Mark Scheme 4725
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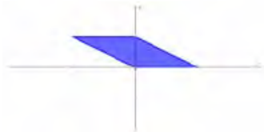
1.	i) $\begin{pmatrix} 7 & 4 \\ 0 & -1 \end{pmatrix}$	B1 B1	 2	Two elements correct All four elements correct
	(ii) $\begin{pmatrix} 3 & 0 \\ 0 & 3 \end{pmatrix}$ $k = 3$	B1 B1	 2 $\boxed{4}$	**A** – **B** correctly found Find k
2	(i) 	M1 A1	 2	For 2 other correct vertices For completely correct diagram
	(ii) $\begin{pmatrix} 1 & -1 \\ 0 & 1 \end{pmatrix}$	B1 B1	2 $\boxed{4}$	Each column correct
3.	(i) $2 + 3i$	B1	1	Conjugate seen
	(ii) $p = -4$ $q = 13$	M1 A1 M1 A1	 4 $\boxed{5}$	Attempt to sum roots or consider x terms in expansion or substitute 2 – 3i into equation and equate imaginary parts Correct answer Attempt at product of roots or consider last term in expansion or consider real parts Correct answer

4.	$\Sigma r^3 + \Sigma r^2$	M1		Consider the sum as two separate parts
	$\Sigma r^2 = \frac{1}{6}n(n+1)(2n+1)$	A1		Correct formula stated
	$\Sigma r^3 = \frac{1}{4}n^2(n+1)^2$	A1		Correct formula stated
	$\frac{1}{12}n(n+1)(n+2)(3n+1)$	M1		Attempt to factorise and simplify or expand both expressions
		A1	5	Obtain given answer correctly or complete verification
			$\boxed{5}$	
5.	(i) -7i	B1		Real part correct
		B1	2	Imaginary part correct
	(ii) 2 + 3i	B1		iz stated or implied or $i^2 = -1$ seen
		B1		Real part correct
	-5 + 12i	B1	3	Imaginary part correct
	(iii) $\frac{1}{5}(4 - 7i)$ or equivalent	M1		Multiply by conjugate
		A1		Real part correct
		A1	3	Imaginary part correct
			$\boxed{8}$	**N.B. Working must be shown**
6..	(i) Circle , Centre O radius 2	B1 B1		Sketch showing correct features
	One straight line	B1		
	Through O with +ve slope	B1		
	In 1st quadrant only	B1	5	
	(ii) $1 + i\sqrt{3}$	M1		Attempt to find intersections by trig, solving equations or from graph
		A1	2	Correct answer stated as complex number
			$\boxed{7}$	

7.	(i)	M1		Attempt at matrix multiplication
	$\mathbf{A}^2 = \begin{pmatrix} 4 & 0 \\ 0 & 1 \end{pmatrix}$ $\mathbf{A}^3 = \begin{pmatrix} 8 & 0 \\ 0 & 1 \end{pmatrix}$	A1 A1	3	Correct $\mathbf{A}^2$ Correct $\mathbf{A}^3$
	(ii) $\mathbf{A}^n = \begin{pmatrix} 2^n & 0 \\ 0 & 1 \end{pmatrix}$	B1	1	Sensible conjecture made
	(iii)	B1 M1 A1 A1	4 $\boxed{8}$	State that conjecture is true for $n = 1$ or 2 Attempt to multiply $\mathbf{A}^n$ and $\mathbf{A}$ or vice versa Obtain correct matrix Statement of induction conclusion
8.	(i)	M1		Correct expansion process shown
	$a\begin{bmatrix} a & 0 \\ 2 & 1 \end{bmatrix} - 4\begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix} + 2\begin{bmatrix} 1 & a \\ 1 & 2 \end{bmatrix}$	A1		Obtain correct unsimplified expression
	$a^2 - 2a$	A1	3	Obtain correct answer
	(ii)	M1		Solve their det $\mathbf{M} = 0$
	$a = 0$ or $a = 2$	A1A1ft	3	Obtain correct answers
	(iii) (a)	B1 B1		Solution, as inverse matrix exists or $\mathbf{M}$ non-singular or det$\mathbf{M} \neq 0$
	(b)	B1 B1	4 $\boxed{10}$	Solutions, eqn. 1 is multiple of eqn 3

9.	(i)	M1 A1	2	Show that terms cancel in pairs Obtain given answer correctly
	(ii)	M1 A1	2	Attempt to expand and simplify Obtain given answer correctly
	(iii) $(n+1)^3 - 1 - \frac{3}{2}n(n+1) - n$ $\frac{1}{2}n(n+1)(2n+1)$	B1 B1 M1 M1 A1 A1	6 $\boxed{10}$	Correct Σr stated $\Sigma 1 = n$ Consider sum of three separate terms on RHS Required sum is LHS – two terms Correct unsimplified expression Obtain given answer correctly

10	(i) $\alpha + \beta + \gamma = 2$ $\alpha\beta\gamma = -4$	B1 B1		Write down correct values
.	$\alpha\beta + \beta\gamma + \gamma\alpha = 3$	B1	3	
	(ii)	M1		Sum new roots
	$\alpha + 1 + \beta + 1 + \gamma + 1 = 5$	A1ft		Obtain numeric value using their (i)
	$p = -5$	A1ft	3	p is negative of their answer
	(iii)	M1*		Expand three brackets
		A1		$\alpha\beta\gamma + \alpha\beta + \beta\gamma + \gamma\alpha + \alpha + \beta + \gamma + 1$
		DM1		Use their (i) results
		A1ft		Obtain 2
	$q = -2$	A1ft	5	q is negative of their answer
		M2 A1 M1 A2 A1 A1	$\boxed{11}$	**Alternative for (ii) & (iii)** Substitute $x = u - 1$ in given equation Obtain correct unsimplified equation for u Expand Obtain $u^3 - 5u^2 + 10u - 2 = 0$ State correct values of p and q.