Question	Scheme		Marks	AOs
3(i)(a)	$\lvert\mathbf{M}\rvert = 2(1+2) - a(-1-1) + 4(2-1) = 0 \Rightarrow a = \ldots$		M1	2.3
	The matrix **M** has an inverse when $a \neq -5$		A1	1.1b
			(2)	
(b)	Minors : $\begin{pmatrix} 3 & -2 & 1 \\ -a-8 & 2 & a+4 \\ 4-a & -6 & -2-a \end{pmatrix}$ or Cofactors : $\begin{pmatrix} 3 & 2 & 1 \\ a+8 & 2 & -a-4 \\ 4-a & 6 & -2-a \end{pmatrix}$		B1	1.1b
	$\mathbf{M}^{-1} = \frac{1}{\lvert\mathbf{M}\rvert}\text{adj}(\mathbf{M})$		M1	1.1b
	$\mathbf{M}^{-1} = \frac{1}{2a+10}\begin{pmatrix} 3 & a+8 & 4-a \\ 2 & 2 & 6 \\ 1 & -a-4 & -2-a \end{pmatrix}$	2 correct rows or columns. Follow through their det**M**	A1ft	1.1b
		All correct. Follow through their det**M**	A1ft	1.1b
			(4)	
(ii)	When $n = 1$, lhs = $\begin{pmatrix} 3 & 0 \\ 6 & 1 \end{pmatrix}$, rhs = $\begin{pmatrix} 3^1 & 0 \\ 3(3^1-1) & 1 \end{pmatrix} = \begin{pmatrix} 3 & 0 \\ 6 & 1 \end{pmatrix}$ So the statement is true for $n = 1$		B1	2.2a
	Assume true for $n = k$ so $\begin{pmatrix} 3 & 0 \\ 6 & 1 \end{pmatrix}^k = \begin{pmatrix} 3^k & 0 \\ 3(3^k-1) & 1 \end{pmatrix}$		M1	2.4
	$\begin{pmatrix} 3 & 0 \\ 6 & 1 \end{pmatrix}^{k+1} = \begin{pmatrix} 3^k & 0 \\ 3(3^k-1) & 1 \end{pmatrix}\begin{pmatrix} 3 & 0 \\ 6 & 1 \end{pmatrix}$		M1	2.1
	$= \begin{pmatrix} 3\times 3^k & 0 \\ 3\times 3(3^k-1)+6 & 1 \end{pmatrix}$		A1	1.1b
	$= \begin{pmatrix} 3^{k+1} & 0 \\ 3(3^{k+1}-1) & 1 \end{pmatrix}$		A1	1.1b
	If the statement is true for $n = k$ then it has been shown true for $n = k + 1$ and as it is true for $n = 1$, the statement is true for all positive integers n		A1	2.4
			(6)	
			(12 marks)	

Question 3 notes:

(i)(a)

M1: Attempts determinant, equates to zero and attempts to solve for a in order to establish the restriction for a

A1: Provides the correct condition for a if **M** has an inverse

(i)(b)

B1: A correct matrix of minors or cofactors

M1: For a complete method for the inverse

A1ft: Two correct rows following through their determinant

A1ft: Fully correct inverse following through their determinant

(ii)

B1: Shows the statement is true for $n = 1$

M1: Assumes the statement is true for $n = k$

M1: Attempts to multiply the correct matrices

A1: Correct matrix in terms of k

A1: Correct matrix in terms of $k + 1$

A1: Correct complete conclusion