Question Number	Scheme	Notes	Marks
2	Condone poor notation e.g., determinant lines used for matrix bracketing		
(a)	$\det\begin{pmatrix}2&0&0\\0&1&4\\3&-2&-3\end{pmatrix}\ \left\{=2\times(-3+8)\right\}\ =10$	Correct value for determinant, seen or stated and not just in a final answer	B1
	$\left\{\text{Minors}:\begin{pmatrix}5&-12&-3\\0&-6&-4\\0&8&2\end{pmatrix}\Rightarrow\right\}\ \text{Cofactors}:\begin{pmatrix}5&12&-3\\0&-6&4\\0&-8&2\end{pmatrix}$	Attempts the cofactor matrix with at least 6 correct elements	M1
	Inverse is $\frac{1}{"10"}\begin{pmatrix}5&0&0\\12&-6&-8\\-3&4&2\end{pmatrix}$ or e.g., $\begin{pmatrix}\frac{1}{2}&0&0\\\frac{6}{5}&-\frac{3}{5}&-\frac{4}{5}\\-\frac{3}{10}&\frac{2}{5}&\frac{1}{5}\end{pmatrix}$	Correct inverse but allow ft on their "10". Allow equivalent fractions/decimals. A0 if clearly obtained incorrectly	A1ft
	Work to obtain Adj(**M**) must be seen but it may be minimal, e.g., sight of the matrix of minors followed by the correct answer is acceptable. Note that B0 M1 A1 is possible.		**(3)**
(b)	$\frac{1}{10}\begin{pmatrix}5&0&0\\12&-6&-8\\-3&4&2\end{pmatrix}\begin{pmatrix}u\\v\\w\end{pmatrix}=...$	Multiplies their $\mathbf{M}^{-1}$ by $\begin{pmatrix}u\\v\\w\end{pmatrix}$ Must use a matrix other than **M** – not just changed by application of determinant. Condone sight of $\mathbf{vM}^{-1}$ = ... but must not be a clearly incorrect multiplication method	M1
	$\begin{pmatrix}x\\y\\z\end{pmatrix}=\frac{1}{10}\begin{pmatrix}5u\\12u-6v-8w\\-3u+4v+2w\end{pmatrix}$ or $\begin{pmatrix}\frac{1}{2}u\\\frac{6}{5}u-\frac{3}{5}v-\frac{4}{5}w\\-\frac{3}{10}u+\frac{2}{5}v+\frac{1}{5}w\end{pmatrix}$ or $\frac{1}{d}\begin{pmatrix}5u\\12u-6v-8w\\-3u+4v+2w\end{pmatrix}$ or $\begin{pmatrix}\frac{5}{d}u\\\frac{12}{d}u-\frac{6}{d}v-\frac{8}{d}w\\-\frac{3}{d}u+\frac{4}{d}v+\frac{2}{d}w\end{pmatrix}$ A1ft: Two correct vector components, coordinates or equations, ft their $d\neq 0$ A1ft: All three correct ft their non-zero $d\neq 0$ Must be exact (and not rounded decimals for ft) **These ft marks are not available for an incorrect** Adj(**M**)		A1ft A1ft
			(3)
Alt Using **M**	$2x=u \qquad x=...$ $y+4z=v \quad\Rightarrow\quad y=...$ $3x-2y-3z=w \qquad z=...$	Uses $\mathbf{M}\begin{pmatrix}x\\y\\z\end{pmatrix}=\begin{pmatrix}u\\v\\w\end{pmatrix}$ and finds x, y and z as functions of u, v and w Condone sight of **vM** = ... but must not be a clearly incorrect multiplication method	M1
	$x=\frac{1}{2}u$ $y=\frac{6}{5}u-\frac{3}{5}v-\frac{4}{5}w$ $z=-\frac{3}{10}u+\frac{2}{5}v+\frac{1}{5}w$	A1: Two correct equations A1: All three correct Any form with terms collected	A1 A1
			(3)

Question Number	Scheme	Notes	Marks
2(c)	$3x-7y+2z=-3 \Rightarrow 3\left(\frac{1}{2}u\right)-7\left(\frac{6}{5}u-\frac{3}{5}v-\frac{4}{5}w\right)+2\left(-\frac{3}{10}u+\frac{2}{5}v+\frac{1}{5}w\right)=-3$	Substitutes their expressions into the equation for Π_1	M1
	$-15u+10v+12w=-6$	Correct **equation.** Terms in any order but constant isolated. Accept any integer multiples.	A1
			(2)
			Total 8
Alts	To gain any marks by an alternative approach, a complete attempt at a Cartesian equation for Π_2 must be made by a viable strategy e.g.,		
	general point on $3x-7y+2z=-3$ is $\left(s,\ t,\ -\frac{3}{2}s+\frac{7}{2}t-\frac{3}{2}\right)$ $\begin{pmatrix}2&0&0\\0&1&4\\3&-2&-3\end{pmatrix}\begin{pmatrix}s\\t\\-\frac{3}{2}s+\frac{7}{2}t-\frac{3}{2}\end{pmatrix} \Rightarrow \begin{matrix}u=2s\\v=-6s+15t-6\\w=\frac{15}{2}s-\frac{25}{2}t+\frac{9}{2}\end{matrix} \Rightarrow \begin{matrix}v=-3u+15t-6\\t=-\frac{2}{25}\left(w-\frac{15}{2}\left(\frac{u}{2}\right)-\frac{9}{2}\right)\end{matrix}$ $\Rightarrow v=-3u-\frac{6}{5}w+\frac{9}{2}u+\frac{27}{5}-6$ Obtains a plane equation in any Cartesian form		M1
	$\left\{v=\frac{3}{2}u-\frac{6}{5}w-\frac{3}{5}\Rightarrow\right\}$ $-15u+10v+12w=-6$	Correct **equation.** Terms in any order but constant isolated. Accept any integer multiples.	A1
			(2)
			Total 8