CAMBRIDGE
INTERNATIONAL EXAMINATIONS

NOVEMBER 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 $(2x-1)^2 < (3x)^2$, or corresponding equation	B1	
		Expand and make reasonable solution attempt at 2/or 3-term quadratic, or equivalent	M1	
		Obtain critical values -1 and $\frac{1}{5}$	A1	
		State correct answer $x < -1, x > \frac{1}{5}$	A1	
	OR:	State one correct equation for a critical value e.g. $2x - 1 = 3x$	M1	
		State two relevant equations separately e.g. $2x - 1 = 3x$ and $2x - 1 = -3x$	A1	
		Obtain critical values -1 and $\frac{1}{5}$	A1	
		State correct answer $x < -1, x > \frac{1}{5}$	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 $x < -1, x > \frac{1}{5}$	B1	4
		[The answer $\frac{1}{5} < x < -1$ scores B0.]		

2	State or obtain $-2 + a + b = 0$, or equivalent		B1	
	Substitute $x = -2$ and equate to -5		M1	
	Obtain 3-term equation, or equivalent		A1	
	Solve a relevant pair of equations, obtaining a or b		M1	
	Obtain both answers $a = 3$ and $b = -1$		A1	5

3	(i)	State or imply that $9^x = y^2$	B1	1
	(ii)	Carry out recognisable solution method for quadratic in y	M1	
		Obtain $y = \frac{1}{2}$ and $y = 3$ from $2y^2 - 7y + 3 = 0$	A1	
		Use log method to solve an equation of the form $3^x = k$	M1	
		Obtain answer $x = -\frac{\ln 2}{\ln 3}$, or exact equivalent { to ANY base }	A1	
		State exact answer $x = 1$ (no penalty if logs used)	B1	5

4	(i)	Make recognisable sketches over the given range of a suitable pair of graphs e.g. $y = \sin x$ and $y = \frac{1}{x^2}$	B1	
		State or imply connection between intersections and roots and justify given statement	B1	2
	(ii)	Calculate values (or signs) of $\sin x - \frac{1}{x^2}$ at $x = 1$ and $x = 1.5$	M1	
		Derive given result correctly	A1	2
	(iii)	Rearrange $\sin x = \frac{1}{x^2}$ and obtain given answer	B1	1
	(iv)	Use the iterative formula correctly with $1 \le x_n \le 1.5$	M1	
		Obtain final answer 1.07	A1	
		Show sufficient iterations to justify its accuracy to 3d.p., or show there is a sign change in the interval (1.065, 1.075)	A1	3

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5 (i) Use relevant formulae for cos $(x - 30°)$ and sin $(x - 60°)$ {allow one sign error} M1*

Use sin 30° = cos 60° = $\frac{1}{2}$ and sin 60° = cos 30° = $\frac{\sqrt{3}}{2}$ M1(dep*)

Collect terms and obtain given answer correctly A1 3

(ii) Carry out correct processes to evaluate a single trig ratio M1

Obtain answer 73.9° A1

Obtain second answer 253.9° and no others A1✓ 3

(iii) State or imply that $\cos^2 x = \frac{1}{13}$ or $\sin^2 x = \frac{12}{13}$ B1

Use a relevant trig formula to evaluate cos $2x$ M1

Obtain exact answer $-\frac{11}{13}$ correctly A1 3

[Use of only say $\cos x = +\frac{1}{\sqrt{13}}$, probably from a right triangle, can earn B1M1A0.]

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6 (a) Obtain indefinite integral $-\frac{1}{2}\cos 2x + \sin x$ B1 + B1

Use limits with attempted integral M1

Obtain answer 2 correctly with no errors A1 4

(b) (i) Identify R with correct definite integral and attempt to integrate M1

Obtain indefinite integral $\ln(x + 1)$ B1

Obtain answer $R = \ln(p + 1) - \ln 2$ A1 3

(ii) Use exponential method to solve an equation of the form $\ln x = k$ M1

Obtain answer $p = 13.8$ A1 2

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7 (i) State $6y\frac{dy}{dx}$ as the derivative of $3y^2$ B1

State $\pm 2x\frac{dy}{dx} \pm 2y$ as the derivative of $-2xy$ (allow any combination of signs here) B1

Equate attempted derivative of LHS to 0 (or 10) and solve for $\frac{dy}{dx}$ M1

Obtain the given answer correctly A1 4

[The M1 is dependent on at least one of the B marks being earned.]

(ii) State or imply the points lie on $y - 2x = 0$ or/ $(y - 2x)/(3y - x) = 0$ B1

Carry out complete method for finding one coordinate of a point of intersection of $y = kx$ with the given curve M1

Obtain $10x^2 = 10$ or $2\frac{1}{2}y^2 = 10$ or 2-term equivalent A1

Obtain one correct point e.g. (1, 2) or/ 2 values of x (or y) A1

Obtain a second correct point e.g. (−1, −2) A1√ 5
