Question Number	Scheme	Notes	Marks
6(a)	$\begin{pmatrix}1 & r\\0 & 2\end{pmatrix}^n=\begin{pmatrix}1 & \left(2^n-1\right)r\\0 & 2^n\end{pmatrix}$		
	Evaluates LHS & RHS for $n = 1$. LHS & RHS indicated (or "true" seen) if not equated $\left(\text{LHS}=\right)\begin{pmatrix}1 & r\\0 & 2\end{pmatrix}^1$ or $\begin{pmatrix}1 & r\\0 & 2\end{pmatrix}=\begin{pmatrix}1 & \left(2^1-1\right)r\\0 & 2^1\end{pmatrix}$ or $\begin{pmatrix}1 & (2-1)r\\0 & 2\end{pmatrix}\left(=\text{RHS}\right)$		**B1**
	Assume true for $n = k$, i.e., $\begin{pmatrix}1 & r\\0 & 2\end{pmatrix}^k=\begin{pmatrix}1 & (2^k-1)r\\0 & 2^k\end{pmatrix}$		
	$\begin{pmatrix}1 & r\\0 & 2\end{pmatrix}^{k+1}=\begin{pmatrix}1 & r\\0 & 2\end{pmatrix}\begin{pmatrix}1 & (2^k-1)r\\0 & 2^k\end{pmatrix}$	Uses $n = k$ result to form expression for $\begin{pmatrix}1 & r\\0 & 2\end{pmatrix}^{k+1}$ Implied by 3 correct elements if they immediately multiply provided the result is not just the "given" answer and allow this to be the intermediate step	**M1**
	$=\begin{pmatrix}1 & (2^k-1)r+2^k r\\0 & 2(2^k)\end{pmatrix}=\begin{pmatrix}1 & (2^{k+1}-1)r\\0 & 2^{k+1}\end{pmatrix}$	Correct result with intermediate step that involves the top right element and no errors seen in the algebra. Allow "meet in the middle" proofs. Only allow $(2^{k+1}-1)r$ written as $r(2^{k+1}-1)$ or $(-1+2^{k+1})r$ or $r(-1+2^{k+1})$. No $2\left(2^k\right)$s for 2^{k+1}	**A1**
	Alternatively: $\begin{pmatrix}1 & r\\0 & 2\end{pmatrix}^{k+1}=\begin{pmatrix}1 & (2^k-1)r\\0 & 2^k\end{pmatrix}\begin{pmatrix}1 & r\\0 & 2\end{pmatrix}=\begin{pmatrix}1 & r+2\left(2^k-1\right)r\\0 & 2\left(2^k\right)\end{pmatrix}=\begin{pmatrix}1 & \left(2^{k+1}-1\right)r\\0 & 2^{k+1}\end{pmatrix}$		
	True for $n = 1$, if **true for $n = k$ <u>then</u> true for $n = k + 1$**, **true for all** (positive integers) n Correct conclusion or narrative. Minimum in **bold**. "Assume **true** for $n = k$ ... **true** for $n = k + 1$" is sufficient for the "**<u>then</u>**" The two previous marks are required and this mark can only follow B0 if the B mark was only withheld for insufficient working provided there was an attempt with $n = 1$. Ignore further verifications for $n = 2$ etc. Condone "for all $n \in \mathbb{Z}$" but **not** $n \in \mathbb{R}$ Condone work with n used for k.		**A1**
			(4)
(b)(i)	$\begin{pmatrix}1 & -2\\0 & 2\end{pmatrix}^4=\begin{pmatrix}1 & (2^4-1)(-2)\\0 & 24\end{pmatrix}=\begin{pmatrix}1 & -30\\0 & 16\end{pmatrix}$	Correct matrix **N.** Could come from manual multiplication or calculator	**B1**
(ii)	$\mathbf{B}=\mathbf{NM}=\begin{pmatrix}1 & -30\\0 & 16\end{pmatrix}\begin{pmatrix}4 & 0\\0 & 5\end{pmatrix}=...$	Attempts **NM** with their **N**. Must not be **MN**. The **N** must have exactly three non-zero elements with 0 as the first element in the second row and their **NM** must have three elements correct for their matrices	**M1**
	$\begin{pmatrix}4 & -150\\0 & 80\end{pmatrix}$	Correct matrix **B**	**A1**
			(3)
(c)	$\det\mathbf{B}=4\times80-(0\times(-150))=320$ area $S=\dfrac{720}{320}$	A correct non-zero value for the determinant of their **B** (no more than two zero elements) **and** divides this result into 720 to obtain a value for the area	**M1**
	$\frac{9}{4}$ or $2\frac{1}{4}$ or 2.25	Correct area. Any exact equivalent. <u>Must follow a correct **B**.</u> Answer only is M1A1 if **B** correct.	**A1**
			(2)
			Total 9