Question Number	Scheme	Marks
6(a)	$\left(\frac{3\pi}{2}, 0\right)$	B1
		(1)
(b)	$f'(x) = \left(6\cos^2 x\right)e^{3\sin x} - \left(2\sin x\right)e^{3\sin x}$	M1A1
	$f'(x) = \left(6\cos^2 x\right)e^{3\sin x} - \left(2\sin x\right)e^{3\sin x}$ $\Rightarrow \left(6\left(1-\sin^2 x\right)-2\sin x\right)(=0)$	**d**M1
	$\Rightarrow 3\sin^2 x + \sin x - 3 = 0$ oe	A1
		(4)
(c)	$\sin x = \frac{-1+\sqrt{37}}{6} \Rightarrow x = ...$	M1
	$x = 2.131$	A1
		(2)
		(7 marks)

Question Number	Scheme	Marks
5(a) Way One	$\cot^2 x - \tan^2 x \equiv \frac{\cos^2 x}{\sin^2 x} - \frac{\sin^2 x}{\cos^2 x} \equiv \frac{\cos^4 x - \sin^4 x}{\sin^2 x \cos^2 x}$	M1
	$\equiv \frac{\left(\cos^2 x - \sin^2 x\right)\left(\cos^2 x + \sin^2 x\right)}{\sin^2 x \cos^2 x} \equiv \frac{\cos 2x}{...}$ or $\frac{...}{\left(\frac{1}{2}\sin 2x\right)^2}$	dM1
	$\equiv \frac{\cos 2x}{\left(\frac{1}{2}\sin 2x\right)^2}$	A1
	$\equiv 4\frac{\cos 2x}{\sin 2x \sin 2x} \equiv 4\cot 2x \operatorname{cosec} 2x$ *	A1*
		(4)
(b)	$4\cot 2\theta \operatorname{cosec} 2\theta = 2\tan^2\theta \Rightarrow \cot^2\theta - \tan^2\theta = 2\tan^2\theta \Rightarrow \cot^2\theta - 3\tan^2\theta = 0$	M1
	$\cot^2\theta - 3\tan^2\theta = 0 \Rightarrow \frac{1}{\tan^2\theta} - 3\tan^2\theta = 0 \Rightarrow \tan^4\theta = \frac{1}{3}$	A1
	$\tan^4\theta = "\frac{1}{3}" \Rightarrow \tan\theta = \pm\sqrt[4]{"\frac{1}{3}"} = "\pm 0.7598.." \Rightarrow \theta = ...$	M1
	$\theta =$ awrt $0.65, \ -0.65$	A1A1
		(5)
		Total 9

7(a)	$y = e^{-x^2}\sin 3x \Rightarrow \frac{dy}{dx} = 3e^{-x^2}\cos 3x - 2xe^{-x^2}\sin 3x$	M1A1
	$3e^{-x^2}\cos 3x - 2xe^{-x^2}\sin 3x = 0 \Rightarrow 3\cos 3x - 2x\sin 3x = 0$ $\Rightarrow 3\cos 3x = 2x\sin 3x \Rightarrow \tan 3x = \frac{3}{2x}$	dM1
	$x = \frac{1}{3}\arctan\left(\frac{3}{2x}\right)$ *	A1*
		(4)
(b)(i)	$x_1 = 0.4 \Rightarrow x_2 = \frac{1}{3}\arctan\left(\frac{3}{2\times 0.4}\right)$	M1
	$(x_2 =) 0.4367$	A1
(ii)	$(x_4 =) 0.4307$	A1
		(3)

(c)	e.g. $f(x) = x - \frac{1}{3}\arctan\left(\frac{3}{2x}\right)$ $f(0.4305) = 0.4305 - \frac{1}{3}\arctan\left(\frac{3}{2\times 0.4305}\right)\left(= 6.38\times 10^{-5}\right)$ $f(0.4295) = 0.4295 - \frac{1}{3}\arctan\left(\frac{3}{2\times 0.4295}\right)\left(= -1.141...\times 10^{-3}\right)$ or e.g. $f(x) = 3e^{-x^2}\cos 3x - 2xe^{-x^2}\sin 3x$ $f(0.4305) = 3e^{-(0.4305)^2}\cos 3(0.4305) - 2(0.4305)e^{-(0.4305)^2}\sin 3\ (0.4305)\left(= -4.968...\times 10^{-4}\right)$ $f(0.4295) = 3e^{-(0.4295)^2}\cos 3(0.4295) - 2(0.4295)e^{-(0.4295)^2}\sin 3\ (0.4295)\left(= 8.885...\times 10^{-3}\right)$	M1
	Sign change therefore x is 0.430 to 3dp	A1
		(2)
		Total 9

