

CAMBRIDGE
INTERNATIONAL EXAMINATIONS

November 2003

GCE AS LEVEL

MARK SCHEME

MAXIMUM MARK: 50

SYLLABUS/COMPONENT: 9709/02

MATHEMATICS
Pure Mathematics : Paper Two



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]**

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 $\theta = \frac{7}{12}\pi$	A1
	Attempt correct method for the other solution in range i.e. $-\cos^{-1}(\sqrt{2}/2) + \alpha$	M1(dep*)
	Obtain solution $\theta = \frac{1}{12}\pi$: [M1A0 for $\frac{25\pi}{12}$]	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. $\frac{4-p}{p} = 3 - p$	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 $\cot^2 x = \operatorname{cosec}^2 x - 1$ and attempt to integrate both terms, or equivalent	M1
	Substitute limits where necessary and obtain a correct unsimplified answer	A1
	Obtain final answer $\sqrt{3} - \frac{1}{3}\pi$	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 $\frac{1}{2}\sqrt{3}$	A1
		[3]