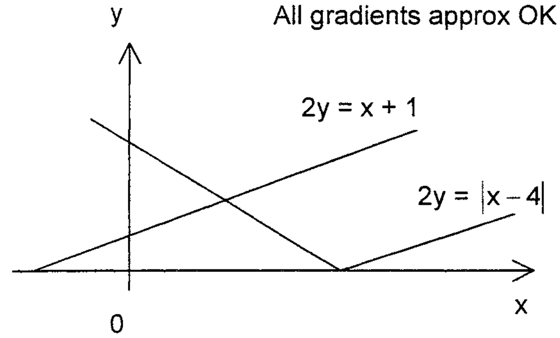
CAMBRIDGE
INTERNATIONAL EXAMINATIONS

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 $2y = \|x-4\|$	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 = 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)	$y = \dfrac{e^{2x}}{2x+3}$ $\quad dy/dx = \dfrac{(2x+3)2e^{2x} - e^{2x}.2}{(2x+3)^2}$	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 2cosx = xsinx	M1	Putting his dy/dx = 0
		→ x tanx = 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
		→ 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)	$\int_0^{\frac{\pi}{4}} \sin 2x dx = \left[\frac{-\cos 2x}{2}\right] = 0 - (-½) = ½$	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	