

NOVEMBER 2001

ADVANCED SUBSIDIARY LEVEL

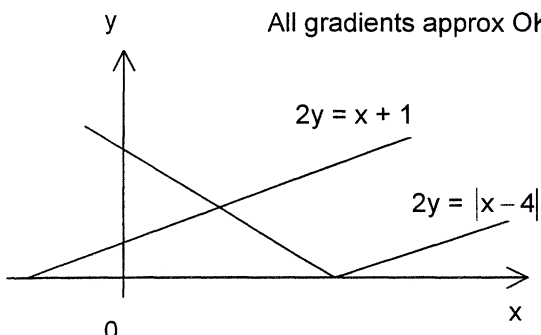
MARK SCHEME

MAXIMUM MARK : 50

SYLLABUS/COMPONENT : 8709/2

MATHEMATICS

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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 $x = 135^\circ$ or 315° or 56.3° or 236.3°	M1 A1 DM1 A1A1 $\sqrt{}$	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 $2^{x+1} = 2u$ $u^2 = 2u + 12$ (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 B1 M1 M1 A1	For both values For correct value of u – even if other given Realises need to use logs (or TI if accurate) log \div 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  (ii) Solution occurs when $2y = x + 1$ and $2y = 4 - x$ $x = 1.5, y = 1.25$	B1 M1 A1 M1 M1 A1	Approx correct – no values needed Must be V-shape – no negatives – to x-axis Two approx parallel, other with negative m Recognition of where solution lies Must be using $(4 - x)$ not $(x - 4)$ Both needed

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

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