

**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

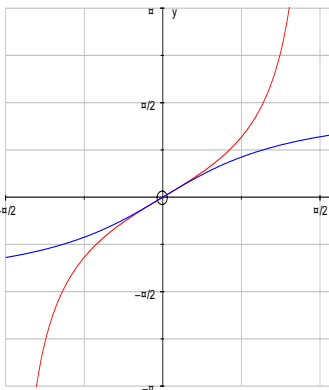
This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, 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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1	<p>(i) Method to compare coefficients or complete the square Obtain <math>a = 4</math> Obtain <math>b = -6</math></p> <p>(ii) State minimum = <math>-6</math> or <math>y = -6</math> State <math>x = 4</math></p> <p>SR Accept <math>(4, -6)</math> SR If differentiation is used to find <math>x = 4</math> award B1</p>	<p>M1 A1 A1 [3]</p> <p>B1 B1 [2]</p>
2	<p>Correct and labelled tan curve with asymptotes clearly intended or shown. Scale required on <math>x</math>-axis Correct arc tan curve <math>\tan^{-1}\left(\frac{\pi}{2}\right)</math> must be approx. 1 or asymptote shown. Scale required on <math>y</math>-axis</p>  <p>State reflection in line <math>y = x</math></p>	<p>B1 B1</p> <p>B1 [3]</p>
3	<p><b>METHOD 1</b> <math>x &lt; 2</math> seen <math>2x - 1 &lt; 3</math> AND <math>-(2x - 1) &lt; 3</math> seen Obtain <math>-1 &lt; x &lt; 2</math></p> <p><b>METHOD 2</b> <math>(2x - 1)^2 &lt; 3^2</math> seen Expand and obtain a 3 term quadratic (<math>x^2 - x - 2 &lt; 0</math>) Obtain <math>-1 &lt; x &lt; 2</math></p>	<p>B1 M1 A1 [3]</p> <p>B1 M1 A1</p>
4	<p>(i) Attempt to move the graph sideways and up. Obtain fully correct figure moved 2 units to the left and 1 up.</p> <p>(ii) Attempt to scale the figure vertically and clearly reflect in <math>x</math>-axis. Obtain fully correct figure with <math>y</math>-coordinates halved and reflected in the <math>x</math>-axis.</p> <p>NB Scales are required on both axes</p>	<p>M1 A1 [2]</p> <p>M1 A1 [2]</p>

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

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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 Obtain $e^t = 0.5$ Attempt $\ln$ on both sides and use power law Obtain $t = -\ln 2$ AG	M1 A1 M1 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 $ar = -9$ Obtain $a = 13.5$	M1 A1		
	Use correct sum to infinity formula and obtain 8.1	B1	[4]	
	SR both $r$ offered with no choice M1 only			

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10	(a)	Attempt integration to obtain an integral in $\ln(f(x))$	M1	
		Substitute limits to obtain correctly $\frac{1}{2}(\ln 9 - \ln 5)$	A1	
		Show clearly the use of at least one log law	M1	
		Obtain $\ln \frac{3}{\sqrt{5}}$ 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		

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

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