

**CAMBRIDGE**  
INTERNATIONAL EXAMINATIONS

**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 <math>(x+2)^2 &lt; (5-2x)^2</math>, 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 <math>x &lt; 1, x &gt; 7</math></p> <p><i>OR:</i> State one correct equation for a critical value e.g. <math>x+2 = 5-2x</math> State two relevant equations separately e.g. <math>x+2 = 5-2x</math> and <math>x+2 = -(5-2x)</math> Obtain critical values 1 and 7 State correct answer <math>x &lt; 1, x &gt; 7</math></p> <p><i>OR:</i> State one critical value (probably <math>x = 1</math>), from a graphical method or by inspection or by solving a linear inequality State the other critical value correctly State correct answer <math>x &lt; 1, x &gt; 7</math> [The answer <math>7 &lt; x &lt; 1</math> scores B0.]</p>	<p>B1 M1 A1 A1 M1 A1 A1 A1 B1 B2 B1</p>	4
2	<p>(i) <i>EITHER:</i> Substitute <math>-2</math> for <math>x</math> and equate to zero Obtain answer <math>a = 7</math></p> <p><i>OR:</i> Carry out complete division and equate remainder to zero Obtain answer <math>a = 7</math></p> <p>(ii) <i>EITHER:</i> Find quadratic factor by division or inspection Obtain answer <math>3x^2 + x - 4</math> Factorise completely to <math>(x+2)(x-1)(3x+4)</math> [To earn the M1 the quotient (or factor) must contain <math>3x^2</math> and another term, at least.]</p> <p><i>OR:</i> State <math>(x-1)</math> is a factor Find remaining linear factor by division or by inspection Factorise completely to <math>(x+2)(x-1)(3x+4)</math></p>	<p>M1 A1 M1 A1 M1 A1 A1 B1 M1 A1</p>	2 3
3	<p>State or imply the relation <math>\ln y = \ln A + n \ln x</math> State or imply <math>\ln A = 2.3</math> Obtain answer <math>A = 9.97</math> Calculate gradient of the given line Obtain answer <math>n = -0.15</math></p>	<p>B1 B1 ✓ B1 M1 A1</p>	5
4	<p>(i) State answer <math>R = \sqrt{13}</math> Use trig formula to find <math>\alpha</math> Obtain answer <math>\alpha = 33.7^\circ</math></p> <p>(ii) Carry out, or indicate need for, evaluation of <math>\cos^{-1}(3.5/\sqrt{13})</math> (<math>\approx 13.9^\circ</math>) Obtain answer <math>47.6^\circ</math> Carry out correct method for second answer Obtain second answer <math>19.8^\circ</math></p> <p>(iii) State coordinates <math>(33.7, \sqrt{13})</math>, 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 $1, 1.08239\dots, \sqrt{2}$ ( $1.41421\dots$ )	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	