

CAMBRIDGE
INTERNATIONAL EXAMINATIONS

June 2003

GCE AS LEVEL

MARK SCHEME

MAXIMUM MARK: 50

SYLLABUS/COMPONENT: 9709/02

MATHEMATICS
Paper 2 (Pure 2)



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

- 1** *EITHER:* State or imply non-modular inequality $(x - 4)^2 > (x + 1)^2$, B1
or corresponding equation M1
Expand and solve a linear inequality, or equivalent A1
Obtain critical value $1\frac{1}{2}$ A1
State correct answer $x < 1\frac{1}{2}$ (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 $1\frac{1}{2}$, or equivalent A1
State correct answer $x < 1\frac{1}{2}$ A1
- OR:* State the critical value $1\frac{1}{2}$, or equivalent, from a graphical method or by B3
inspection or by solving a linear inequality B1
State correct answer $x < 1\frac{1}{2}$
- [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 $a^3 - 1$ 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 $\frac{1}{2}(-3 \pm \sqrt{5})$ and $\frac{1}{2}(3 \pm \sqrt{13})$, or equivalent A1
- [3]**
- 3 (i)** State or imply indefinite integral of e^{2x} is $\frac{1}{2}e^{2x}$, or equivalent B1
Substitute correct limits correctly M1
Obtain answer $R = \frac{1}{2}e^{2p} - \frac{1}{2}$, or equivalent A1
- [3]**
- (ii)** Substitute $R = 5$ and use logarithmic method to obtain an equation M1*
in $2p$ M1 (dep*)
Solve for p A1
Obtain answer $p = 1.2$ (1.1989 ...)
- [3]**

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

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 $t = \frac{1}{3}, 3$ (only)	M1
	Obtain one answer, e.g. $x = 18.4^\circ \pm 0.1^\circ$	A1
	Obtain second answer $x = 71.6^\circ$ 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. $y = 1 \ln x$ 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 $\ln x - (2 - x^2)$ 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 $h = \frac{1}{8}\pi$ and three ordinates	M1
	Obtain answer $0.57 (0.57220...) \pm 0.01$ (accept 0.18π)	A1
		[3]

Page 3	Mark Scheme	Syllabus	Paper
	A AND AS LEVEL – JUNE 2003	9709	2

(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 $\sin 2A$ and $\cos 2A$ 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]