UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

Pre-U Certificate

MARK SCHEME for the May/June 2012 question paper

for the guidance of teachers

9794 MATHEMATICS

9794/01 Paper 1 (Pure Mathematics 1), maximum raw mark 80

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

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UNIVERSITY of CAMBRIDGE
International Examinations

1	(i)	Use of correct sum formula.	M1		
		Obtain correct unsimplified form $\frac{16(1-0.8^{12})}{1-0.8}$	A1		
		Obtain 74.5 or rounding to 74.5 but not 74 or 75 (74.50244)	A1	[3]	
	(ii)	Use correct formula	M1		
		Obtain 80.	A1	[2]	[5]
2	(i)	f(1) = 0 clearly shown.	B1		
		Attempt method for division by $(x-1)$ only	M1		
		Obtain $x^2 - 2x - 15$	A1		
		Obtain $(x-1)(x+3)(x-5)$	A1	[4]	
	(ii)	State any two correct roots.	B1√		
		State $x = -3, 1, 5$	B1	[2]	[6]
3	(i)	Attempt differentiation of at least one term.	M1		
		Obtain $3x^2 + 2x - 1$	A1	[2]	
	(ii)	State or imply their derivative equal to 0	B1		
		Attempt to solve quadratic.	M1		
		Obtain $x = -1$ and 1/3	A1		
		Obtain $y = 4$ and $\frac{76}{27}$ (= 2.81) NIS	A1	[4]	[6]
4	(i)	Attempt f(0) = 2 and f(1) = –3 or equiv	M1		
		Conclude correctly.	A1	[2]	
	(ii)	Attempt to use iterative formula and no other method	M1		
		0.5, 0.3541666, 0.340737425, 0.339926715, 0.339879765, 0.339877052.	A1		
		Conclude 0.3399	A1	[3]	[5]
5	(i)	It is a many-one function or equiv.	B1	[1]	
	(ii)	Attempt to form gf(x)	M1		
		Obtain $7x^2 - 2$ only	A1	[2]	
	(iii)	Attempt to make x the subject.	M1		
		Obtain $\frac{1}{7}(x+2)$ only.	A1	[2]	[5]
6	(i)	State 3 – i	B1	[1]	
	(ii)	Show 3 + i on an Argand diagram	B1		
		Show 3 – i	B1√	[2]	
	(iii)	Show 9 + 6i – 1.	B1		
		= 8 + 6i	B1	[2]	[5]

7	(i)	State $1 - (0.5)(2x)$	B1		
		State $(0.5)(0.5)(-0.5)(2x)^2$	B1		
		Attempt $\dfrac{\left(\frac{1}{2}\right)\left(\frac{-1}{2}\right)\left(\frac{-3}{2}\right)}{3!}(\pm 2x)^3$	M1		
		Obtain $-0.5x^3$	A1	[4]	
	(ii)	$\lvert x\rvert < 0.5$ or equiv	B1	[1]	
	(iii)	Obtain $2 - x$ correctly by partial expansion of their bracket	B1		
		State $a = -2$ correctly by partial expansion of their bracket	B1		
		Attempt to multiply $(2 + x)$ and their expansion. Must show at least 7 terms	M1		
		State $b = -1.5$	A1	[4]	[9]
8	(i)	Attempt to eliminate fractions by choosing suitable x values or sim eqns	M1		
		Obtain $2x + 11 = A(x + 3) + B(2x + 1)$ OR			
		$A + 2B = 2$ and $3A + B = 11$	A1		
		Obtain $A = 4$	A1		
		$B = -1$	A1	[4]	
	(ii)	Attempt integration to obtain at least one ln term, either $P\ln(2x + 1)$ or $Q\ln(x + 3)$	M1		
		Obtain $2\ln(2x + 1) - \ln(x + 3)$	A1		
		Use limits of 2 and 0 in correct order in any function	M1		
		Attempt use of any log law once on their exact expression	M1		
		Obtain ln15 NIS	A1	[5]	[9]
9	(i)	Obtain ±111 anywhere	M1		
		Obtain at least one of $\sqrt{198}$ or $\sqrt{285}$	B1		
		Attempt $\cos\theta = \dfrac{\overrightarrow{CA}\cdot\overrightarrow{CB}}{\lvert\overrightarrow{CA}\rvert\lvert\overrightarrow{CB}\rvert}$	M1		
		Obtain $\dfrac{111}{\sqrt{198}\times\sqrt{285}}$	A1		
		Obtain 62.14° (62.14276°)	A1	[5]	
	(ii)	Use 0.5 (their AC)(their CB)sin ACB	M1		
		Obtain 105	A1	[2]	
	(iii)	Attempt $\mathbf{b} - \mathbf{a} = \begin{pmatrix}13\\9\\1\end{pmatrix} - \begin{pmatrix}1\\0\\7\end{pmatrix}$ or $\mathbf{a} - \mathbf{b}$.	M1		
		Obtain $\begin{pmatrix}12\\9\\-6\end{pmatrix} = 3\begin{pmatrix}4\\3\\-2\end{pmatrix}$ or $\begin{pmatrix}-12\\-9\\6\end{pmatrix} = -3\begin{pmatrix}4\\3\\-2\end{pmatrix}$ in column vector form or aef	A1		
		Obtain $\mathbf{r} = \mathbf{i} + 0\mathbf{j} + 7\mathbf{k} + \lambda(4\mathbf{i} + 3\mathbf{j} - 2\mathbf{k})$ AG	A1	[3]	[10]

