Mark Scheme 4725 June 2006

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

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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
			5	
5.	(i) -7i	B1 B1	2	Real part correct Imaginary part correct
	(ii) 2 + 3i	B1 B1		iz stated or implied or $i^2 = -1$ seen Real part correct
	-5 + 12i	B1	3	Imaginary part correct
	(iii) $\frac{1}{5}(4-7i)$ or equivalent	M1 A1 A1	3 8	Multiply by conjugate Real part correct Imaginary part correct N.B. Working must be shown
6	 (i) Circle, Centre O radius 2 One straight line Through O with +ve slope In 1st quadrant only 	B1 B1 B1 B1 B1 B1	5	Sketch showing correct features
	(ii) $1 + i\sqrt{3}$	M1		Attempt to find intersections by trig, solving equations or from graph
		A1	2 7	Correct answer stated as complex number

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 A^2 Correct 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	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	
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 M non- singular or det $\mathbf{M} \neq 0$
	(b)	B1 B1	4	Solutions, eqn. 1 is multiple of eqn 3
			10	

		1		
9.				
	(i)	M1		Show that terms cancel in pairs
		A1		Obtain given answer correctly
	(ii)	M1		Attempt to expand and simplify
		A1		Obtain given answer correctly
	(iii)	B1		Correct Σr stated
		B1		$\Sigma 1 = n$
		M1		Consider sum of three separate terms on RHS
	$(1)^{3}$ 1 3 (11)	M1		Required sum is LHS – two terms
	(n + 1) - 1n(n + 1) - n	A1		Correct unsimplified expression
	$\frac{1}{2}n(n+1)(2n+1)$	A1		Obtain given answer correctly
	$2^{n(n+1)(2n+1)}$		2	Solum given answer correctly
			2	
			6 10	
			μυ	

10	(i) $\alpha + \beta + \gamma = 2$ $\alpha\beta\gamma = -4$	B1 B1		Write down correct values
	$\alpha\beta + \beta\gamma + \gamma\alpha = 3$	B 1	3	
	(ii)	M1		Sum new roots
	$\alpha + 1 + \beta + 1 + \gamma + 1 = 5$	A1ft		Obtain numeric value using their (i)
	<i>p</i> = -5	A1ft	3	<i>p</i> 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
	<i>q</i> = -2	A1ft	5	q is negative of their answer
		M2 A1 M1 A2 A1 A1	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 .