Question Number	Scheme	Notes	Marks
1	$\mathbf{M}=\begin{pmatrix}1 & a\\ 3 & -5\end{pmatrix}\qquad \mathbf{M}^{-1}=2\mathbf{M}+8\mathbf{I}$ Condone any brackets (or missing brackets) for matrices throughout. Allow **clear** miscopying slips (e.g., $-5-3a$ becomes $-3-5a$) to access M marks.		
(a)	$\{\det\mathbf{M}=\}-5-3a$	Correct determinant. Allow unsimplified	B1
	$\{\mathbf{M}^{-1}=\}\dfrac{1}{-5-3a}\begin{pmatrix}-5 & -a\\ -3 & 1\end{pmatrix}$ or $\begin{pmatrix}\frac{-5}{-5-3a} & \frac{-a}{-5-3a}\\ \frac{-3}{-5-3a} & \frac{1}{-5-3a}\end{pmatrix}$ May see e.g., $\dfrac{-1}{5+3a}\begin{pmatrix}-5 & -a\\ -3 & 1\end{pmatrix}$, $\dfrac{1}{5+3a}\begin{pmatrix}5 & a\\ 3 & -1\end{pmatrix}$	M1: For $\dfrac{1}{\pm5\pm3a}\times$ a **changed** matrix or a correct Adj(**M**) seen i.e., ...$\begin{pmatrix}-5 & -a\\ -3 & 1\end{pmatrix}$ A1: Any correct inverse	M1 A1
			(3)
(b)	$\left\{\dfrac{1}{-5-3a}\begin{pmatrix}-5 & -a\\ -3 & 1\end{pmatrix}=\right\}2\begin{pmatrix}1 & a\\ 3 & -5\end{pmatrix}+8\begin{pmatrix}1 & 0\\ 0 & 1\end{pmatrix}=\begin{pmatrix}2 & 2a\\ 6 & -10\end{pmatrix}+\begin{pmatrix}8 & 0\\ 0 & 8\end{pmatrix}=\begin{pmatrix}10 & 2a\\ 6 & -2\end{pmatrix}$ Substitutes **M** into the RHS of the equation and combines matrices appropriately obtaining one correct element which may be unsimplified e.g., 2 + 8. Apply BOD if only see e.g., $-5=2(-5-3a)+8$ but next mark is M0. Allow equivalent work if writes as e.g, $\mathbf{M}^{-1}-2\mathbf{M}=+8\mathbf{I}$ so $\dfrac{-5}{-5-3a}-2=8$ implies the 2 + 8. Condone use of $\begin{pmatrix}1 & 1\\ 1 & 1\end{pmatrix}$ for **I**. If $\mathbf{I}=\mathbf{0}$ then M0. Note that it is fine to just use 1 element and proceed directly to an equation.		M1
	e.g., $\Rightarrow -5=10(-5-3a)$ or $-5=-50-30a$ or $5=10(5+3a)\Rightarrow a=...$ $\left\{-\frac{3}{2}\right\}$ Obtains a non-zero value for a from a consistent "extracted" equation (with no fraction). If the fraction is not dealt with (going straight to a value for a) it must be consistent. Equation must come from $\dfrac{1}{\pm5\pm3a}\times$ a changed matrix = credible attempt at $2\mathbf{M}+8\mathbf{I}$ M0 for equating to a zero element of their $2\mathbf{M}+8\mathbf{I}$. Accept a value following an appropriate equation. If no equation must correctly get $-\frac{3}{2}$ oe. Ignore usual rules if equation is quadratic. If RHS is only seen multiplied out it must be consistent with the work. Condone use of $\begin{pmatrix}1 & 1\\ 1 & 1\end{pmatrix}$. If $\mathbf{I}=\mathbf{0}$ then M0. May see: $-a=2a(-5-3a),\ -3=6(-5-3a),\ 1=-2(-5-3a)\Rightarrow a=...$ $a=2a(5+3a),\ 3=6(5+3a),\ -1=-2(5+3a)\Rightarrow a=...$		M1
	A1: $-\dfrac{3}{2}$ or $-1\dfrac{1}{2}$ or -1.5 and allow equivalent fractions e.g., $-\dfrac{45}{30}$ Requires both previous marks and no sight of incorrect **I.** Must come from correct work **for the element used**. Ignore any extra equations or checks if they are wrong but unused. But do not isw if any extra incorrect unrejected solutions are offered e.g., a = 0 from $6a^2+9a=0$		A1
			(3)
	Some alternatives for (b) are shown overleaf		**Total 6**

1(b)	$\mathbf{M}=\begin{pmatrix}1 & a\\ 3 & -5\end{pmatrix}\qquad \mathbf{M}^{-1}=2\mathbf{M}+8\mathbf{I}$	
Alt 1	$\mathbf{M}^{-1}=2\mathbf{M}+8\mathbf{I}\Rightarrow \mathbf{I}=2\mathbf{M}^2+8\mathbf{M}\Rightarrow \begin{pmatrix}1 & 0\\ 0 & 1\end{pmatrix}=\begin{pmatrix}\underline{6a+10} & 0\\ 0 & 6a+10\end{pmatrix}\Rightarrow 6a+10=1\Rightarrow a=-\frac{3}{2}$ M1: Achieves $\underline{pa+q}$ M1: Solves $pa+q=1$ A1: Correct value (no others or incorrect **I**)	
Alt 2	$\det\mathbf{M}^{-1}=\det(2\mathbf{M}+8\mathbf{I})\Rightarrow \frac{1}{-5-3a}=\underline{-20-12a}\Rightarrow 36a^2+120a+99=12a^2+40a+33=(2a+3)(6a+11)=0\Rightarrow a=-\frac{3}{2}$ M1: Achieves $\underline{pa+q}$ M1: Solves $\frac{1}{\pm5\pm3a}=pa+q$ A1: Correct value and no others	
Others	Determinants may also be used to form the equation in Alt 1 i.e., $1=(6a+10)^2$ Another (unlikely) possibility is to equate the traces of the matrices: $\frac{1}{-5-3a}(-5+1)=10+(-2)\Rightarrow -4=-40-24a\Rightarrow a=-\frac{3}{2}$	