June 2004

GCE AS LEVEL

MARK SCHEME

MAXIMUM MARK: 50

SYLLABUS/COMPONENT: 9709/02

MATHEMATICS
Paper 2 (Pure 2)

UNIVERSITY of CAMBRIDGE
International Examinations

1		Use logarithms to linearise an equation	M1	
		Obtain $\frac{x}{y} = \frac{\ln 5}{\ln 2}$ or equivalent	A1	
		Obtain answer 2.32	A1	**3**
2	**(i)**	Use the given iterative formula correctly at least ONCE with $x_1 = 3$	M1	
		Obtain final answer 3.142	A1	
		Show sufficient iterations to justify its accuracy to 3 d.p.	A1	**3**
	(ii)	State any suitable equation e.g. $x = \frac{1}{5}\left(4x + \frac{306}{x^4}\right)$	B1	
		Derive the given answer α (or x) = $\sqrt[5]{306}$	B1	**2**
3	**(i)**	Substitute x = 3 and equate to zero	M1	
		Obtain answer α = –1	A1	**2**
	(ii)	At any stage, state that x = 3 is a solution	B1	
		EITHER: Attempt division by (x–3) reaching a partial quotient of $2x^2 + kx$	M1	
		Obtain quadratic factor $2x^2 + 5x + 2$	A1	
		Obtain solutions x = –2 and x = -½	A1	
		OR: Obtain solution x = –2 by trial and error	B1	
		Obtain solution x = -½ similarly	B2	**4**
		[If an attempt at the quadratic factor is made by inspection, the M1 is earned if it reaches an unknown factor of $2x^2 + bx + c$ and an equation in b and/or c.]		
4	**(i)**	State answer R = 5	B1	
		Use trigonometric formulae to find α	M1	
		Obtain answer α = 53.13°	A1	**3**
	(ii)	Carry out, or indicate need for, calculation of $\sin^{-1}(4.5/5)$	M1	
		Obtain answer 11.0°	A1√	
		Carry out correct method for the second root e.g. 180° – 64.16° – 53.13°	M1	
		Obtain answer 62.7° and no others in the range	A1√	**4**
		[Ignore answers outside the given range.]		
	(iii)	State least value is 2	B1√	**1**
5	**(i)**	State derivative of the form $(e^{-x} \pm xe^{-x})$. Allow $xe^{x} \pm e^{x}$ {via quotient rule}	M1	
		Obtain correct derivative of $e^{\pm x} - xe^{-x}$	A1	
		Equate derivative to zero and solve for x	M1	
		Obtain answer x = 1	A1	**4**
	(ii)	Show or imply correct ordinates 0, 0.367879…, 0.27067…	B1	
		Use correct formula, or equivalent, with h = 1 and three ordinates	M1	
		Obtain answer 0.50 with no errors seen	A1	**3**
	(iii)	Justify statement that the rule gives an under-estimate	B1	**1**

6	**(i)**	State that $\frac{dx}{dt} = 2 + \frac{1}{t}$ or $\frac{dy}{dt} = 1 - \frac{4}{t^2}$, or equivalent	B1	
		Use $\frac{dy}{dx} = \frac{dy}{dt} \div \frac{dx}{dt}$	M1	
		Obtain the given answer	A1	**3**
	(ii)	Substitute t = 1 in $\frac{dy}{dx}$ and both parametric equations	M1	
		Obtain $\frac{dy}{dx} = -1$ and coordinates (2, 5)	A1	
		State equation of tangent in any correct horizontal form e.g. x + y = 7	A1√	**3**
	(iii)	Equate $\frac{dy}{dx}$ to zero and solve for t	M1	
		Obtain answer t = 2	A1	
		Obtain answer y = 4	A1	
		Show by any method (but <u>not</u> via $\frac{d}{dt}(y')$) that this is a minimum point	A1	**4**
7	**(i)**	Make relevant use of the cos(A + B) formula	M1*	
		Make relevant use of cos2A and sin2A formulae	M1*	
		Obtain a correct expression in terms of cosA and sinA	A1	
		Use $\sin^2 A = 1 - \cos^2 A$ to obtain an expression in terms of cosA	M1(dep*)	
		Obtain given answer correctly	A1	**5**
	(ii)	Replace integrand by $\frac{1}{4}\cos 3x + \frac{3}{4}\cos x$, or equivalent	B1	
		Integrate, obtaining $\frac{1}{12}\sin 3x + \frac{3}{4}\sin x$, or equivalent	B1 + B1√	
		Use limits correctly	M1	
		Obtain given anser	A1	**5**