

JUNE 2002

GCE Advanced Subsidiary Level

MARK SCHEME

MAXIMUM MARK : 50

SYLLABUS/COMPONENT : 9709 /2

MATHEMATICS
(Pure 2)



UNIVERSITY of CAMBRIDGE
Local Examinations Syndicate

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1	<p><i>EITHER:</i> State or imply non-modular inequality $(x+2)^2 < (5-2x)^2$, or corresponding equation Expand and make reasonable solution attempt at 2- or 3-term quadratic, or equivalent Obtain critical values 1 and 7 State correct answer $x < 1, x > 7$</p> <p><i>OR:</i> State one correct equation for a critical value e.g. $x+2 = 5-2x$ State two relevant equations separately e.g. $x+2 = 5-2x$ and $x+2 = -(5-2x)$ Obtain critical values 1 and 7 State correct answer $x < 1, x > 7$</p> <p><i>OR:</i> State one critical value (probably $x = 1$), from a graphical method or by inspection or by solving a linear inequality State the other critical value correctly State correct answer $x < 1, x > 7$ [The answer $7 < x < 1$ scores B0.]</p>	<p>B1 M1 A1 A1 M1 A1 A1 A1 B1 B2 B1</p>	4
2	<p>(i) <i>EITHER:</i> Substitute -2 for x and equate to zero Obtain answer $a = 7$</p> <p><i>OR:</i> Carry out complete division and equate remainder to zero Obtain answer $a = 7$</p> <p>(ii) <i>EITHER:</i> Find quadratic factor by division or inspection Obtain answer $3x^2 + x - 4$ Factorise completely to $(x+2)(x-1)(3x+4)$ [To earn the M1 the quotient (or factor) must contain $3x^2$ and another term, at least.]</p> <p><i>OR:</i> State $(x-1)$ is a factor Find remaining linear factor by division or by inspection Factorise completely to $(x+2)(x-1)(3x+4)$</p>	<p>M1 A1 M1 A1 M1 A1 A1 B1 M1 A1</p>	2 3
3	<p>State or imply the relation $\ln y = \ln A + n \ln x$ State or imply $\ln A = 2.3$ Obtain answer $A = 9.97$ Calculate gradient of the given line Obtain answer $n = -0.15$</p>	<p>B1 B1✓ B1 M1 A1</p>	5
4	<p>(i) State answer $R = \sqrt{13}$ Use trig formula to find α Obtain answer $\alpha = 33.7^\circ$</p> <p>(ii) Carry out, or indicate need for, evaluation of $\cos^{-1}(3.5/\sqrt{13})$ ($\approx 13.9^\circ$) Obtain answer 47.6° Carry out correct method for second answer Obtain second answer 19.8°</p> <p>(iii) State coordinates $(33.7, \sqrt{13})$, or equivalent</p>	<p>B1 M1 A1 M1 A1 M1 A1✓ B1✓</p>	3 4 1

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5	(i)	Obtain a derivative of the form $ke^{-x} + lxe^{-x}$ where $kl \neq 0$	B1		
		Obtain correct derivative $2e^{-x} - 2xe^{-x}$, or equivalent	B1		
		Equate $\frac{dy}{dx}$ to zero and solve for x	M1		
		Obtain coordinates $(1, 2e^{-1})$ for P	A1	4	
	(ii)	State that $\frac{1}{2} = 2xe^{-x}$ and deduce the given answer correctly	B1	1	
	(iii)	State or imply that $x_1 = 0.25$	B1		
		Continue the iteration correctly	M1		
		Obtain final answer 0.36 after sufficient iterations to justify its accuracy to 2d.p., or after showing there is a sign change in $(0.355, 0.365)$	A1	3	
6	(a)	(i)	State indefinite integral $k \sin 2x$ and use limits	M1	
			Obtain given answer correctly	A1	2
		(ii)	Use double-angle formula to convert integrand to the form $a + b \cos 2x$, where $ab \neq 0$	M1*	
			Integrate and use limits (both terms)	M1(dep*)	
			Obtain answer $\frac{1}{8}(\pi - 2)$, or equivalent	A1	3
		(b)	(i)	Show or imply correct ordinates $1, 1.08239\dots, \sqrt{2}$ (1.41421...)	B1
			Use correct formula, or equivalent, with $h = \pi/8$ and three ordinates	M1	
			Obtain correct answer 0.90 with no errors seen	A1	3
		(ii)	Make a correct relevant sketch of $y = \sec x$	B1*	
			State that the rule gives an over-estimate	B1(dep*)	2
7	(i)	State $\frac{dx}{dt} = 1 + \frac{2}{t}$, $\frac{dy}{dt} = 2 - \frac{1}{t}$	B1		
		Use $\frac{dy}{dx} = \frac{dy}{dt} \div \frac{dx}{dt}$	M1		
		Obtain $\frac{dy}{dx}$ in any correct form e.g. $\frac{2t-1}{t+2}$	A1	3	
		(ii)	Substitute $t = 1$ in $\frac{dy}{dx}$ and both parametric equations	M1	
			Obtain $\frac{dy}{dx} = \frac{1}{3}$ and coordinates $(1, 2)$	A1✓	
			Obtain equation $3y = x + 5$, or any 3-term equivalent	A1✓	3
		(iii)	Equate $\frac{dy}{dx}$ to zero and solve for t	M1	
		Obtain answer $t = \frac{1}{2}$	A1		
		Obtain the given value of y correctly	A1		
		Show by any method that this is a minimum	A1	4	