CAMBRIDGE
INTERNATIONAL EXAMINATIONS

June 2003

GCE AS LEVEL

MARK SCHEME

MAXIMUM MARK: 50

SYLLABUS/COMPONENT: 9709/02

MATHEMATICS
Paper 2 (Pure 2)

UNIVERSITY of CAMBRIDGE
Local Examinations Syndicate

Page 1	Mark Scheme	Syllabus	Paper
	A AND AS LEVEL – JUNE 2003	9709	2

1 *EITHER:* State or imply non-modular inequality $(x - 4)^2 > (x + 1)^2$, or corresponding equation — B1
Expand and solve a linear inequality, or equivalent — M1
Obtain critical value 1½ — A1
State correct answer $x < 1½$ (allow $\leq$) — A1

OR: State a correct linear equation for the critical value e.g. $4 - x = x + 1$ — B1
Solve the linear equation for x — M1
Obtain critical value 1½, or equivalent — A1
State correct answer $x < 1½$ — A1

OR: State the critical value 1½, or equivalent, from a graphical method or by inspection or by solving a linear inequality — B3
State correct answer $x < 1½$ — B1

[4]

2 (i) *EITHER:* Expand *RHS* and obtain at least one equation for a — M1
Obtain $a^2 = 9$ and $2a = 6$, or equivalent — A1
State answer $a = 3$ only — A1

OR: Attempt division by $x^2 + ax + 1$ or $x^2 - ax - 1$, and obtain an equation in a — M1
Obtain $a^2 = 9$ and either $a^3 - 11a + 6 = 0$ or $a^3 - 7a - 6 = 0$, or equivalent — A1
State answer $a = 3$ only — A1

[Special case: the answer $a = 3$, obtained by trial and error, or by inspection, or with no working earns B2.] **[3]**

(ii) Substitute for a and attempt to find zeroes of one of the quadratic factors — M1
Obtain one correct answer — A1
State all four solutions $½(-3 \pm \sqrt{5})$ and $½(3 \pm \sqrt{13})$, or equivalent — A1

[3]

3 (i) State or imply indefinite integral of e^{2x} is $½e^{2x}$, or equivalent — B1
Substitute correct limits correctly — M1
Obtain answer $R = ½ e^{2p} - ½$, or equivalent — A1

[3]

(ii) Substitute $R = 5$ and use logarithmic method to obtain an equation in $2p$ — M1*
Solve for p — M1 (dep*)
Obtain answer $p = 1.2$ (1.1989 ...) — A1

[3]

4 (i)	Use tan ($A \pm B$) formula to obtain an equation in tan x	M1
	State equation $\frac{\tan x + 1}{1 - \tan x} = 4\frac{(1 - \tan x)}{1 + \tan x}$, or equivalent	A1
	Transform to a 2- or 3-term quadratic equation	M1
	Obtain given answer correctly	A1
		[4]
(ii)	Solve the quadratic and calculate one angle, or establish that $t = {}^1/_3$, 3 (only)	M1
	Obtain one answer, e.g. $x = 18.4° \pm 0.1°$	A1
	Obtain second answer $x = 71.6°$ and no others in the range	A1
	[Ignore answers outside the given range]	**[3]**
5 (i)	Make recognizable sketch over the given range of two suitable graphs, e.g. $y = 1\text{n } x$ and $y = 2 - x^2$	B1+B1
	State or imply link between intersections and roots and justify given answer	B1
		[3]
(ii)	Consider sign of In $x - (2 - x^2)$ at $x = 1$ and $x = 1.4$, or equivalent	M1
	Complete the argument correctly with appropriate calculation	A1
		[2]
(iii)	Use the given iterative formula correctly with $1 \leq x_n \leq 1.4$	M1
	Obtain final answer 1.31	A1
	Show sufficient iterations to justify its accuracy to 2d.p., or show there is a sign change in the interval (1.305, 1.315)	A1
		[3]
6 (i)	Attempt to apply the chain or quotient rule	M1
	Obtain derivative of the form $\frac{k\sec^2 x}{(1 + \tan x)^2}$ or equivalent	A1
	Obtain correct derivative $-\frac{\sec^2 x}{(1 + \tan x)^2}$ or equivalent	A1
	Explain why derivative, and hence gradient of the curve, is always negative	A1
		[4]
(ii)	State or imply correct ordinates: 1, 0.7071.., 0.5	B1
	Use correct formula, or equivalent, with $h = {}^1/_8\pi$ and three ordinates	M1
	Obtain answer 0.57 (0.57220...) ± 0.01 (accept 0.18π)	A1
		[3]

(iii)	Justify the statement that the rule gives an over-estimate	B1
		[1]
7 (i)	State $\frac{dx}{d\theta} = 2 - 2\cos 2\theta$ or $\frac{dy}{d\theta} = 2\sin 2\theta$	B1
	Use $\frac{dy}{dx} = \frac{dy}{d\theta} \div \frac{dx}{d\theta}$	M1
	Obtain answer $\frac{dy}{dx} = \frac{2\sin 2\theta}{2 - 2\cos 2\theta}$ or equivalent	A1
	Make relevant use of sin 2*A* and cos 2*A* formulae	(indep.) M1
	Obtain given answer correctly	A1
		[5]
(ii)	Substitute $\theta = \frac{1}{4}\pi$ in $\frac{dy}{dx}$ and both parametric equations	M1
	Obtain $\frac{dy}{dx} = 1$, $x = \frac{1}{2}\pi - 1$, $y = 2$	A1
	Obtain equation $y = x + 1.43$, or any exact equivalent	A1√
		[3]
(iii)	State or imply that tangent is horizontal when $\theta = \frac{1}{2}\pi$ or $\frac{3}{2}\pi$	B1
	Obtain a correct pair of *x*, *y* or *x*- or *y*-coordinates	B1
	State correct answers $(\pi, 3)$ and $(3\pi, 3)$	B1
		[3]