9(a)	$\frac{\cos 2x}{\sin x} + \frac{\sin 2x}{\cos x} = \frac{\cos 2x}{\sin x} + \frac{2\sin x\cos x}{\cos x}$ (One Correct identity)	B1
	$= \frac{1-2\sin^2 x}{\sin x} + \frac{2\sin x\cancel{\cos x}}{\cancel{\cos x}}$	M1
	$= \frac{1}{\sin x} - \frac{2\sin\cancel{^2}x}{\cancel{\sin x}} + 2\sin x = \frac{1}{\sin x} = \text{cosec } x$ *	A1*
		(3)
(b)	E.g. Equation is $\text{cosec}^2\theta = 6\cot\theta - 4 \Rightarrow 1 + \cot^2\theta = 6\cot\theta - 4$	M1
	E.g. $\cot^2\theta - 6\cot\theta + 5 = 0$	A1
	E.g. $\tan\theta = \frac{1}{5}, 1$	dM1
	$\theta = 0.197, \frac{\pi}{4}$	A1, A1
		(5)
(c)	$\int_{\frac{\pi}{6}}^{\frac{\pi}{4}} \text{cosec}x\cot x\,dx = \left[-\text{cosec}x\right]_{\frac{\pi}{6}}^{\frac{\pi}{4}}$	M1
	$= 2 - \sqrt{2}$	A1
		(2)
		10 marks

10.(a)	$x = 3\cos 2y \Rightarrow \left(\frac{dx}{dy} =\right) -6\sin 2y$	M1 A1 **(2)**
(b)	E.g. $\frac{dx}{dy} = -6\sqrt{1-kx^2}$ or $\frac{dy}{dx} = \frac{1}{\text{their}\frac{dx}{dy}}$	M1
	$\frac{dy}{dx} = -\frac{1}{6\sqrt{1-\cos^2 2y}} = -\frac{1}{6\sqrt{1-\left(\frac{x}{3}\right)^2}} = -\frac{1}{2\sqrt{9-x^2}}$	dM1 A1 **(3)**
(c)	Sets $\frac{dy}{dx} = -\frac{1}{2\sqrt{9-x^2}} = -\frac{1}{4}$	
	$x^2 = 5 \Rightarrow a = \sqrt{5}$	M1 A1
	$\sqrt{5} = 3\cos 2y \Rightarrow b = \frac{1}{2}\arccos\left(\frac{\sqrt{5}}{3}\right)$	dM1 A1
Alt (c)	Sets $\frac{dy}{dx} = -\frac{1}{6\sin 2y} = -\frac{1}{4}$	
	$\Rightarrow \sin 2y = \frac{2}{3} \Rightarrow y = \frac{1}{2}\arcsin\left(\frac{2}{3}\right)$	M1A1
	$x = 3\cos 2y = 3\sqrt{1-\sin^2\left(\arcsin\frac{2}{3}\right)} = \sqrt{5}$	dM1 A1 **(4)** **(9 marks)**

Question Number	Scheme	Marks
1(a)	$f(x)$ „ 9	B1
		(1)
(b)	$fg(1.5) = f\left(\frac{3}{2\times 1.5+1}\right) = 9-\left(\frac{3}{2\times 1.5+1}\right)^2$	M1
	$= \frac{135}{16}$	A1
		(2)
(c)	$g(x) = \frac{3}{2x+1} \Rightarrow g^{-1}(x) = \frac{3-x}{2x}$	M1 A1
	$0 < x$ „ 3	B1
		(3)
		Total 6

Question Number	Scheme	Marks
3(a)	$\log_{10} D = 1.04 + 0.38t \Rightarrow D = 10^{1.04+0.38t}$ **or** $a = 10^{1.04}$ or $b = 10^{0.38}$	M1
	$a =$ awrt 10.96 **or** $b =$ awrt 2.399	A1
	$D = 10.96 \times 2.399^t$	A1
		(3)
(b)	$45000 = "10.96" \times "2.399"^T \Rightarrow T = ...$ or $\log_{10} 45000 = 1.04 + 0.38T \Rightarrow T = ...$	M1
	awrt 9.51	A1
		(2)
(c)	$D = "10.96" \times "2.399"^{12} \Rightarrow D = ...$ or $\log_{10} D = 1.04 + 0.38 \times 12 \Rightarrow D = ...$ or $350000 = "10.96" \times "2.399"^t \Rightarrow t = ...$ or $\log_{10} 350000 = 1.04 + 0.38 \times t \Rightarrow t = ...$	M1
	$D =$ awrt (£)400 000 $\Rightarrow$ yes or $t =$ awrt 11.9 $\Rightarrow$ yes	A1
		(2)
		(7 marks)

2(a)	$R = 25$	B1
	$\tan\alpha = \frac{24}{7} \Rightarrow \alpha = ...$	M1
	$\alpha = 1.287$	A1
		(3)
(b)(i)	$\text{Min} = \frac{5}{90 - 3 \times "25" \times (-1)}$	M1
	$= \frac{1}{33}$	A1
(b)(ii)	$(2x + "1.287") = \pi, ... \Rightarrow x = ...$	M1
	$\Rightarrow x = \frac{\pi - "1.287"}{2} = 0.927$	A1
		(4)
		Total 7