CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge Pre-U Certificate

MARK SCHEME for the May/June 2015 series

9794 MATHEMATICS

9794/01 Paper 01 (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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International Examinations

1	Use factorisation, the quadratic formula or a graph to locate zeros. -3 and 4 or $(x + 3)(x - 4)$seen Obtain $-3 < x < 4$.	M1 A1 A1 [3]
2	Obtain correctly an equation in a single variable: $(10 - 2y)^2 + 2y^2 = 36$ Obtain $3y^2 - 20y + 32$ (= 0) aef or equivalent in x Solve their 3 term quadratic = 0 Obtain any two values from (2, 4) and $\left(\frac{14}{3}, \frac{8}{3}\right)$ Obtain (2,4) and $\left(\frac{14}{3}, \frac{8}{3}\right)$	M1 A1 depM1 A1 A1 [5]
3	Substitute into correct sine rule $\left(\frac{x}{\sin 28} = \frac{2x-1}{\sin 39}\right)$ Simplify to obtain a value for x Obtain x rounding to 1.52 (1.51626967) (exact answer gets A0)	B1 M1 A1 [3]
4 (i)	State or imply $\ln P = \ln a + bt$ State intercept = $\ln a$ State gradient = b	B1 B1 B1 [3]
(ii)	Obtain $b = 2.5$ Attempt to solve $\ln a = 2$ only Obtain $a = e^2$ or 7.39	B1 M1 A1 [3]
5 (i)	Obtain fully correct $(x - 3)^2 - 9 + (y - 2)^2 - 4 = 12$ Obtain $(x - 3)^2 + (y - 2)^2 = 25$ Obtain $r = 5$	M1 A1 B1 [3]
(ii)	State gradient $= \frac{3}{4}\left(= \frac{2-(-1)}{3-(-1)} = \frac{5-(-1)}{7-(-1)}\right)$ Obtain equation of straight line $(y - q) =$ *their* $m(x - p)$ where $(p, q) = (-1,-1)$, (3, 2) or (7, 5) only Obtain $1 = 3x - 4y$	B1 M1 A1 [3]
(iii)	Calculate $\frac{2-6}{3-0}$ **SR** A diagram used to justify $\frac{-4}{3}$ B0B1B1. Obtain gradient = $\frac{-4}{3}$ Clearly state $\frac{-4}{3} \times \frac{3}{4} = -1$ or "negative reciprocal"	B1 depB1 depB1 [3]

6	(i)	Compose correctly gf to give $\frac{3}{x-1}+2\left(=\frac{2x+1}{x-1}\right)$	B1
		State domain $x \neq 1$ or equivalent notation	dep B1
		State range $y \neq 2$ or equivalent notation	dep B1 [3]
	(ii)	Attempt correct method to find inverse	M1
		State $(y=)\frac{x+1}{x-2}$ or $(y=)\frac{3}{x-2}+1$	A1
		State $x = 2$	depA1 [3]
7	(i)	Find λ, μ or both from at least one correct equation e.g $3+\lambda=1$ or $2-6\lambda=5+3\mu,\ 1-2\lambda=2+\mu$	M1
		Obtain $\lambda=-2$ or $\mu=3$	A1
		Obtain (1, 14, 5)	A1
		Show substitution of values of λ and μ into third equation or both lines	M1
		Demonstrate consistency or obtain (1, 14, 5) from both lines	A1 [5]
	(ii)	Use **i** − 6**j** −2**k** and 3**j** + **k** (**N.B** using (3, 2, 1) and (1, 5, 2) = 15 B0)	B1
		Use $\cos\theta = \frac{a\cdot b}{\lvert a\rvert\lvert b\rvert}$ for their vectors *a* and *b*	M1
		Attempt evaluation of correct *a* and *b* $\left(=\frac{\pm 20}{\sqrt{41}\sqrt{10}}\right)$	A1
		Obtain 9° or better (8.984876°) or 0.156853^c	A1 [4]
8	(i)	Show or imply multiplication of denominator and numerator by (3 + i)	M1
		Obtain either 10 for the denominator OR 2 + 4i for the numerator	A1
		Obtain $\frac{2+4\mathrm{i}}{10}$ or simplified equivalent, e.g. $0.2+0.4\mathrm{i},\ \frac{1+2\mathrm{i}}{5}$	A1 [3]
	(ii)	Show relative position of:	
		$z = (1, 1)$	B1
		$w = (3, -1)$	B1
		$z/w = (0.2, 0.4)$	B1 [3]
	(iii)	Use $\tan^{-1}\left(\pm\frac{1}{3}\right)$ or equivalent, e.g $\sin^{-1}\left(\pm\frac{1}{\sqrt{10}}\right)$	M1
		Obtain –0.322 or 5.96	A1 [2]
	(iv)	State or imply $(1+\mathrm{i})+\frac{2}{(1+\mathrm{i})}$	B1
		Form LCM or multiply fraction by conjugate $\left(=\frac{(1+\mathrm{i})^2+2}{1+\mathrm{i}}\right)$	M1
		Obtain 2 **AND** state "real". CWO with all steps shown	A1 [3]

