CAMBRIDGE
INTERNATIONAL EXAMINATIONS

NOVEMBER 2001

ADVANCED SUBSIDIARY LEVEL

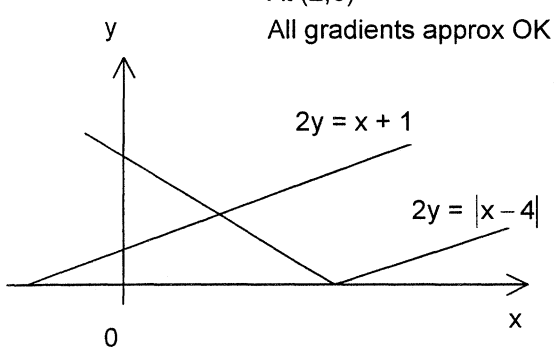
MARK SCHEME

MAXIMUM MARK : 50

SYLLABUS/COMPONENT : 8709/2

MATHEMATICS

UNIVERSITY of CAMBRIDGE
Local Examinations Syndicate

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

4		Attempt at $Y = mX + c$	**M1**	Attempt at any $y = mx + c$ eqn
		$Y = -0.6X + c$	**A1**	m and c correct
		Puts $Y = \ln y$ and $X = \ln x$	**M1**	Putting $Y = \ln y$ and $X = \ln x$
		$\ln y = -0.6\ln x + 3$		
		$y = e^3x^{-0.6}$	**M1**	Correct elimination of logs
		$n = -0.6$ and $A = e^3 = 20.1$	**A1A1**	
			6	
5	**(a)**	$y = \frac{e^{2x}}{2x+3}$ $\quad dy/dx = \frac{(2x+3)2e^{2x} - e^{2x}.2}{(2x+3)^2}$	**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 $y - 2 = -4(x - 3)$	**M1**	Must have used calculus, not for normal
		or $y + 4x = 14$		
			A1	Any form ok.
			8	
6	**(i)**	$y = x^2\cos x$ $\quad dy/dx = 2x\cos x - x^2\sin x$	**M1**	Correct uv formula
			A1	Unsimplified ok
		$= 0$ when $x = 0$ or $2\cos x = x\sin x$	**M1**	Putting his $dy/dx = 0$
		$\rightarrow x \tan x = 2$.	**A1**	Co
	(ii)	$u_2 = 1.107$ $\quad u_3 = 1.065$ $\quad u_4 = 1.081$	**M1**	Correct manipulation of u_{n+1} from u_n
		$u_5 = 1.075$ $\quad u_6 = 1.078$ $\quad u_7 = 1.077$	**A1**	First two correct
		$\rightarrow$ 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 $u_{n+1} = u_n = L$
		$L \tan L = 2$.	**A1**	Co
			9	

7				
	(i)	$\int_0^{\frac{\pi}{4}} \sin 2x\,dx = \left[\frac{-\cos 2x}{2}\right] = 0 - (-\frac{1}{2}) = \frac{1}{2}$	**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	