CAMBRIDGE
INTERNATIONAL EXAMINATIONS

November 2003

GCE AS LEVEL

MARK SCHEME

MAXIMUM MARK: 50

SYLLABUS/COMPONENT: 9709/02

MATHEMATICS
Pure Mathematics : Paper Two

UNIVERSITY of CAMBRIDGE
Local Examinations Syndicate

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

1 *EITHER:* State or imply non-modular inequality e.g. $-2 < 8-3x < 2$, or $(8-3x)^2 < 2^2$,
or corresponding equation or pair of equations   M1

Obtain critical values 2 and $3\frac{1}{3}$ A1

State correct answer $2 < x < 3\frac{1}{3}$ A1

OR: State one critical value (probably $x = 2$), from a graphical method or by
inspection or by solving a linear equality or equation   B1
State the other critical value correctly   B1

State correct answer $2 < x < 3\frac{1}{3}$ B1

[3]

2 State or imply at any stage $\ln y = \ln k - x\ln a$ B1
Equate estimate of $\ln y$- intercept to $\ln k$ M1
Obtain value for k in the range 9.97 ± 0.51 A1
Calculate gradient of the line of data points   M1
Obtain value for a in the range 2.12 ± 0.11 A1

[5]

3 (i) *EITHER:* Substitute -1 for x and equate to zero   M1
Obtain answer $a=6$ A1

OR: Carry out complete division and equate remainder to zero   M1
Obtain answer $a=6$ A1
[2]

(ii) Substitute 6 for a and either show f$(x) = 0$ or divide by $(x - 2)$ obtaining a
remainder of zero   B1
EITHER: State or imply $(x + 1)(x - 2)= x^2 - x - 2$ B1
Attempt to find another quadratic factor by division or inspection   M1
State factor $(x^2 + x - 3)$ A1

OR: Obtain $x^3 + 2x^2 - 2x - 3$ after division by $x + 1$, or $x^3 - x^2 - 5x + 6$
after division by x - 2   B1
Attempt to find a quadratic factor by further division by relevant divisor
or by inspection   M1
State factor $(x^2 + x - 3)$ A1

[4]

4 (i) State answer $R = 2$ B1
Use trig formula to find α M1

Obtain answer $\alpha = \frac{1}{3}\pi$ A1

[3]

© University of Cambridge Local Examinations Syndicate 2003

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

(ii) Carry out, or indicate need for, evaluation of $\cos^{-1}(\sqrt{2}/2)$ M1*

Obtain, or verify, the solution $\theta = \dfrac{7}{12}\pi$ A1

Attempt correct method for the other solution in range
i.e. $-\cos^{-1}(\sqrt{2}/2) + \alpha$ M1(dep*)

Obtain solution $\theta = \dfrac{1}{12}\pi$: [M1A0 for $\dfrac{25\pi}{12}$]   A1

[4]

5 (i) Make recognisable sketch of $y = 2^x$ or $y = x^2$, for $x < 0$ B1
Sketch the other graph correctly   B1

[2]

(ii) Consider sign of $2^x - x^2$ at x = –1 and x = –0.5, or equivalent   M1
Complete the argument correctly with appropriate calculations   A1

[2]

(iii) Use the iterative form correctly   M1
Obtain final answer –0.77   A1
Show sufficient iterations to justify its accuracy to 2 s.f., or show there
is a sign change in the interval (–0.775, –0.765)   A1

[3]

6 (i) State A is (4, 0)   B1
State B is (0, 4)   B1

[2]

(ii) Use the product rule to obtain the first derivative   M1(dep)
Obtain derivative $(4 - x)e^x - e^x$, or equivalent   A1
Equate derivative to zero and solve for x M1 (dep)
Obtain answer $x = 3$ only   A1

[4]

(iii) Attempt to form an equation in p e.g. by equating gradients of OP
and the tangent at P, or by substituting (0, 0) in the equation of the
tangent at P M1

Obtain equation in any correct form e.g. $\dfrac{4-p}{p} = 3 - p$ A1

Obtain 3-term quadratic $p^2 - 4p + 4 = 0$, or equivalent   A1
Attempt to solve a quadratic equation in p M1
Obtain answer $p = 2$ only   A1

[5]

7 (i) Attempt to differentiate using the quotient, product or chain rule   M1
Obtain derivative in any correct form   A1
Obtain the given answer correctly   A1

[3]

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

(ii)   State or imply the indefinite integral is –cot$x$ B1
Substitute limits and obtain given answer correctly   B1
[2]

(iii)   Use $\cot^2 x = \mathrm{cosec}^2 x - 1$ and attempt to integrate both terms,
or equivalent   M1
Substitute limits where necessary and obtain a correct unsimplified
answer   A1
Obtain final answer $\sqrt{3} - \dfrac{1}{3}\pi$ A1

[3]

(iv)   Use cos 2A formula and reduce denominator to $2\sin^2 x$ B1
Use given result and obtain answer of the form $k\sqrt{3}$ M1
Obtain correct answer $\dfrac{1}{2}\sqrt{3}$ A1

[3]