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

1	*EITHER*:	State or imply non-modular inequality $(x+2)^2 < (5-2x)^2$, or corresponding equation	B1	
		Expand and make reasonable solution attempt at 2- or 3-term quadratic, or equivalent	M1	
		Obtain critical values 1 and 7	A1	
		State correct answer $x < 1$, $x > 7$	A1	
	OR:	State one correct equation for a critical value e.g. $x + 2 = 5 - 2x$	M1	
		State two relevant equations separately e.g. $x + 2 = 5 - 2x$ and $x + 2 = -(5 - 2x)$	A1	
		Obtain critical values 1 and 7	A1	
		State correct answer $x < 1$, $x > 7$	A1	
	OR:	State one critical value (probably $x = 1$), from a graphical method or by inspection or by solving a linear inequality	B1	
		State the other critical value correctly	B2	
		State correct answer $x < 1$, $x > 7$	B1	4
		[The answer $7 < x < 1$ scores B0.]		

2	(i) *EITHER*:	Substitute -2 for x and equate to zero	M1	
		Obtain answer $a = 7$	A1	
	OR:	Carry out complete division and equate remainder to zero	M1	
		Obtain answer $a = 7$	A1	2
	(ii) *EITHER*:	Find quadratic factor by division or inspection	M1	
		Obtain answer $3x^2 + x - 4$	A1	
		Factorise completely to $(x + 2)(x - 1)(3x + 4)$	A1	
		[To earn the M1 the quotient (or factor) must contain $3x^2$ and another term, at least.]		
	OR:	State $(x - 1)$ is a factor	B1	
		Find remaining linear factor by division or by inspection	M1	
		Factorise completely to $(x + 2)(x - 1)(3x + 4)$	A1	3

3	State or imply the relation $\ln y = \ln A + n \ln x$	B1	
	State or imply $\ln A = 2.3$	B1✓	
	Obtain answer $A = 9.97$	B1	
	Calculate gradient of the given line	M1	
	Obtain answer $n = -0.15$	A1	5

4	(i)	State answer $R = \sqrt{13}$	B1	
		Use trig formula to find α	M1	
		Obtain answer $\alpha = 33.7°$	A1	3
	(ii)	Carry out, or indicate need for, evaluation of $\cos^{-1}(3.5/\sqrt{13})$ $(\approx 13.9°)$	M1	
		Obtain answer 47.6°	A1	
		Carry out correct method for second answer	M1	
		Obtain second answer 19.8°	A1✓	4
	(iii)	State coordinates $(33.7, \sqrt{13})$, or equivalent	B1✓	1

5 (i) Obtain a derivative of the form $k e^{-x} + l x e^{-x}$ where $kl \neq 0$ — B1
Obtain correct derivative $2 e^{-x} - 2x e^{-x}$, 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 $\frac{1}{2} = 2x e^{-x}$ and deduce the given answer correctly — B1 — 1

(iii) State or imply that $x_2 = 0.25$ — 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..., $\sqrt{2}$ (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