Question			Answer	Marks	Guidance	
1			$y = e^{2x}\cos x$	M1	product rule used	consistent with their derivs
			$\Rightarrow \quad dy/dx = 2e^{2x}\cos x - e^{2x}\sin x$	A1	cao – mark final ans	e.g. $2e^{2x} - e^{2x}\tan x$ is A0
			$dy/dx = 0 \Rightarrow e^{2x}(2\cos x - \sin x) = 0$	M1	their derivative = 0	
			$\Rightarrow \quad 2\cos x = \sin x$			
			$\Rightarrow \quad 2 = \sin x/\cos x = \tan x$	M1	$\sin x / \cos x = \tan x$ used	or $\sin^2 x + \cos^2 x = 1$ used
			$\Rightarrow \quad x = 1.11$	A1	1.1 or 0.35π or better, or arctan 2, not 63.4° but condone ans given in both degrees and radians here	1.1071487 …, 0.352416…π, penalise incorrect rounding
			$\Rightarrow \quad y = 4.09$	A1cao	art 4.1	no choice
				[6]		

2			$y = \ln(1 - \cos 2x)$, let $u = 1 - \cos 2x$	M1	$1/(1 - \cos 2x)$ soi	
			$\Rightarrow \quad dy/dx = dy/du \,.\, du/dx$			
			$= (1/u).\ 2\sin 2x$	M1	$d/dx\,(1 - \cos 2x) = \pm\, 2\sin 2x$	
			$= \dfrac{2\sin 2x}{1-\cos 2x}$	A1cao		
			When $x = \pi/6$, $\dfrac{dy}{dx} = \dfrac{2\sin(\pi/3)}{1-\cos(\pi/3)}$	M1	substituting π/6 or 30° into their deriv	must be in at least two places
			$= 2\sqrt{3}$	A1cao		isw after correct answer seen
				[5]		

Question			er	Marks	Guidance	
3	(i)		$y = e^{-x}\sin 2x$ $\Rightarrow \quad dy/dx = e^{-x}.2\cos 2x + (-e^{-x})\sin 2x$	M1 B1 A1 **[3]**	Product rule $d/dx(\sin 2x) = 2\cos 2x$ Any correct expression	$u \times$ their $v' + v \times$ their u' but mark final answer
	(ii)		$dy/dx = 0$ when $2\cos 2x - \sin 2x = 0$ $\Rightarrow \quad 2 = \tan 2x$ $\Rightarrow \quad 2x = \arctan 2$ $\Rightarrow \quad x = ½ \arctan 2$ *	M1 M1 A1 **[3]**	ft their dy/dx but must eliminate e^{-x} $\sin 2x / \cos 2x = \tan 2x$ used [or $\tan^{-1}$] **NB AG**	derivative must have 2 terms substituting ½ arctan 2 into their deriv M0 (unless $\cos 2x = 1/\sqrt{5}$ and $\sin 2x = 2/\sqrt{5}$ found) must show previous step

4	(i)		translation in the x–direction of $\pi/4$ to the right translation in y-direction of 1 unit up.	M1 A1 M1 A1 **[4]**	allow 'shift', 'move' oe (eg using vector) allow 'shift', 'move' oe (eg using vector)	If just vectors given withhold **one** 'A' mark only 'Translate $\begin{pmatrix} \pi/4 \\ 1 \end{pmatrix}$' is 4 marks; if this is followed by an additional incorrect transformation, SC M1M1A1A0 $\begin{pmatrix} \pi/4 \\ 1 \end{pmatrix}$ only is M2A1A0

Question			Answer	Marks	Guidance	
4	(ii)		$g(x)=\dfrac{2\sin x}{\sin x+\cos x}$			(Can deal with num and denom separately)
			$g'(x)=\dfrac{(\sin x+\cos x)2\cos x-2\sin x(\cos x-\sin x)}{(\sin x+\cos x)^2}$	M1	Quotient (or product) rule consistent with their derivs	$\dfrac{vu'-uv'}{v^2}$; allow one slip, missing brackets
			$=\dfrac{2\sin x\cos x+2\cos^2 x-2\sin x\cos x+2\sin^2 x}{(\sin x+\cos x)^2}$	A1	Correct expanded expression (could leave the '2' as a factor)	$\dfrac{uv'-vu'}{v^2}$ is M0. Condone cos x^2, sin x^2
			$=\dfrac{2\cos^2 x+2\sin^2 x}{(\sin x+\cos x)^2}=\dfrac{2(\cos^2 x+\sin^2 x)}{(\sin x+\cos x)^2}$			
			$=\dfrac{2}{(\sin x+\cos x)^2}$ *	A1	**NB AG**	must take out 2 as a factor or state $\sin^2 x+\cos^2 x=1$
			When $x=\pi/4$, $g'(\pi/4)=2/(1/\sqrt{2}+1/\sqrt{2})^2$	M1	substituting $\pi/4$ into correct deriv	
			$=1$	A1		
			$f'(x)=\sec^2 x$	M1	o.e., e.g. $1/\cos^2 x$	
			$f'(0)=\sec^2(0)=1$, [so gradient the same here]	A1		
				[7]		

