4725 Further Pure Mathematics 1

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

7	(i) $13^n + 6^{n-1} + 13^{n+1} + 6^n$	B1 M1 A1	3	Correct expression seen Attempt to factorise both terms in (i) Obtain correct expression
	(ii)	B1 B1 B1 B1	4 **7**	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) $\sum \alpha' = 6k$ $\alpha'\beta' = \alpha\beta - (\alpha - \beta) - 1$ $\alpha'\beta' = k^2 - (4\sqrt{2})k - 1$ $x^2 - 6kx + k^2 - (4\sqrt{2})k - 1 = 0$	B1ft M1 A1ft B1ft	4 **10**	Sum of new roots stated or used Express new product in terms of old roots Obtain correct value for new product 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 1st 3 terms First 3 terms all correct Last 3 terms all correct (in terms or n or r) Show pairs cancelling Obtain correct answer, a.e.f.(in terms of n)
	(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.
	$4x^4 - 8x^2 - 5 = 0$	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.
	$x = \pm\frac{\sqrt{10}}{2}, y = \pm\frac{\sqrt{2}}{2}$ $\pm(\frac{\sqrt{10}}{2} + i\frac{\sqrt{2}}{2})$	A1	6	Correct answers as complex numbers
	(ii) $z^2 = 2 \pm i\sqrt{5}$	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
	$z = \pm(\frac{\sqrt{10}}{2} \pm i\frac{\sqrt{2}}{2})$			
	(iii)	B1ft	1	Sketch showing roots correctly
	(iv)	B1 B1ft B1ft	 3 **14**	Sketch of straight line, $\perp$ to α Bisector