and λ_2 where $\lambda_1 < \lambda_2$

(a) determine a normalised eigenvector corresponding to the eigenvalue λ_1

(6)

The line l_1 has equation $\mathbf{r} = \begin{pmatrix} 4 \\ -1 \\ 0 \end{pmatrix} + \mu \begin{pmatrix} 2 \\ 0 \\ -1 \end{pmatrix}$, where μ is a scalar parameter.

The transformation T is represented by **M**.

The line l_1 is transformed by T to the line l_2

(b) Determine a vector equation for l_2, giving your answer in the form $\mathbf{r} \times \mathbf{b} = \mathbf{c}$ where **b** and **c** are constant vectors.

(3)

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Question 2 continued

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Question 2 continued

(Total for Question 2 is 9 marks)