CAMBRIDGE

INTERNATIONAL EXAMINATIONS

NOVEMBER 2001

ADVANCED SUBSIDIARY LEVEL

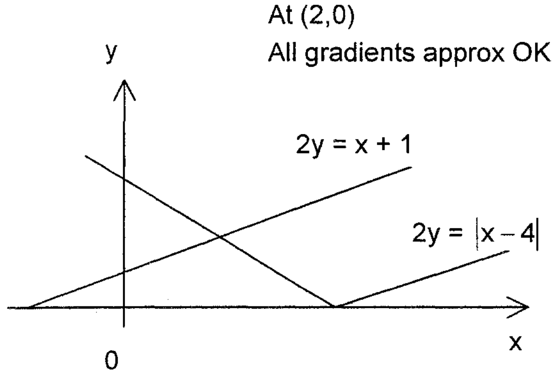
MARK SCHEME

MAXIMUM MARK : 50

SYLLABUS/COMPONENT : 8709/2

MATHEMATICS

UNIVERSITY of CAMBRIDGE
Local Examinations Syndicate

1		$2\sec^2x - \tan x = 5$ Use of $\sec^2x = 1 + \tan^2x$ $\rightarrow 2\tan^2x - \tan x - 3 = 0$ Solution of this $\tan x = -1$ or 1.5 $x = 135°$ or $315°$ or $56.3°$ or $236.3°$	M1 A1 DM1 A1A1√ **5**	Use of tan – sec link Correct only Correct attempt to solve A1 for one pair correct. A1sq for other pair.
2	(i)	$4^x = u^2$ and $2^{x+1} = 2u$ $u^2 = 2u + 12$	B1	For both values
	(ii)	Leads to $u = 4.6055$ (or $1 + \sqrt{13}$) Solution of 2^x = "his value" by logs $x = \log 4.6055 \div \log 2$ $x = 2.20$	B1 M1 M1 A1 **5**	For correct value of u – even if other given Realises need to use logs (or TI if accurate) log ÷ log Co to 3 sig figs (but allow 2.2) (Loses this A mark if 2 answers given)
3	(i)	Graph of $2y = x + 1$ Graph of $2y = \|x - 4\|$ At (2,0) All gradients approx OK 	B1 M1 A1	Approx correct – no values needed Must be V-shape – no negatives – to x-axis Two approx parallel, other with negative m
	(ii)	Solution occurs when $2y = x + 1$ and $2y = 4 - x$ $x = 1.5, y = 1.25$	M1 M1 A1 **6**	Recognition of where solution lies Must be using (4 – x) not (x – 4) Both needed

Question	Part	Answer	Marks	Notes
4		Attempt at Y = mX + c	M1	Attempt at any y = mx + c eqn
		Y = – 0.6X + c	A1	m and c correct
		Puts Y = lny and X = lnx	M1	Putting Y = lny and X = lnx
		lny = – 0.6lnx + 3		
		$y = e^3x^{-0.6}$	M1	Correct elimination of logs
		n = – 0.6 and A = e^3 = 20.1	A1A1	
			6	
5	(a)	$y = \frac{e^{2x}}{2x+3}$ dy/dx = $\frac{(2x+3)2e^{2x} - e^{2x}.2}{(2x+3)^2}$	M1	Correct u/v formula – or uv with $e^{2x}(2x + 3)^{-1}$
			A1	Correct unsimplified
		If x = 0, dy/dx = 4/9	A1	Co
	(b)	Implicit differentiation.	M1	Some evidence of implicit needed
		2x + 2ydy/dx = y + xdy/dx	A1A1	A1 LHS, A1 RHS
		At (3,2), dy/dx = – 4		
		Eqn of tangent y – 2 = – 4(x – 3) or y + 4x = 14	M1	Must have used calculus, not for normal
			A1	Any form ok.
			8	
6	(i)	$y = x^2\cos x$ dy/dx = $2x\cos x - x^2\sin x$	M1	Correct uv formula
			A1	Unsimplified ok
		= 0 when x = 0 or 2cosx = xsinx	M1	Putting his dy/dx = 0
		→ x tanx = 2.	A1	Co
	(ii)	u_2 = 1.107 u_3 = 1.065 u_4 = 1.081	M1	Correct manipulation of u_{n+1} from u_n
		u_5 = 1.075 u_6 = 1.078 u_7 = 1.077	A1	First two correct
		→ Limit of 1.08	A1	Correct limit
	(iii)	Since a limit is reached (=L)		
		$u_{n+1} = u_n = L$		
		$L = \tan^{-1}(2/L)$	M1	Putting $u_{n+1} = u_n = L$
		L tanL = 2.	A1	Co
			9	

7				
	(i)	$\int_0^{\frac{\pi}{4}} \sin 2x\,dx = \left[\frac{-\cos 2x}{2}\right] = 0 - (-\tfrac{1}{2}) = \tfrac{1}{2}$	M1	Needs "–" and cos 2x.
			A1	Co
		$\int_0^{\frac{\pi}{4}} \cos^2 x\,dx = \int \frac{\cos 2x}{2} + \frac{1}{2}\,dx$	M1	Using double angles + attempt at integration
		$= \left[\frac{\sin 2x}{4} + \frac{x}{2}\right]$	A1	Co
			DM1	Use of limits 0 to π/4
		$= \frac{1}{8}(2 + \pi)$	A1	Co beware of fortuitous answers.
	(ii)	$\int (2s + 3c)^2\,dx = \int (4s^2 + 9c^2 + 12sc)dx$	B1	Correct squaring – needs all terms
		$12sc = 6\sin 2x$ Integral = $6 \times \frac{1}{2} = 3$	B1	There could be alternatives to these marks.
		$9c^2$ Integral = $9 \times \frac{1}{8} \times (\pi + 2)$	B1	They could also be implied.
		$4s^2 = 4 - 4c^2$		
		Integral = 4x between 0 and $\frac{1}{4}\pi$	M1	Dealing correctly with $\int 4s^2$
		4 x integral of c^2 from 0 to $\frac{1}{4}\pi$		
		= 9.36 or 13π/8 + 17/4	A1	Correct in either form.
			11	