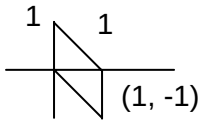
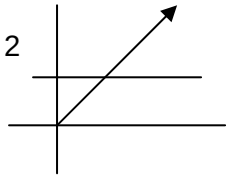
4725 Further Pure Mathematics 1

1	(i)  (ii) $\begin{pmatrix} 1 & 0 \\ -1 & 1 \end{pmatrix}$	M1 A1 B1 B1	2 2 **4**	For 2 other correct vertices seen, correct direction of shear seen For completely correct diagram, must include scales Each column correct
2	$\frac{a}{6}n(n+1)(2n+1)+bn$ $a = 6$ $b = -3$	M1 A1 M1 A1 A1	 5 **5**	Consider sum as two separate parts Correct answer a.e.f. Compare co-efficients Obtain correct answers
3	(i) $7u^3 + 24u^2 - 3u + 2 = 0$ (ii) *EITHER* correct value is $-\frac{3}{7}$ *OR* correct value is $-\frac{3}{7}$	M1 A1 M1 A1ft M1 A1	 2 2 **4**	Use given substitution Obtain correct equation a.e.f. Required expression related to new cubic Their c / their a Use $\frac{\alpha+\beta+\gamma}{\alpha\beta\gamma}$ or equivalent Obtain correct answer
4	(i) $z^* = 3 + 4i$ $21 + 12i$ (ii) $3 - 5i$ $-16 - 30i$ (iii) $\frac{9}{25} + \frac{12}{25}i$	B1 B1 B1 B1ft B1ft M1 A1 A1	 2 3 3 **8**	Conjugate seen or implied Obtain correct answer Correct $z - i$ or expansion of $(z - I)^2$ seen Real part correct Imaginary part correct Multiply by conjugate Numerator correct Denominator correct
5	(i) $\begin{pmatrix} -13 \\ 1 \\ -10 \end{pmatrix}$ (ii) $\begin{pmatrix} 8 & 16 & -4 \\ 0 & 0 & 0 \\ 6 & 12 & -3 \end{pmatrix}$ (iii) (8)	B1 B1 M1 A1A1A1 M1 A1	 2 4 2 **8**	4**B** seen or implied or 2 elements correct Obtain correct answer Obtain a 3 x 3 matrix Each row (or column) correct Obtain a single value Obtain correct answer, must have matrix

6	(i)  (ii) $2\sqrt{3} + 2\mathrm{i}$	B1 B1 B1 B1 B1 B1 M1 A1	 5 3 **8**	Horizontal straight line in 2 quadrants Through (0, 2) Straight line Through *O* with positive slope In 1st quadrant only State or obtain algebraically that $y = 2$ Use suitable trigonometry Obtain correct answer a.e.f. decimals OK must be a complex number
7	(i) $a = -6$ (ii) $\mathbf{A}^{-1} = \frac{1}{a+6}\begin{pmatrix} 1 & -3 \\ 2 & a \end{pmatrix}$ $x = \frac{4}{a+6}, y = \frac{2-a}{a+6}$	M1 A1 B1 B1ft M1 A1ft A1ft	 2 5 **7**	Use det **A** = 0 Obtain correct answer Both diagonals correct Divide by det **A** Premultiply column by $\mathbf{A}^{-1}$, no other method Obtain correct answers from their $\mathbf{A}^{-1}$
8	(i) $u_2 = 4,\ u_3 = 9,\ u_4 = 16$ (ii) $u_n = n^2$ (iii)	M1 A1 B1 B1 M1 A1 A1	 2 1 4 **7**	Obtain next terms All terms correct Sensible conjecture made State that conjecture is true for $n = 1$ or 2 Find u_{n+1} in terms of n Obtain $(n + 1)^2$ Statement of Induction conclusion
9	(i) $\alpha^3 + 3\alpha^2\beta + 3\alpha\beta^2 + \beta^3$ (ii) *Either* $\alpha + \beta = 5, \alpha\beta = 7$ $\alpha^3 + \beta^3 = 20$ $x^2 - 20x + 343 = 0$ *Or* $u^{\frac{2}{3}} - 5u^{\frac{1}{3}} + 7 = 0$ $u^3 - 20u + 343 = 0$	M1 A1 B1 B1 M1 A1 M1 A1ft M1 A1 M2 A2	 2 6 **8**	Correct binomial expansion seen Obtain given answer with no errors seen State or use correct values Find numeric value for $\alpha^3 + \beta^3$ Obtain correct answer Use new sum and product correctly in quadratic expression Obtain correct equation Substitute $x = u^{\frac{1}{3}}$ Obtain correct answer Complete method for removing fractional powers Obtain correct answer

10	(i)	M1 A1	 2	Attempt to combine 3 fractions Obtain given answer correctly
	(ii)	M1 A1 M1 A1 M1 A1	 6	Express at least first 3 terms using (i) All terms correct Express at least last 2 terms using (i) All terms correct in terms of n Show that correct terms cancel Obtain unsimplified correct answer
		$2+1-\frac{1}{2}-\frac{2}{n+1}-\frac{1}{n+2}$		
	(iii) $\frac{5}{2}$	B1ft	1	Obtain correct answer from their (ii)
	(iv) $\frac{2}{N+1}+\frac{1}{N+2}=\frac{7}{10}$	B1ft		Their (iii) – their (ii)
		M1		Attempt to clear fractions & solve equation, Obtain correct simplified equation
	$7N^2-9N-36=0$	A1		Obtain only the correct answer
	$N=3$	A1	4 **13**	