4725 Further Pure Mathematics 1

1		M1		Multiply by conjugate of denominator
1		A1 A1		Obtain correct numerator
	7 + 17;	A1	4	Obtain correct denominator
	$\frac{7}{26} + \frac{17}{26}$ i.		4	
2	$\begin{pmatrix} 5 & 0 \end{pmatrix}$	B1		Both diagonals correct
	(i) $\frac{1}{10} \begin{pmatrix} 5 & 0 \\ -a & 2 \end{pmatrix}$	B1	2	Divide by correct determinant
	$\left(-a 2\right)$			
	(ii) $\begin{pmatrix} 3 & -2 \end{pmatrix}$	B1		Two elements correct
	$\begin{pmatrix} \mathbf{n} \end{pmatrix} \begin{pmatrix} 2a & 6 \end{pmatrix}$	B1	2	Remaining elements correct
			4	
3		M1		Express as sum of 3 terms
	$n^{2}(n+1)^{2} + n(n+1)(2n+1) + n(n+1)$	A1		2 correct unsimplified terms
		A1		3 rd correct unsimplified term
	$n(n+1)^2(n+2)$	M1		Attempt to factorise
	n(n+1) (n+2)	A1ft	_	Two factors found, ft their quartic
		A1	6	Correct final answer a.e.f.
		D1	6	
4		B1 M1		State or use correct result
		M1		Combine matrix and its inverse Obtain \mathbf{L} or \mathbf{L}^2 but not 1
	$\begin{pmatrix} 0 & 0 \end{pmatrix}$	A1	4	Obtain I or I^2 but not 1
	$\begin{pmatrix} 0 & 0 \end{pmatrix}$	A1	4 4	Obtain zero matrix but not 0 S.C. IS $0/4$, D1 for AA^{-1} , I
5		M1	4	S.C. If 0/4, B1 for $AA^{-1} = I$ Consider determinant of coefficients of LHS
Э	Either	M1 M1		
	4k-4	A1		Sensible attempt at evaluating any 3×3 det
	$4\kappa - 4$	M1		Obtain correct answer a.e.f. unsimplified
	k = 1	Alft	5	Equate det to 0 Obtain $k = 1$, ft provided all M's awarded
	$\kappa = 1$	AIIt	5	$\int \frac{1}{k} = 1$, it provided all wiss awarded
	Or	M1		Eliminate either x or y
		A1		Obtain correct equation
		M1		Eliminate 2 nd variable
		A1		Obtain correct linear equation
		A1		Deduce that $k = 1$
			5	
6	(i) Either	B1 DB1	2	Reflection, in <i>x</i> -axis
	Or	B1 DB1		Stretch parallel to y-axis, s.f. –1
			-	
	(ii)	B1 DB1	2	Reflection, in $y = -x$
	(iii) $\begin{pmatrix} 0 & 1 \\ 0 & 1 \end{pmatrix}$	D1 D1	2	Each achumn connact
	(iii) $\begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}$	B1 B1	2	Each column correct
	(iv)	B1B1B1	3	Rotation, 90° , clockwise about O
		2.2.21	9	S.C. If (iii) incorrect, B1 for identifying
			-	their transformation, B1 all details correct
L		J		

7	(i) $13^n + 6^{n-1} + 13^{n+1} + 6^n$ (ii)	B1 M1 A1 B1 B1 B1 B1 B1	3 4 7	Correct expression seen Attempt to factorise both terms in (i) Obtain correct expression Check that result is true for $n = 1$ (or 2) Recognise that (i) is divisible by 7 Deduce that u_{n+1} is divisible by 7 Clear statement of Induction conclusion
8	(i)	M1 A1	2	Expand at least 1 of the brackets Derive given answer correctly
	(ii) $\alpha + \beta = 6k, \alpha\beta = k^2$ $\alpha - \beta = (4\sqrt{2})k$	B1 B1 M1 A1	4	State or use correct values Find value of $\alpha - \beta$ using (i) Obtain given value correctly (allow if $-6k$ used)
	(iii) $\sum \alpha' = 6k$	B1ft	-	Sum of new roots stated or used
	$\alpha' \beta' = \alpha \beta - (\alpha - \beta) - 1$	M1		Express new product in terms of old roots
	$\alpha'\beta' = k^2 - (4\sqrt{2})k - 1$	A1ft		Obtain correct value for new product
	$x^{2} - 6kx + k^{2} - (4\sqrt{2})k - 1 = 0$	B1ft	4 10	Write down correct quadratic equation
9	(i)	M1 A1	2	Use correct denominator Obtain given answer correctly
	(ii) $1 + \frac{1}{3} - \frac{1}{2n-1} - \frac{1}{2n+1}$	M1 M1 A1 A1 M1 A1	6	Express terms as differences using (i) Do this for at least 1^{st} 3 terms First 3 terms all correct Last 3 terms all correct (in terms or <i>n</i> or <i>r</i>) Show pairs cancelling Obtain correct answer, a.e.f.(in terms of <i>n</i>)
	(iii) $\frac{4}{3}$	B1ft	1 9	Given answer deduced correctly, ft their (ii)

10	(i) $x^2 - y^2 = 2, 2xy = \sqrt{5}$	M1 A1		Attempt to equate real and imaginary parts Obtain both results a.e.f.
	$4x^{4} - 8x^{2} - 5 = 0$ $x = \pm \frac{\sqrt{10}}{2}, y = \pm \frac{\sqrt{2}}{2}$	M1 M1 A1		Eliminate to obtain quadratic in x^2 or y^2 Solve to obtain x (or y) values Correct values for both x & y obtained a.e.f.
	$\pm \left(\frac{\sqrt{10}}{2} + i\frac{\sqrt{2}}{2}\right)$	A1	6	Correct answers as complex numbers
	(ii) $z^2 = 2 \pm i \sqrt{5}$ $z = \pm (\frac{\sqrt{10}}{2} \pm i \frac{\sqrt{2}}{2})$	M1 A1 M1 A1ft	4	Solve quadratic in z^2 Obtain correct answers Use results of (i) Obtain correct answers, ft must include root from conjugate
	(iii)	B1ft	1	Sketch showing roots correctly
	(iv)	B1 B1ft B1ft	3 14	Sketch of straight line, \perp to α Bisector