Question Number	Scheme	Marks
9(a)	$\dfrac{3\sin\theta\cos\theta}{\cos\theta+\sin\theta}=(2+\sec 2\theta)(\cos\theta-\sin\theta)$ $\Rightarrow \dfrac{3}{2}\sin 2\theta=(2+\sec 2\theta)(\cos\theta-\sin\theta)\left(\cos\theta+\sin\theta\right)$ **or** $\Rightarrow 3\sin\theta\cos\theta=(2+\sec 2\theta)\cos 2\theta$	M1
	$\Rightarrow \dfrac{3}{2}\sin 2\theta=(2+\sec 2\theta)\cos 2\theta$	**d**M1
	$\Rightarrow \dfrac{3}{2}\sin 2\theta=(2+\sec 2\theta)\cos 2\theta$ $\Rightarrow \dfrac{3}{2}\sin 2\theta=2\cos 2\theta+1\Rightarrow 3\sin 2\theta-4\cos 2\theta=2$ *	A1*
		(3)

(b)	Way 1 using $R\sin(2x-\alpha)$ or $R\cos(2x+\alpha)$	
	$\Rightarrow R=\sqrt{3^2+4^2}=\ldots(5)$ **or** $(\alpha=)\ \tan^{-1}\left(\frac{4}{3}\text{ or }\frac{3}{4}\right)=\ldots$	M1
	$\Rightarrow R=\sqrt{3^2+4^2}=\ldots(5)$ **and** $(\alpha=)\ \tan^{-1}\left(\frac{4}{3}\text{ or }\frac{3}{4}\right)=\ldots$	**d**M1
	$3\sin 2x-4\cos 2x=2\Rightarrow 5\sin(2x-0.927)=2$ **or** $3\sin 2x-4\cos 2x=2\Rightarrow 5\cos(2x+0.644)=-2$	A1
	$5\sin(2x-0.927)=2\Rightarrow x=\dfrac{\sin^{-1}\frac{2}{5}+0.927}{2}$ **or** $5\cos(2x+0.644)=-2\Rightarrow x=\dfrac{\cos^{-1}\frac{-2}{5}-0.644}{2}$	**dd**M1
	$x=$ awrt 3.81	A1
		(5)
		(8 marks)

Question Number	Scheme	Marks
4(a)	$R = \sqrt{12}$ or $2\sqrt{3}$	B1
	$\alpha = \tan^{-1}\left(\frac{3}{\sqrt{3}}\right) = \ldots$	M1
	$(f(x) =)\sqrt{12}\sin\left(2x - \frac{\pi}{3}\right)$	A1
		(3)
(b)(i)	Minimum value $= \frac{18}{\sqrt{12}+4\sqrt{3}} (= \sqrt{3})$	B1
(ii)	$\sin\left(6x - \frac{\pi}{3}\right) = 1 \Rightarrow x = \frac{5}{36}\pi$	M1A1
		(3)
		(6 marks)

7 (a)	$\sin 4\theta \equiv 2\sin 2\theta \cos 2\theta$	M1
	$\equiv 2(2\sin\theta\cos\theta)(1 - 2\sin^2\theta)$	dM1
	$\equiv 4\sin\theta\cos\theta - 8\sin^3\theta\cos\theta$	
	$\equiv \sin\theta\cos\theta(4 - 8\sin^2\theta)$	A1
		(3)
(b)	$\sec x \sin 4x = 5\sin^3 x \cot x$	
	$\frac{1}{\cos x} \times \cos x \sin x(4 - 8\sin^2 x) = 5\sin^3 x \cot x$	B1
	$\div \sin x \Rightarrow 4 - 8\sin^2 x = 5\sin^2 x \cot x$	
	$\div \cos^2 x \Rightarrow 4\sec^2 x - 8\tan^2 x = 5\tan^2 x \cot x$	M1
	$\Rightarrow 4\sec^2 x - 5\tan x - 8\tan^2 x = 0$ *	A1*
		(3)
(c)	Uses $\sec^2 x = 1 + \tan^2 x$	M1
	$\Rightarrow 4\tan^2 x + 5\tan x - 4 = 0$	A1
	$\Rightarrow \tan x = \frac{-5 \pm \sqrt{89}}{8} \Rightarrow x = \ldots$	dM1
	$\Rightarrow x =$ awrt 0.506, 2.08	A1
		(4)
		(10 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
	$\equiv \frac{(\cos^2 x - \sin^2 x)(\cos^2 x + \sin^2 x)}{\sin^2 x \cos^2 x} \equiv \frac{\cos 2x}{\ldots}$ or $\frac{\ldots}{\left(\frac{1}{2}\sin 2x\right)^2}$	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
	$\tan^4\theta = "\frac{1}{3}" \Rightarrow \tan\theta = \pm\sqrt[4]{"\frac{1}{3}"} = "\pm 0.7598.." \Rightarrow \theta = \ldots$	M1
	$\theta =$ awrt $0.65, \ -0.65$	A1A1
		(5)
		Total 9

