CAMBRIDGE INTERNATIONAL EXAMINATIONS

Pre-U Certificate

MARK SCHEME for the May/June 2014 series

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.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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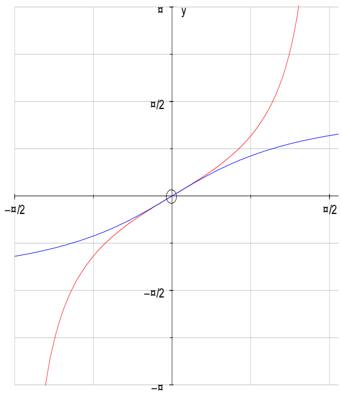
International Examinations

1	**(i)**	Method to compare coefficients or complete the square Obtain $a = 4$ Obtain $b = -6$	M1 A1 A1	 [3]
	(ii)	State minimum $= -6$ or $y = -6$ State $x = 4$ SR Accept $(4, -6)$ SR If differentiation is used to find $x = 4$ award B1	B1 B1	 [2]
2		Correct and labelled tan curve with asymptotes clearly intended or shown. Scale required on x-axis Correct arc tan curve $\tan^{-1}(\frac{\pi}{2})$ must be approx. 1 or asymptote shown. Scale required on y-axis  State reflection in line $y = x$	B1 B1 B1	 [3]
3		**METHOD 1** $x < 2$ seen $2x - 1 < 3$ AND $-(2x - 1) < 3$ seen Obtain $-1 < x < 2$ **METHOD 2** $(2x - 1)^2 < 3^2$ seen Expand and obtain a 3 term quadratic $(x^2 - x - 2 < 0)$ Obtain $-1 < x < 2$	 B1 M1 A1 B1 M1 A1	 [3]
4	**(i)**	Attempt to move the graph sideways and up. Obtain fully correct figure moved 2 units to the left and 1 up.	M1 A1	 [2]
	(ii)	Attempt to scale the figure vertically and clearly reflect in x-axis. Obtain fully correct figure with y-coordinates halved and reflected in the x-axis. NB Scales are required on both axes	M1 A1	 [2]

5		State $3 - \mathrm{i}$ Attempt a complete method for determining p and q. Obtain $p = -6$ Obtain $q = 10$	B1 M1 A1 A1 [4]
6	**(i)**	Show $7 \times 2 - 10 - 2^2 = 0$ OR solve $x^2 - 7x + 10 = 0$ to obtain $x = 2$ at least	B1 [1]
	(ii)	Obtain $\frac{dy}{dx} = 7 - 2x$ Obtain $y = 2$ and $\frac{dy}{dx} = 1$ at $x = 3$ Attempt equation of straight line Obtain $y = x - 1$ Substitute $x = 1$ and obtain $y = 0$	B1 B1 M1 A1 A1 [5]
	(iii)	Obtain area of triangle = 2 Attempt integration Obtain $\left[\frac{7x^2}{2} - 10x - \frac{1}{3}x^3\right]$ Attempt to substitute limits of 2 and 3. Obtain $\frac{7}{6}$ Attempt subtraction from area of triangle Obtain $\frac{5}{6}$ with no decimals seen	B1 M1 A1 M1 A1 M1 A1 [7]
7		Obtain any equiv form of correct derivative $\frac{-2}{x^3} - 0.018$ Attempt use of correct formula Use $x_0 = 2$ and continue at least as far as x_1 State 2.47 SR 2.47 may be awarded B1 for any method or no method seen	B1 M1 dep M1 A1 [4]

8	(i)	Attempt $\frac{dy}{dx} = \frac{dy}{dt} \times \frac{dt}{dx}$	M1	
		Obtain $\frac{dy}{dx} = \frac{e^t - 5}{e^t - 2}$	A1	[2]
	(ii)	Equate their derivative to 3 and attempt to solve	M1	
		Obtain $e^t = 0.5$	A1	
		Attempt ln on both sides and use power law	M1	
		Obtain $t = -\ln 2$ AG	A1	[4]
		OR		
		Substitute $t = -\ln 2$ into $\frac{dy}{dx} = \frac{e^t - 5}{e^t - 2}$	M1	
		Use power log law to show or imply $\frac{dy}{dx} = \frac{e^{\ln\frac{1}{2}} - 5}{e^{\ln\frac{1}{2}} - 2}$	M1	
		Obtain $\frac{dy}{dx} = \frac{\frac{1}{2} - 5}{\frac{1}{2} - 2}$	A1	
		Obtain 3	A1	
9	(i)	Attempt to use an expression for r, e.g. $\frac{6}{x} = \frac{x+5}{6}$ or $\frac{36}{x^2} = \frac{x+5}{x}$	M1	
		Obtain correctly $x^2 + 5x - 36 = 0$ AG	A1	
		Obtain $x = 4$ or -9	B1	[3]
	(ii)	Obtain $r = \frac{3}{2}$	B1	
		Obtain $r = \frac{-2}{3}$ and only these	B1	[2]
	(iii)	State $r = -\frac{2}{3}$ or imply this by considering only this value of r	B1	
		Attempt to solve $ar^2 = 6$ or $ar = -9$	M1	
		Obtain $a = 13.5$	A1	
		Use correct sum to infinity formula and obtain 8.1	B1	[4]
		SR both r offered with no choice M1 only		