10	**(i)**	Write the bracketed expression in terms of sin and cos. $\left(\frac{\cos^2\theta}{\sin^2\theta} - \frac{\sin^2\theta}{\cos^2\theta}\right)$	M1		
		Sight of $\sin^2 2\theta = k\sin^2\theta\cos^2\theta$	M1		
		Obtain $4(\cos^4\theta - \sin^4\theta)$ AG	A1		
		Factorise $\cos^4\theta - \sin^4\theta$	M1		
		State explicitly $\cos^2\theta + \sin^2\theta = 1$ to obtain $4\cos 2\theta$ AG	A1	**[5]**	
	(ii)	Divide by 4 and $\cos^{-1}$ in correct order for at least one angle	M1		
		Divide angles by 2	M1		
		Obtain two angles from correct working	A1		
		Obtain 30, 150, 210 and 330	A1	**[4]**	**[9]**

11 (i)	Use f′= 1 and g = ln x and apply the correct formula for integration by parts Obtain correctly $\int \ln x\,dx = x\ln x - x + c$ AG	M1 A1	**[2]**	
(ii) (a)	**METHOD 1** INTEGRATION BY PARTS USING $(\ln x)^2$ AS f′= ln x and g = ln x Obtain $(\ln x)(x \ln x - x) - \int f(x)dx$ Obtain $g(x) - \int \frac{x\ln x - x}{x}dx$ Attempt to simplify integral and substitute result from **(i)** Obtain $\int(\ln x - 1)dx = x\ln x - x - x$ and hence $x(\ln x)^2 - 2x\ln x + 2x\ (+ c)$. **METHOD 2** INTEGRATION BY PARTS USING $(\ln x)^2$ AS $1\times(\ln x)^2$ Obtain $x(\ln x)^2 - \int f(x)dx$ Obtain $g(x) - \int \frac{2x\ln x}{x}dx$ Attempt to simplify integral and substitute result from **(i)** Obtain $2\int \ln x\,dx = 2(x\ln x - x)$ and hence $x(\ln x)^2 - 2x\ln x + 2x\ (+ c)$. **METHOD 3** INTEGRATION BY PARTS TWICE USING $(\ln x)^2 = u^2$ Obtain $u^2e^u - \int f(x)dx$ Obtain $g(x) - \int 2ue^u\,du$ Attempt to integrate again Obtain $\int 2ue^u\,du = 2(ue^u - e^u)$ and hence $x(\ln x)^2 - 2x\ln x + 2x\ (+ c)$.	 B1 B1 M1 A1 B1 B1 M1 A1 B1 B1 M1 A1	 **[4]**	
(ii) (b)	**METHOD 1** USING PARTS Attempt integration by parts as $g(x) - \int f(x)dx$ Obtain $(\ln x)(\ln(\ln x)) - \int f(x)dx$ Obtain $g(x) - \int \frac{1}{x}dx$ Obtain $(\ln x)(\ln(\ln x)) - \ln x + c$ Sight of + c in last two parts **METHOD 2** USING SUBSTITUTION Attempt to obtain an integral in u by stating or implying $u = \ln x$ AND $du = \frac{1}{x}dx$ OR $u = \ln x$ AND $x = e^u$ AND $dx = e^u\,du$ Obtain directly $\int \ln u\,du$ OR $\int \frac{\ln u}{e^u}e^u du$ and cancel to obtain $\int \ln u\,du$ Obtain $u(\ln u) - u$ Obtain $(\ln x)(\ln(\ln x)) - \ln x\ (+ c)$ Use + c in **(b)(i)** and **(ii)**	 M1 A1 A1 A1 B1 M1 A1 A1 A1 B1	 **[5]**	 **[11]**