Question Number	Scheme	Notes	Marks
3	$\mathbf{M}=\begin{pmatrix}3 & -4 & k\\ 1 & -2 & k\\ 1 & -5 & 5\end{pmatrix}$		
(a)	$\lvert\mathbf{M}-\lambda\mathbf{I}\rvert=\mathbf{M}=\begin{vmatrix}3-\lambda & -4 & k\\ 1 & -2-\lambda & k\\ 1 & -5 & 5-\lambda\end{vmatrix}=\begin{vmatrix}0 & -4 & k\\ 1 & -5 & k\\ 1 & -5 & 2\end{vmatrix}$ $(0)+4[2-k]+k[-5+5]$ Attempts $\lvert\mathbf{M}-\lambda\mathbf{I}\rvert$ using $\lambda=3$		M1
	$(0)+4[2-k]+k[-5+5]=0\Rightarrow k=...$ Uses $\lvert\mathbf{M}-\lambda\mathbf{I}\rvert=0$ and solves for k		M1
	$k=2$	Cao	A1
			(3)
(b)	$(3-\lambda)[(\lambda+2)(\lambda-5)+10]+4(5-\lambda-2)+2(-5+2+\lambda)=0$ Attempts $\lvert\mathbf{M}-\lambda\mathbf{I}\rvert=0$ using their value of k		M1
	$\Rightarrow(3-\lambda)[(\lambda+2)(\lambda-5)+12]=0$ $(\lambda+2)(\lambda-5)+12\Rightarrow\lambda^2-3\lambda+2=0\Rightarrow(\lambda-2)(\lambda-1)=0\Rightarrow\lambda=...$ Uses $\lambda=3$as a factor to obtain and solve a 3TQ to find the other eigenvalues (Alternatively may use calculator to solve $\lambda^3-6\lambda^2+11\lambda-6=0$)		M1
	$\lambda=1,\ 2$	Correct values	A1
			(3)
(c)	$\begin{pmatrix}3 & -4 & 2\\ 1 & -2 & 2\\ 1 & -5 & 5\end{pmatrix}\begin{pmatrix}x\\ y\\ z\end{pmatrix}=3\begin{pmatrix}x\\ y\\ z\end{pmatrix}\Rightarrow\begin{matrix}3x-4y+2z=3x\\ x-2y+2z=3y\\ x-5y+5z=3z\end{matrix}$	Uses the eigenvalue 3 and their k to form at least 2 equations in x, y and z	M1
	$\alpha\begin{pmatrix}1\\ 1\\ 2\end{pmatrix}$ (α a constant)	Any correct eigenvector. Allow any constant multiple of **i** + **j** + 2**k**	A1
	$\frac{1}{\sqrt{6}}\begin{pmatrix}1\\ 1\\ 2\end{pmatrix}$	Correct normalised vector	A1
			(3)
			Total 9