4 Let k and m be non-zero constants. The matrices $\mathbf{A}$, $\mathbf{B}$ and $\mathbf{C}$ are given by

$$\mathbf{A} = \begin{pmatrix} 0 & 1 \\ -1 & 1 \\ 1 & 1 \end{pmatrix}, \quad \mathbf{B} = \begin{pmatrix} k & 0 \\ 0 & m \end{pmatrix} \text{ and } \mathbf{C} = \begin{pmatrix} 2 & -1 & 1 \\ 1 & 1 & 2 \end{pmatrix}.$$

(a) Give full details of the geometrical transformation in the x-y plane represented by the matrix $\mathbf{B}$ in each of the following cases.

(i) $m = 1$ [2]

....

....

(ii) $m = k$ [2]

....

....

(b) Show that the matrix $\mathbf{ABC}$ is singular. [6]