



GCE

Mathematics

Advanced GCE

Unit **4725**: Further Pure Mathematics 1

Mark Scheme for June 2011

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1 (i)	$\begin{pmatrix} 4 & 4a \\ 12 & 0 \end{pmatrix}$	B1	3B	seen or implied
		B1 B1	3	2 elements correct Other 2 elements correct, a.e.f., including brackets
<hr/>				
(ii)	$\begin{pmatrix} 4+4a & 3a \\ 4 & 1 \end{pmatrix}$	M1		Sensible attempt at matrix multiplication
		A1	2	for AB or BA Obtain correct answer
<hr/>				
2		B1 M1* DM1 A1 A1	5	Establish result true for $n = 1$ or 2 Add next term to given sum formula Combine with correct denominator Obtain correct expression convincingly Specific statement of induction conclusion, provided 1 st 4 marks earned
<hr/>				
3	$k^2 - 16$ $k = \pm 4$	B1 M1 A1	3	Obtain correct det Equate their det to 0 Obtain correct answers
<hr/>				
4	$3 \times \frac{1}{6} \times 2n(2n+1)(4n+1) - \frac{1}{2} \times 2n$ $2n^2(4n+3)$	M1 A1 A1 M1 A2	6	Express as sum of two series Each term correct a.e.f. Attempt to factorise Completely correct answer, (A1 if one factor not found)
<hr/>				
5 (i)	$ a = 2$ $\arg a = 60^\circ, \frac{\pi}{3}, 1.05$	B1 B1	2	Correct modulus Correct argument
<hr/>				
(ii)		B1 B1 B1 B1 B1* DB1	6	Circle Centre $(1, \sqrt{3})$ Through origin, centre $(\pm 1, \pm \sqrt{3})$ and another y intercept Vertical line Through a or their centre, with +ve gradient Correct half line
<hr/>				

6	$\det C = \Delta = 5a - 5$	$\frac{1}{\Delta} \begin{pmatrix} 5 & -4 & 1 \\ -5 & 4a & -a \\ 5 & -3a-1 & 2a-1 \end{pmatrix}$	<p>M1 Show correct expansion process for 3×3 or multiplication of C and adjC M1 Correct evaluation of any 2×2 A1 Obtain correct answer M1 Show correct process for adjoint entries A1 Obtain at least 4 correct entries in adjoint A1 Obtain completely correct adjoint B1 Divide their adjoint by their determinant</p>	7
7				
7 (i)			B1 1 Obtain given answer correctly	

(ii)			<p>M1 Express at least 1st two and last two terms using (i) A1 1st two terms correct A1 Last two terms correct M1 Show that correct terms cancel</p>	
	$\frac{3}{2} - \frac{1}{n} - \frac{1}{(n+1)}$		A1 5 Obtain correct answer, a.e.f. in terms of n	

(iii)			<p>B1ft Sum to infinity stated or implied or start at 1000 as in (ii) M1 S_{∞} – their (ii) with $n = 999$ or 1000 or show correct cancelling</p>	
	$\frac{1999}{999000}$		<p>A1 3 Obtain correct answer, a.e.f. (condone 0.002)</p>	
8				
8 (i)			<p>B1 (0, 3) seen B1 (3, 0) seen B1 3 Square with A ' B' and C' positioned correctly</p>	

(ii)	$\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix} \text{ or } \begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix}$		B1* Reflection in $y = x$ or $y = -x$	
	$\begin{pmatrix} 3 & 0 \\ 0 & 3 \end{pmatrix} \text{ or } \begin{pmatrix} -3 & 0 \\ 0 & -3 \end{pmatrix}$		DB1 Correct matrix, dep on stating reflection	
			B1* Enlargement scale factor 3 or s.f. -3	
			<p>DB1 4 Correct matrix, dep on stating enlargement S.C. B2 for a pair of transformations consistent with their diagram.</p>	
7				

9 (i)	$16 + 30i$	B1	1	State correct value
(ii)	$a = -32$	M1		Use $a = -(\text{sum of roots})$
		A1		Obtain correct answer
	$b = 1156$	M1		Use $b = \text{product of roots}$
		A1	4	Obtain correct answer
		M1		Substitute, expand and equate imag. parts
		A1		Obtain $a = -32$
		M1		Equate real parts
		A1		Obtain $b = 1156$
(iii)		M1		Attempt to equate real and imaginary parts of $(p+iq)^2$ & $16 - 30i$ or root from (ii)
	$p^2 - q^2 = 16$ and $pq = -15$	A1		Obtain both results cao
		M1		Obtain quadratic in p^2 or q^2
		M1		Solve to obtain $p = (\pm)5$ or $q = (\pm)3$
		A1		Obtain 2 correct answers as complex nos
	$\pm (5 \pm 3i)$	M1		Attempt at all 4 roots
		A1	7	State other two roots as complex nos
		12		
10 (i)				
	$\frac{1}{u^{\frac{3}{2}}} + \frac{3}{u} + 2 = 0$	B1		Use substitution correctly
	<i>EITHER</i>	M1		Rearrange
		M1		Square
	$\frac{9}{u^2} + \frac{12}{u} + 4 = \frac{1}{u^3}$	A1		Obtain correct equation
	$4u^3 + 12u^2 + 9u - 1 = 0$	A1	5	Obtain given answer
	<i>OR</i>			
	e. g. $(2u^{\frac{3}{2}} + 3u^{\frac{1}{2}} + 1)(2u^{\frac{3}{2}} + 3u^{\frac{1}{2}} - 1) = 0$	M2		Multiply their equation in u by appropriate related expression
		A2		Obtain given answer
(ii)		B1		Stated or imply that $u = \frac{1}{x^2}$
		M1		Use $-\frac{b}{a}$
	-3	A1		Obtain correct answer
		M1		Use $\frac{c}{a}$
	$\frac{9}{4}$	A1	5	Obtain correct answer
		10		

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