Mark Scheme 4725
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1	*EITHER* $a = 2$ $b = 2\sqrt{3}$, *OR* $a = 2 \quad b = 2\sqrt{3}$	M1 A1 M1 A1 M1 M1 A1 A1	 4 **4**	Use trig to find an expression for a (or b) Obtain correct answer Attempt to find other value Obtain correct answer a.e.f. (Allow 3.46) State 2 equations for a and b Attempt to solve these equations Obtain correct answers a.e.f. SR ± scores A1 only
2	$(1^3 =) \frac{1}{4} \times 1^2 \times 2^2$ $\frac{1}{4} n^2(n+1)^2 + (n+1)^3$ $\frac{1}{4}(n+1)^2(n+2)^2$	B1 M1 M1(indep) A1 A1	 5 **5**	Show result true for $n = 1$ Add next term to given sum formula Attempt to factorise and simplify Correct expression obtained convincingly Specific statement of induction conclusion
3	$3\Sigma r^2 - 3\Sigma r + \Sigma 1$ $3\Sigma r^2 = \frac{1}{2} n(n+1)(2n+1)$ $3\Sigma r = \frac{3}{2} n(n+1)$ $\Sigma 1 = n$ n^3	M1 A1 A1 A1 M1 A1	 6 **6**	Consider the sum of three separate terms Correct formula stated Correct formula stated Correct term seen Attempt to simplify Obtain given answer correctly
4	(i) $\frac{1}{2} \begin{pmatrix} 5 & -1 \\ -3 & 1 \end{pmatrix}$ (ii) $\frac{1}{2} \begin{pmatrix} 2 & 0 \\ 23 & -5 \end{pmatrix}$	B1 B1 M1 M1(indep) A1ft A1ft	 2 4 **6**	Transpose leading diagonal and negate other diagonal or solve sim. eqns. to get 1st column Divide by the determinant or solve 2nd pair to get 2nd column Attempt to use $B^{-1}A^{-1}$ or find B Attempt at matrix multiplication One element correct, a.e.f, All elements correct, a.e.f. NB ft consistent with their (i)

5	(i) $\frac{1}{r(r+1)}$ (ii) $1-\frac{1}{n+1}$ (iii) $S_\infty = 1$ $\frac{1}{n+1}$	B1 M1 M1 A1 B1ft M1 A1 c.a.o.	1 3 3 **7**	Show correct process to obtain given result Express terms as differences using (i) Show that terms cancel Obtain correct answer, must be *n* not any other letter State correct value of sum to infinity Ft their (ii) Use sum to infinity – their (ii) Obtain correct answer a.e.f.
6	(i) (a) $\alpha+\beta+\gamma=3, \alpha\beta+\beta\gamma+\gamma\alpha=2$ (b) $\alpha^2+\beta^2+\gamma^2=(\alpha+\beta+\gamma)^2-2(\alpha\beta+\beta\gamma+\gamma\alpha)$ $=9-4=5$ (ii) (a) $\frac{3}{u^3}-\frac{9}{u^2}+\frac{6}{u}+2=0$ $2u^3+6u^2-9u+3=0$ (b) $\frac{1}{\alpha}+\frac{1}{\beta}+\frac{1}{\gamma}=-3$	B1 B1 M1 A1 ft M1 A1 M1 A1ft	2 2 2 2 **8**	State correct values State or imply the result and use their values Obtain correct answer Use given substitution to obtain an equation Obtain correct answer Required expression is related to new cubic stated or implied -(their "b" / their "a")

7	(i) $a(a - 12) + 32$ (ii) det **M** = 12 non-singular (iii) *EITHER* *OR*	M1 M1 A1 M1 A1ft B1 M1 A1 M1 A1 A1	 3 2 3 **8**	Show correct expansion process Show evaluation of a 2 x 2 determinant Obtain correct answer a.e.f. Substitute $a = 2$ in their determinant Obtain correct answer and state a consistent conclusion det M = 0 so non-unique solutions Attempt to solve and obtain 2 inconsistent equations Deduce that there are no solutions Substitute $a = 4$ and attempt to solve Obtain 2 correct inconsistent equations Deduce no solutions
8	(i) Circle, centre (3, 0), *y*-axis a tangent at origin Straight line, through (1, 0) with +ve slope In 1st quadrant only (ii) Inside circle, below line, above *x*-axis	B1B1 B1 B1 B1 B1 B2ft	 6 2 **8**	Sketch showing correct features N.B. treat 2 diagrams asa MR Sketch showing correct region SR: B1ft for any 2 correct features

9	(i) $\begin{pmatrix} \sqrt{2} & 0 \\ 0 & \sqrt{2} \end{pmatrix}$	B1	1	Correct matrix
	(ii) Rotation (centre O), 45^0, clockwise	B1B1B1	3	Sensible alternatives OK, must be a single transformation
	(iii)	B1	1	Matrix multiplication or combination of transformations
	(iv) $\begin{pmatrix} 0 \\ 0 \end{pmatrix}$ $\begin{pmatrix} 1 \\ 1 \end{pmatrix}$ $\begin{pmatrix} 1 \\ -1 \end{pmatrix}$ $\begin{pmatrix} 2 \\ 0 \end{pmatrix}$	M1 A1	2	For at least two correct images For correct diagram
	(v) det **C** = 2	B1		State correct value
	area of square has been doubled	B1	2	State correct relation a.e.f.
			9	
10	(i)	M1		Attempt to equate real and imaginary parts of $(x + iy)^2$ and 16+30i
	$x^2 - y^2 = 16$ and $xy = 15$	A1A1		Obtain each result
		M1		Eliminate to obtain a quadratic in x^2 or y^2
	$\pm(5 + 3i)$	M1		Solve to obtain $x = (\pm)\,5$ or $y = (\pm)\,3$
	(ii)	A1	6	Obtain correct answers as complex numbers
	$z = 1 \pm \sqrt{16 + 30i}$	M1*		Use quadratic formula or complete the square
	6 + 3i, -4 - 3i	A1 *M1dep A1 A1ft	5	Simplify to this stage Use answers from (i) Obtain correct answers
			11	