9		Use the product rule on given $\mathrm{f}(x)$ or $x^2\mathrm{e}^{-x}$ and obtain a two term expression	M1
		Obtain $2x\mathrm{e}^{-x}$	A1
		Obtain $-(x^2-3)\mathrm{e}^{-x}$ or $-x^2e^{-x}$	A1
		Obtain and solve their 3 term quadratic = 0	M1
		Obtain $x = -1, 3$	A1
		Obtain $y = -2\mathrm{e}, 6\mathrm{e}^{-3}$	A1
		State $\pm\,\mathrm{e}^{-x} \neq 0$ or equivalent	B1
			[7]
10	**(i)**	Use $\dfrac{\mathrm{d}y}{\mathrm{d}x} = \dfrac{\mathrm{d}y}{\mathrm{d}t} \times \dfrac{\mathrm{d}t}{\mathrm{d}x}$	M1
		Obtain either $\dfrac{\mathrm{d}y}{\mathrm{d}t} = \dfrac{3}{2}(1+t)^{\frac{1}{2}}$ or $\dfrac{\mathrm{d}x}{\mathrm{d}t} = \dfrac{3}{2}(1-t)^{\frac{1}{2}}$	B1
		Obtain correct $\dfrac{\mathrm{d}y}{\mathrm{d}x} = \dfrac{1.5(1+t)^{0.5}}{1.5(1-t)^{0.5}}$	A1
		Show multiplication of denominator and numerator by $\sqrt{1+t}$ or equivalent on correct derivative.	M1
		Clearly derive $\dfrac{1+t}{\sqrt{1-t^2}}$	A1
			[5]
	(ii)	Show $(1-t^2)^{-0.5} = 1+\left(-\dfrac{1}{2}\right)(-t^2)+\left(\dfrac{1}{2}\right)\left(-\dfrac{1}{2}\right)\left(-\dfrac{3}{2}\right)(-t^2)^2$	M1
		Obtain $1+\dfrac{t^2}{2}+\dfrac{3t^4}{8}$	A1
		Show multiplication of their $1+\dfrac{t^2}{2}+\dfrac{3t^4}{8}$ by $(1+t)$	M1
		Obtain $1+t+\dfrac{t^2}{2}$	A1
		Obtain $\dfrac{t^3}{2}+\dfrac{3t^4}{8}$	A1
		Substitute $t = 0.5$ and obtain 1.71 or better (1.7109275)	A1
			[6]

11	Obtain dx = f(u) du or equivalent	B1
	Rewrite $\sqrt{x+1}$ in terms of u and substitute to obtain an integral in u	M1
	Obtain unsimplified $\int \frac{2u\,\mathrm{d}u}{2(u^2-1)\sqrt{(u^2-1)+1}}$	A1
	Obtain $\int \frac{\mathrm{d}u}{u^2-1}$	A1
	Use partial fractions in form $\frac{A}{u+1}+\frac{B}{u-1}$	M1
	Obtain $A = \frac{-1}{2}$ and $B = \frac{1}{2}$ both correctly placed	A1
	Integrate to obtain $\left(k\ln\lvert u-1\rvert + m\ln\lvert u+1\rvert\right)$	M1
	Obtain $\frac{1}{2}\ln(u-1)-\frac{1}{2}\ln(u+1)=c$ or $\frac{1}{2}\ln\left(\frac{u-1}{u+1}\right)+c$	A1
	Show correct use of at least one log law on a correct equation	M1
	State or show clearly $+\,c = \ln A$ **and** obtain $\ln\left(A\sqrt{\frac{\sqrt{x+1}-1}{\sqrt{x+1}+1}}\right)$ **AG**	A1 [10]