4725 Further Pure Mathematics 1

1.		B1		State correct value of S_{250} or S_{100}
		M1		Subtract $S_{250} - S_{100}$ (or S_{101} or S_{99})
	$984390625 - 25502500 = 958888125$	A1	**3**	Obtain correct exact answer
			3	
2.	$3a + 5b = 1, \ a + 2b = 1$	M1		Obtain a pair of simultaneous
		M1		equations
	$a = -3, b = 2$	A1 A1	**4**	Attempt to solve
			4	Obtain correct answers.
3.	(i) $11 - 29i$	B1 B1	**2**	Correct real and imaginary parts
	(ii) $1 + 41i$	B1 B1	**2**	Correct real and imaginary parts
			4	
4.	Either $p + q = -1, pq = -8$	B1		Both values stated or used
	$\dfrac{p+q}{pq}$	B1		Correct expression seen
		M1		Use their values in their expression
	$-\dfrac{7}{8}$	A1	**4**	Obtain correct answer
			4	
	Or $\dfrac{1}{p} + \dfrac{1}{q} = 8$	B1		Substitute $x = \frac{1}{u}$ and use new quadratic
	$p + q = 1$	B1		Correct value stated
	$-\dfrac{7}{8}$	M1		Use their values in given expression
		A1		Obtain correct answer
	Or $\dfrac{-1 \pm \sqrt{33}}{2}$	M1		Find roots of given quadratic equation
		A1		Correct values seen
	$-\dfrac{7}{8}$	M1		Use their values in given expression
		A1		Obtain correct answer
5.	(i) $u^3 = \{(-)(5u + 7)\}^2$	M1		Use given substitution and rearrange
		A1		Obtain correct expression, or equivalent
	$u^3 - 25u^2 - 70u - 49 = 0$	A1	**3**	Obtain correct final answer
	(ii)	M1		Use coefficient of u of their cubic or identity connecting the symmetric functions and substitute values from given equation
	-70	A1 ft	**2**	Obtain correct answer
			5	

6.	(i) $3\sqrt{2}, -\frac{\pi}{4}$ or -45° AEF	B1 B1	2	State correct answers
	(ii)(a)	B1B1 B1 ft	3	Circle, centre (3, -3), through O ft for $(\pm 3, \pm 3)$ only
	(ii)(b)	B1 B1 B1	3	Straight line with +ve slope, through (3, -3) or their centre Half line only starting at centre
	(iii)	B1ft B1ft B1ft	3	Area above horizontal through a, below (ii) (b) Outside circle
			11	
7.	(i)	M1 A1	2	Show that terms cancel in pairs Obtain given answer correctly
	(ii)	M1 A1	2	Attempt to expand and simplify Obtain given answer correctly
	(iii)	B1 B1		Correct $\sum r$ stated $\quad \sum 1 = n$
		M1* *DM1		Consider sum of 4 separate terms on RHS Required sum is LHS – 3 terms
	$(n+1)^4 - 1 - n(n+1)(2n+1) - 2n(n+1) - n$	A1		Correct unsimplified expression
	$4\sum_{r=1}^{n} r^3 = n^2(n+1)^2$	A1	6	Obtain given answer correctly
			10	
8.	(i)	B1 B1 B1	3	Find coordinates (0, 0) (3, 1) (2, 1) (5, 2) found Accurate diagram sketched
	(ii) $\begin{pmatrix} 1 & 0 \\ 1 & 1 \end{pmatrix}$	B1 B1	2	Each column correct
	(iii) *Either* $\begin{pmatrix} 1 & 2 \\ 0 & 1 \end{pmatrix}$	B1 M1 A1ft		Correct inverse for their (ii) stated Post multiply **C** by inverse of (ii) Correct answer found
	Or	M1 A2ft		Set up 4 equations for elements from correct matrix multiplication All elements correct, -1 each error
		B1 B1 B1	6 **11**	Shear, x axis invariant or parallel to x-axis eg image of (1, 1) is (3, 1) **SR** allow s.f. 2 or shearing angle of correct angle to appropriate axis

9.			M1		Correct expansion process shown
	(i) $\quad a\begin{vmatrix} a & 1 \\ 1 & 2 \end{vmatrix} - \begin{vmatrix} 1 & 1 \\ 1 & 2 \end{vmatrix} + \begin{vmatrix} 1 & a \\ 1 & 1 \end{vmatrix}$		A1		Obtain correct unsimplified expression
	$\quad\quad 2a^2 - 2a$		A1	3	Obtain correct answer
	(ii)		M1		Equate their det to 0
	$\quad\quad a = 0$ or 1		A1ft		Obtain correct answers, ft solving a quadratic
			A1ft	3	
	(iii) (a)		B1 B1		Equations consistent, but non unique solutions
	$\quad\quad$ (b)		B1		Correct equations seen &
			B1	4	inconsistent, no solutions
				10	
10.	i)		M1		Attempt to find next 2 terms
	$\quad\quad u_2 = 7 \quad u_3 = 19$		A1		Obtain correct answers
			A1	3	Show given result correctly
	(ii)		M1		Expression involving a power of 3
	$\quad\quad u_n = 2(3^{n-1}) + 1$		A1	2	Obtain correct answer
	(iii)		B1ft		Verify result true when $n = 1$ or $n = 2$
			M1		Expression for u_{n+1} using recurrence relation
	$\quad\quad u_{n+1} = 3(2(3^{n-1})+1) - 2$		A1		Correct unsimplified answer
	$\quad\quad u_{n+1} = 2(3^n) + 1$		A1		Correct answer in correct form
			B1		Statement of induction conclusion
				5	
				10	