10 **(a)**	Attempt integration to obtain an integral in ln (f(x))	M1	
	Substitute limits to obtain correctly $\frac{1}{2}$ (1n9 – 1n5)	A1	
	Show clearly the use of at least one log law	M1	
	Obtain 1n $\frac{3}{\sqrt{5}}$ www AG	A1	[4]
(b)	Attempt integration by parts with $u = x$ du = 1 and dv = $(x-2)^{0.5}$ and $v = \frac{2}{3}(x-2)^{\frac{3}{2}}$	M1	
	Obtain $kx(x-2)^{\frac{3}{2}} - m\int f(x)dx$	M1	
	Obtain $kg(x) - m\int f(x-2)^{\frac{3}{2}}dx$	M1	
	Obtain $\frac{2}{3}x(x-2)^{\frac{3}{2}} - \frac{4}{15}(x-2)^{\frac{5}{2}} + c$	A1	[4]
	OR		
	Attempt reverse substitution with $u = x - 2$ du = dx and $\sqrt{x-2} = \sqrt{u}$	M1	
	Obtain $\int(u \pm 2)u^{0.5}du$	M1	
	Obtain $ku^{\frac{5}{2}} + mu^{\frac{3}{2}}$	M1	
	Obtain $\frac{2}{5}(x-2)^{\frac{5}{2}} + \frac{4}{3}(x-2)^{\frac{3}{2}} + c$	A1	

11 **(i)**	Attempt use of the form $\frac{A}{y}+\frac{B}{1-y}$ and remove fractions	M1	
	Obtain $A = 2$	A1	
	Obtain $B = 2$	A1	[3]
(ii)	Attempt to separate variables and use result from (i)	M1	
	Attempt integration of both sides	M1	
	Obtain $2\ln y - 2\ln \lvert 1-y \rvert = x + C$ aef	A1	
	Attempt use of at least one log law correctly	M1	
	State or imply $1\text{n}\left(\frac{y^2}{(1-y)^2}\right) = x + \text{C}$ and obtain convincingly		
	$\frac{y^2}{(1-y)^2} = Ae^x$ AG	A1	[5]
(iii)	Substitute (0, 2) and obtain $A = 4$	B1	
	Select the correct root of – 2 and attempt to make y the subject	M1	
	i.e. $\frac{y}{(1-y)} = -2e^{\frac{x}{2}}$		
	Obtain $y = \frac{2e^{\frac{x}{2}}}{2e^{\frac{x}{2}} - 1}$ or equiv simplified form.	A1	[3]

12	**(i)**	Attempt to use $\tan 4x = \tan 2(2x)$	M1
		Obtain $\tan 4x = \dfrac{2\tan 2x}{1-\tan^2(2x)}$ or $\dfrac{\tan 2x + \tan 2x}{1-\tan^2(2x)}$	A1
		Attempt to substitute for $\tan 2x$	M1*
		Obtain $\dfrac{\dfrac{2(2\tan x)}{1-\tan^2 x}}{1-\left(\dfrac{2\tan x}{1-\tan^2 x}\right)^2}$	dep A1
		Correctly form a single term in the denominator by removing the 1	dep M1
		Obtain $\dfrac{4\tan x(1-\tan^2 x)}{1-6\tan^2 x+\tan^4 x}$ AG. Stages in the argument must be consistent and clearly presented for A1.	A1 [6]
	(ii)	State or imply that the root gives $\tan 4x = 1$	B1*
		Attempt to write the equation in the same structure as the identity $\dfrac{4\tan x(1-\tan^2 x)}{1-6\tan^2 x+\tan^4 x}$	M1 dep
		Obtain $p = 4$	A1 dep
		Convincing and clear argument with all stages shown including the statement that $\tan\left(\dfrac{\pi}{4}\right) = 1$	B1 dep
		Evaluation using decimals 0/4	[4]