Question			er	Marks	Guidance	
4	(iii)		$\int_0^{\pi/4} f(x)\,dx = \int_0^{\pi/4} \frac{\sin x}{\cos x}\,dx$ let $u = \cos x$, $du = -\sin x\,dx$ when $x = 0$, $u = 1$, when $x = \pi/4$, $u = 1/\sqrt{2}$			
			$= \int_1^{1/\sqrt{2}} -\frac{1}{u}\,du$	M1	substituting to get $\int -1/u\ (du)$	ignore limits here, condone no d*u* but not d*x* allow $\int 1/u\ .-du$
			$= \int_{1/\sqrt{2}}^{1} \frac{1}{u}\,du$ *	A1	NB **AG**	but for A1 must deal correctly with the −ve sign by interchanging limits
			$= [\ln u]_{1/\sqrt{2}}^{1}$	M1	[ln *u*]	
			$= \ln 1 - \ln(1/\sqrt{2})$ $= \ln \sqrt{2} = \ln 2^{1/2} = ½ \ln 2$	A1	$\ln\sqrt{2}$, ½ ln 2 or $-\ln(1/\sqrt{2})$	mark final answer
				[4]		
	(iv)		Area = area in part **(iii)** translated up 1 unit.	M1	soi from $\pi/4$ added	or
			So = ½ ln 2 + 1 × $\pi/4$ = ½ ln 2 + $\pi/4$.	A1cao	oe (as above)	$\int_{\pi/4}^{\pi/2} (1+\tan(x-\pi/4))\,dx = [x + \ln\sec(x-\pi/4)]_{\pi/4}^{\pi/2}$ $= \pi/2 + \ln\sqrt{2} - \pi/4 = \pi/4 + \ln\sqrt{2}$ B2
				[2]		

Question			Answer	Marks	Guidance	
5			$y = x^2 \tan 2x$ $\Rightarrow \mathrm{d}y/\mathrm{d}x = 2x^2\sec^2 2x + 2x\tan 2x$ **OR** $y = x^2 \dfrac{\sin 2x}{\cos 2x}$ $\dfrac{\mathrm{d}y}{\mathrm{d}x} = x^2 \dfrac{\cos 2x.2\cos 2x - \sin 2x(-2\sin 2x)}{\cos^2 2x} + 2x\dfrac{\sin 2x}{\cos 2x}$ $= \ldots = 2x^2\sec^2 2x + 2x\tan 2x$ **OR** $y = \dfrac{x^2 \sin 2x}{\cos 2x}$ $\dfrac{\mathrm{d}y}{\mathrm{d}x} = \dfrac{\cos 2x(2x\sin 2x + x^2 2\cos 2x) - 2x^2 \sin 2x(-\sin 2x)}{\cos^2 2x}$ $= \ldots = 2x^2\sec^2 2x + 2x\tan 2x$	M1 M1 A1cao M1 A1 A1cao M1 A1 A1cao **[3]**	product rule $\mathrm{d}/\mathrm{d}u(\tan u) = \sec^2 u$ soi or $2x^2/\cos^2 2x + 2x\tan 2x$ product rule correct expression or $2x^2/\cos^2 2x + 2x\tan 2x$ (isw) quotient rule correct expression or $2x^2/\cos^2 2x + 2x\tan 2x$ (isw)	$u \times$ their $v' + v \times$ their u' attempted M0 if $\mathrm{d}/\mathrm{d}x\,(\tan 2x) = (2)\sec^2 x$ isw *see additional notes for complete solution* $u \times$ their $v' + v \times$ their u' attempted or $(2x^2 + 2x\sin 2x\cos 2x)/\cos^2 2x$ or $2x^2/\cos^2 2x + 2x\sin 2x / \cos 2x$ *see additional notes for complete solution* $(v \times$ their $u' - u \times$ their $v')/v^2$ attempted or $(2x^2 + 2x\sin 2x\cos 2x)/\cos^2 2x$ or $2x^2/\cos^2 2x + 2x\sin 2x / \cos 2x$

6 $\Rightarrow$	$y = \sqrt[3]{1+x^2} = (1 + x^2)^{1/3}$ $\dfrac{\mathrm{d}y}{\mathrm{d}x} = \dfrac{1}{3}(1+x^2)^{-\frac{2}{3}}.2x$ $= \dfrac{2}{3}x(1+x^2)^{-\frac{2}{3}}$	M1 M1 B1 A1 [4]	$(1 + x^2)^{1/3}$ chain rule $(1/3)\,u^{-2/3}$ (soi) cao, mark final answer	Do not allow MR for square root their $\mathrm{d}y/\mathrm{d}u \times \mathrm{d}u/dx$ (available for wrong indices) no ft on ½ index oe e.g. $\dfrac{2x(1+x^2)^{-\frac{2}{3}}}{3}$, $\dfrac{2x}{3\sqrt[3]{(1+x^2)^2}}$, etc but must combine 2 with 1/3.

7 $y = x^2(1 + 4x)^{1/2}$ $\Rightarrow \frac{dy}{dx} = x^2.\frac{1}{2}(1+4x)^{-1/2}.4 + 2x(1+4x)^{1/2}$ $= 2x(1+4x)^{-1/2}(x+1+4x)$ $= \frac{2x(5x+1)}{\sqrt{1+4x}}$ *	M1 B1 A1 M1 A1 [5]	product rule with $u = x^2$, $v = \sqrt{(1 + 4x)}$ ½ $(\ldots)^{-1/2}$ soi correct expression factorising or combining fractions NB **AG**	consistent with their derivatives; condone wrong index in v used for M1 only (need not factor out the $2x$) must have evidence of $x + 1 + 4x$ oe or $2x(5x + 1)(1 + 4x)^{-½}$ or $2x(5x + 1)/(1 + 4x)^{½}$