Question	Scheme	Marks	AOs
8(a)	$$\lvert \mathbf{A} \rvert = 3(6-3)-1(6-k)-1(3-k)=2k$$	B1	1.1b
	Cofactors $\begin{pmatrix} 3 & k-6 & 3-k \\ -9 & 18+k & k-9 \\ 2 & -4 & 2 \end{pmatrix}$ or Transpose of matrix of minors $\begin{pmatrix} 3 & 9 & 2 \\ 6-k & 18+k & 4 \\ 3-k & 9-k & 2 \end{pmatrix}$	M1	2.1
	$$\mathbf{A}^{-1} = \frac{1}{2k}\begin{pmatrix} 3 & -9 & 2 \\ k-6 & 18+k & -4 \\ 3-k & k-9 & 2 \end{pmatrix}$$	dM1 A1	1.1b 1.1b
		(4)	
(b)	$$\begin{pmatrix} x \\ y \\ z \end{pmatrix} = \frac{1}{2k}\begin{pmatrix} 3 & -9 & 2 \\ k-6 & 18+k & -4 \\ 3-k & k-9 & 2 \end{pmatrix}\begin{pmatrix} 3 \\ 1 \\ 6 \end{pmatrix} = \dots$$	M1	1.1a
	Any 2 of $\quad x = \dfrac{6}{k}, \quad y = \dfrac{2k-12}{k}, \quad z = \dfrac{6-k}{k}$	A1	2.1
	$\left(\dfrac{6}{k},\ \dfrac{2k-12}{k}, \dfrac{6-k}{k}\right)$ **or** $x = \dfrac{6}{k}, \quad y = \dfrac{2k-12}{k}, \quad z = \dfrac{6-k}{k}$ **or** $x = \dfrac{6}{k}, \quad y = 2-\dfrac{12}{k}, \quad z = \dfrac{6}{k}-1$	A1	2.5
		(3)	
		(7 marks)	

Notes

(a)

If **no attempt** at part (a) has been made you may award marks for work seen in part (b) for finding the inverse.

B1(M1 on epen): Correct determinant of $2k$

M1: Starts the process of finding the inverse and obtains at least 6 correct elements of cofactors Alternatively transposes their matrix of minors and obtains at least 6 correct elements.

dM1: A complete recognisable method to find the inverse including dividing by the determinant Allow minor slips if the process is clearly correct.

A1: Correct inverse.

(b)

M1: Attempts $\mathbf{A}^{-1}\begin{pmatrix} 3 \\ 1 \\ 6 \end{pmatrix}$ with their $\mathbf{A}^{-1}$ which must be in terms of k,

to obtain at least one of $x =$, $y =$ or $z =$ which may be seen embedded in a column vector, simplified or unsimplified, the determinant may be outside their column vector.

Condone a slip in copying $\begin{pmatrix} 3 \\ 1 \\ 6 \end{pmatrix}$ e.g. $\begin{pmatrix} 1 \\ 3 \\ 6 \end{pmatrix}$ or $\begin{pmatrix} 3 \\ 1 \\ 2 \end{pmatrix}$

A1(M1 on epen): Two correct expressions for x, y or z simplified or unsimplified, which may appear in a column vector, determinant **cannot** be outside the vector.

A1: Correct coordinates in simplest form. Allow e.g. $y = 2 - \dfrac{12}{k}$

Their final answer must be written as coordinates and not as a column vector but can be written as $x =$, $y =$ and $z =$

Alternative (**using algebraic method for simultaneous equations**):

M1: Solves simultaneously to obtain at least one of $x =$, $y =$ or $z =$ must be in terms of k.

A1(M1 on epen): Two correct expressions for x, y or z simplified or unsimplified.

A1: Correct coordinates in simplest form. Allow e.g. $y = 2 - \dfrac{12}{k}$

Their final answer must be written as coordinates and not as a column vector but can be written as $x =$, $y =$ and $z =$

e.g.

Eliminates z and achieves $4x + 2y = 4$ and $(6-k)x + 3y = 0$

Uses $12x + 6y = 12$ and $(12-2k)x + 6y = 0$ to produce $2kx = 12 \Rightarrow x = \dfrac{6}{k}$