Mark Scheme 4725 January 2006

## 4725

Mark Total

1.	(i) $2 + 16i - i - 8i^{2}$ 10 + 15i (ii) $\frac{1}{5}(10 + 15i)$ or $2 + 3i$	M1 A1 M1 A1 A1ft	2	Attempt to multiply correctly Obtain correct answer Multiply numerator & denominator by conjugate Obtain denominator 5 Their part (i) or 10 + 15i derived again / 5
			5	
2.	$1^2 = \frac{1}{6} \times 1 \times 2 \times 3$	B1		Show result true for $n = 1$ or 2
	$\frac{1}{2}n(n+1)(2n+1) + (n+1)^2$	M1		Add next term to given sum formula, any letter OK
	6	DM1		Attempt to factorise or expand and simplify
	$\frac{1}{6}(n+1)(n+2)\{2(n+1)+1\}$	A1	5	Correct expression obtained
	0	A1	5	Specific statement of induction conclusion, with no errors seen
3.	(i)			
	$2\begin{bmatrix} 2 \\ 1 \\ 1 \end{bmatrix} - 1\begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix} + 3\begin{bmatrix} 1 \\ 2 \\ 1 \end{bmatrix}$	M1		Show correct expansion process, allow sign slips
	2 x 5 – 1 x 2 +3 x -1 5 (ii)	A1 A1 B1ft	3	Obtain correct (unsimplified) expression Obtain correct answer State that <b>M</b> is non-singular as det <b>M</b> non-zero, ft their determinant
4.			4	
	$u^2 + 4u + 4$	B1		u + 2 squared and cubed correctly
	$u^3 + 6u^2 + 12u + 8$			
		M1		Substitute these and attempt to simplify
		A1		Obtain $u^{3} - 5 = 0$ or equivalent
	$u = \sqrt[3]{5}$	A1ft		Correct solution to their equation
	$x = 2 + \sqrt[3]{5}$	A1ft	5	Obtain 2 + their answer [ Decimals score 0/2 of final A marks]
			5	

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5.	$8\Sigma r^3 - 6\Sigma r^2 + 2\Sigma r$	M1		Co	nsider the sum of three separate terms
	$8\Sigma r^3 = 2n^2(n+1)^2$	A1		Co	prrect formula stated or used a.e.f.
	$6\Sigma r^2 = n(n + 1)(2n + 1)$	A1		Co	prrect formula stated or used a.e.f.
	$2\Sigma r = n(n+1)$	A1		Co	prrect term seen
	$2n^{3}(n+1)$ AG	M1 A1	6 6	Att Ob	tempt to factorise or expand and simplify otain given answer correctly
6.	(i) $\frac{1}{2}$ ( 8 - 2)	B1			Transpose leading diagonal and negate other diagonal
	$\left( \begin{array}{c} -3 \\ \end{array} \right)$	B1	2	2	Divide by determinant
	(ii) Either $\frac{1}{2} \begin{pmatrix} 14 & 2 \\ 5 & 0 \end{pmatrix}$	B1 M1A1			State or imply $(\mathbf{AB})^{-1} = \mathbf{B}^{-1}\mathbf{A}^{-1}$ Use this result and obtain $\mathbf{B}^{-1} = \mathbf{C}^{-1}\mathbf{A}$ , or equivalent matrix algebra
	( - 5 0 ) Or	M1 A1ft	5	5	Matrix multn., two elements correct, for any pair All elements correct ft their (i)
	$\frac{1}{5} \begin{pmatrix} 3 & -1 \\ -1 & 2 \end{pmatrix}$ $\mathbf{B} = \mathbf{A}^{-1} \mathbf{C}$	B1			Find <b>A</b> -1
	$\mathbf{B} = \frac{1}{5} \begin{pmatrix} 0 & -2 \\ 5 & 14 \end{pmatrix}$	M1			Premultiply by <b>A</b> <sup>-1</sup> stated or implied
	$\frac{1}{2}$ ( 14 2 )	A1ft			Matrix multn. Two elements correct All elements correct
	$\left( -50 \right)$ Or	A1			Correct <b>B</b> <sup>-1</sup>
	$\mathbf{AB} = \left( \begin{array}{c} 2a + c \ 2b + d \end{array} \right)$	B1			
	(a + 3cb + 3d) a = 0, c = 1, b = -0, 4, d = 2, 8	M1			Find <b>AB</b>
	u = 0, v = 1, v = -0.7, u = 2.0	A1A1			Solve one pair of simultaneous equations
	$\left  \frac{1}{2} \right  \left( \begin{array}{c} 14 & 2 \\ -7 & -7 \\ -7 $	A1			Each pair of answers
	(-50)			7	Correct <b>B</b> <sup>-1</sup>