Question Number	Scheme	Marks
9(a)	$4\sin\theta\cos\theta = 2\sin 2\theta$	B1
	e.g. $\Rightarrow 6\sin^2\theta\cot 2\theta + 2\sin 2\theta = (3 - 3\cos 2\theta)\frac{\cos 2\theta}{\sin 2\theta} + 2\sin 2\theta$	M1A1
		(3)
(b)	$3\cot 2\theta - 14 = 6\sin^2\theta\cot 2\theta + 4\sin\theta\cos\theta$	
	e.g. $\Rightarrow 3\cot 2\theta\sin 2\theta - 14\sin 2\theta = (3 - 3\cos 2\theta)\cos 2\theta + 2\sin^2 2\theta$	M1
	$\Rightarrow -14\sin 2\theta = -3(1 - \sin^2 2\theta) + 2\sin^2 2\theta$	M1
	$5\sin^2 2\theta + 14\sin 2\theta - 3 = 0$ *	A1*
		(3)
(c)	$(\sin 2x =)\frac{1}{5} \Rightarrow x = \ldots$	M1
	$x =$ awrt $5.8°$, awrt $84.2°$	A1A1
		(3)
		(9 marks)

1	$3\tan^2\theta+7\sec\theta-3=0\Rightarrow 3\left(\sec^2\theta-1\right)+7\sec\theta-3=0$	M1
	$3\sec^2\theta+7\sec\theta-6=0$	A1
	$(3\sec\theta-2)(\sec\theta+3)=0\Rightarrow\sec\theta=...\Rightarrow\cos\theta=...$	dM1
	$\theta=109.5°, 250.5°$	A1, A1
		(5)

	$f(x)=8\sin x\cos x+4\cos^2 x-3$	
4(a)	States or uses $\sin 2x=2\sin x\cos x$ or $\cos 2x=\pm 2\cos^2 x\pm 1$	M1
	Uses $\sin 2x=2\sin x\cos x$ and $\cos 2x=\pm 2\cos^2 x\pm 1$ in f (x)	dM1
	$\left(f(x)=\right)\ 8\sin x\cos x+4\cos^2 x-3=4\sin 2x+2\cos 2x-1$	A1
		(3)
(b)	$R^2=a^2+b^2\Rightarrow R=\sqrt{20}$ or $2\sqrt{5}$	B1ft
	$\tan\alpha=\frac{b}{a}\Rightarrow\alpha=...\ \left(="\text{awrt } 0.464"\right)$	M1
	$\left(f(x)=\right)\ 2\sqrt{5}\sin\left(2x+0.464\right)-1$	A1
		(3)
(c)	(i) Maximum value = "$2\sqrt{5}-1$"	B1 ft
	(ii) Solves $2x+\alpha=\frac{5\pi}{2}\Rightarrow x=...$	M1
	$\left(x=\right)$ awrt 3.69 (or $\left(x=\right)$ awrt 3.70)	A1
		(3)
		(9 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)	$\left(2x+"1.287"\right)=\pi,...\Rightarrow x=...$	M1
	$\Rightarrow x=\frac{\pi-"1.287"}{2}=0.927$	A1
		(4)
		Total 7