Question	Scheme	Marks	AOs
7(a)	$\lvert\mathbf{M}\rvert = 2(-k-8)+1(-3-12)+1(6-3k)=0 \Rightarrow k=\ldots$	M1	1.1b
	$k \neq -5$	A1	2.4
		(2)	
(b) Way 1	$\mathbf{M}=\begin{pmatrix}2 & -1 & 1\\ 3 & -6 & 4\\ 3 & 2 & -1\end{pmatrix} \Rightarrow \begin{pmatrix}x\\ y\\ z\end{pmatrix}=\mathbf{M}^{-1}\begin{pmatrix}p\\ 1\\ 0\end{pmatrix}$	M1	3.1a
	$\mathbf{M}^{-1}=\frac{1}{5}\begin{pmatrix}-2 & 1 & 2\\ 15 & -5 & -5\\ 24 & -7 & -9\end{pmatrix}$	B1	1.1b
	$\begin{pmatrix}x\\ y\\ z\end{pmatrix}=\frac{1}{5}\begin{pmatrix}-2 & 1 & 2\\ 15 & -5 & -5\\ 24 & -7 & -9\end{pmatrix}\begin{pmatrix}p\\ 1\\ 0\end{pmatrix} \Rightarrow \begin{pmatrix}x\\ y\\ z\end{pmatrix}=\ldots$	M1	2.1
	$\begin{pmatrix}x\\ y\\ z\end{pmatrix}=\frac{1}{5}\begin{pmatrix}-2p+1\\ 15p-5\\ 24p-7\end{pmatrix}$	A1	1.1b
	$\left(\frac{-2p+1}{5},\ 3p-1, \frac{24p-7}{5}\right)$	A1ft	2.5
		(5)	
(b) Way 2	$\begin{matrix}2x-y+z=p\\ 3x-6y+4z=1\\ 3x+2y-z=0\end{matrix} \Rightarrow \text{e.g.} \begin{matrix}8y-5z=-1\\ 9y-5z=3p-2\end{matrix} \Rightarrow y=\ldots$ $\Rightarrow x=\ldots, z=\ldots$	M1	3.1a
	$y=3p-1$(or $x=\frac{-2p+1}{5}$ or $z=\frac{24p-7}{5}$)	B1	1.1b
	$8(3p-1)-5z=-1 \Rightarrow z=\ldots \Rightarrow x=\ldots$	M1	2.1
	$z=\frac{24p-7}{5}$, $x=\frac{-2p+1}{5}$	A1	1.1b
	$\left(\frac{-2p+1}{5},\ 3p-1, \frac{24p-7}{5}\right)$	A1ft	2.5

(c)(i)	For consistency: E.g. $5x+y=4-q$ and $15x+3y=q$	M1	3.1a
	$4-q=\frac{q}{3} \Rightarrow q=...$	M1	2.1
	$q=3$	A1	1.1b
	Alternative for (c)(i): $x=1 \Rightarrow 2-y+z=1,\ 3+2y-z=0 \Rightarrow y=...,z=...$ M1 for allocating a number to one variable and solves for the other 2 $x=1, y=-4, z=-5 \Rightarrow 3+20-20=q$ M1 substitutes into the second equation and solves for q A1: $q=3$		
(ii)	Three **planes** that intersect in a **line** Or Three **planes** that form a **sheaf** allow **sheath**!	B1	2.4
		(4)	
			(11 marks)

Notes

(a)

M1: Attempts determinant, equates to zero and attempts to solve for *k* in order to establish the restriction for *k*. For the determinant, at least 2 of the 3 "elements" should be correct.

May see rule of Sarrus used for determinant e.g.

$$|\mathbf{M}|=(2)(k)(-1)+(4)(3)(-1)+(3)(2)(1)-(3)(k)(-1)-(2)(4)(2)-(-1)(3)(-1)=0 \Rightarrow k=...$$

A1: Describes the correct condition for *k* with no contradictions. Allow e.g. $k < -5$, $k > -5$

(b)**Way 1**

M1: A complete strategy for solving the given equations. Need to see an attempt at the inverse followed by a correct method for finding *x*, *y* and *z*

B1: Correct inverse matrix

M1: Uses their inverse and attempts the multiplication with the correct vector

A1: Correct values for *x*, *y* and *z* in any form

A1ft: Correct values given in coordinate form only. **Follow through their *x*, *y* and *z*.**

Way 2

M1: A complete strategy for solving the given equations. Need to see an attempt at eliminating one variable followed by a correct method for finding *x*, *y* and *z*

B1: One correct value

M1: Uses the equations to find values for the other 2 variables

A1: Correct values for *x*, *y* and *z* in any form

A1ft: Correct values given in coordinate form only. **Follow through their *x*, *y* and *z*.**

(c)(i)

M1: Uses a correct strategy that will lead to establishing a value for *q*. E.g. eliminating one of *x*, *y* or *z*

M1: Solves a suitable equation to obtain a value for *q*

A1: Correct value

(ii)

B1: Describes the correct geometrical configuration.

Must include the **two** ideas of **planes** and meeting in a **line** or forming a **sheaf** with no contradictory statements.