-				
7.	(a) (i) $\sqrt{13}$	B1	1	Obtain correct answer, decimals OK
	(ii) - 0.59 (b) 1 – 2i	M1 A1 A1 M1 A1A1 A1	3	Using tan $^{-1 b}/_{a}$ , or equivalent trig allow + or - Obtain 0.59 Obtain correct answer Express LHS in Cartesian form & equate real and imaginary parts Obtain $x = 1$ and $y = -2$ Correct answer written as a complex number
	(c)	B1 B1	2	Sketch of vertical straight line Through (- 0.5, 0)
			10	
8.	(i) $\begin{pmatrix} 0\\0 \end{pmatrix} \begin{pmatrix} 2\\0 \end{pmatrix} \begin{pmatrix} 2\\-2 \end{pmatrix} \begin{pmatrix} 0\\-2 \end{pmatrix}$	B1 B1 B1	3	For correct vertex (2, -2) For all vertices correct For correct diagram
	(ii) Either $\begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$	B1,B1 B1		Reflection, in <i>x</i> -axis Correct matrix
	$\left(\begin{array}{cc} 2 & 0 \\ 0 & 2 \end{array}\right)$	B1,B1 B1	6	Enlargement, centre <i>O</i> s.f.2 Correct matrix
	Or $\begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}$	B1,B1 B1		Reflection, in the <i>y</i> -axis Correct matrix
	$\left(\begin{array}{rrr} -2 & 0 \\ 0 & -2 \end{array}\right)$	B1,B1 B1		Enlargement, centre <i>O</i> s.f. –2 Correct matrix
	Or $\begin{pmatrix} 2 & 0 \\ 0 & 1 \end{pmatrix}$	B1,B1 B1		Stretch, in <i>x</i> -direction s.f. 2 Correct matrix
	$\left(\begin{array}{cc} 1 & 0 \\ 0 & -2 \end{array}\right)$	B1,B1 B1		Stretch, in <i>y</i> -direction s.f2 Correct matrix
			9	

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9.	(i) $r + 2 - r$	M1		Show correct process for subtracting fractions
	(1) $r(r+2)$			
	2	A1	2	Obtain given answer correctly
	r(r+2)			
	(ii) AG	M1		Express terms as differences using (i)
		M1		Express 1 <sup>st</sup> 3 (or last 3) terms so that cancelling occurs
		A1		Obtain $1 + \frac{1}{2}$
		A1		Obtain $-\frac{1}{n+2}$ , $-\frac{1}{n+1}$
	$\frac{3}{2} - \frac{1}{n+1} - \frac{1}{n+2}$	A1	5	Obtain correct answer in any form
	(iii) (a)			
	$\frac{3}{2}$	B1ft	1	Obtain value from their sum to <i>n</i> terms
	(b)			
	+	M1		Using (iii) (a) – (ii) or method of differences again $[n \rightarrow \infty]$ is a method error ]
	n+1 $n+2$	A1 ft	2	Obtain answer in any form
			10	
10.	(i)		10	
	$\alpha + \beta + \gamma = 9$	B1	1	
	(ii)	B1		State or use other root is $p - iq$
	$\rho - \rho$	M1		Substitute into (i)
	$p = \frac{y - x}{2}$	A1 A1	4	Obtain $2p + \alpha = 9$ Obtain correct answer a.e.f.
	(iii) $\alpha\beta\gamma = 29$	B1	1	
	(iv) $\alpha(p^2 + q^2) = 29$	M1 A1ft		Substitute into (iii)
	<b>X 1</b> /	M1		
				Rearrange to obtain $q$ or $q^{-}$
		M1		Substitute their expression for <i>p</i> a.e.f.
	$q = \sqrt{\frac{29}{\alpha}} - \frac{(9-\alpha)}{4}$	A1	5	Obtain correct answer a.e.f.
	$\alpha$ 4		11	
				Substitute into $\alpha\beta + \beta\gamma + \gamma\alpha = 27$
	(iv) Alternative method $2n\alpha + n^2 + a^2 - 27$	M1		Obtain unsimplified expression with no i's
	$2p\alpha + p + q = 21$			Rearrange to obtain $a$ or $a^2$
		M1		Substitute their expression for n a e f
	$\left(9-\alpha\right)^2$	M1		Substitute then expression for $\mu$ a.e.i.
	$q = \sqrt{27} - \frac{(y - \alpha)}{4} - \alpha(9 - \alpha)$	A1		Obtain correct answer a.e.f.