Question Number	Scheme	Notes	Marks
9	"Solutions relying entirely on calculator technology are not acceptable"		
(a)	$1+\sin\theta=1+\cos 2\theta \Rightarrow \sin\theta=1-2\sin^2\theta \Rightarrow 2\sin^2\theta+\sin\theta-1=0$ Sets $1+\sin\theta=1+\cos 2\theta$ and obtains a 3TQ in $\sin\theta$ (terms may not all be on one side) by using $\cos 2\theta=\pm1\pm2\sin^2\theta$ or equivalent work condoning sign errors only in identities		**M1**
	$2\sin^2\theta+\sin\theta-1=0\Rightarrow(2\sin\theta-1)(\sin\theta+1)=0$ $\Rightarrow \sin\theta=\frac{1}{2}\Rightarrow\theta=...$	Solves 3TQ in $\sin\theta$ for θ Must see factorisation or equivalent work	**dM1**
	$\left(\frac{3}{2},\frac{\pi}{6}\right)$ Allow $r=\frac{3}{2},\ \theta=\frac{\pi}{6}$ even if followed by $\left(\frac{\pi}{6},\frac{3}{2}\right)$ Correct polar coordinates. Ignore extra coordinate pairs unless correct *P* is rejected		**A1**
			(3)

(b)	Note that the $\frac{1}{2}$s may have already been applied		
	$\int(1+\sin\theta)^2\,\mathrm{d}\theta=\int\left(1+2\sin\theta+\sin^2\theta\right)\mathrm{d}\theta=\int\left(1+2\sin\theta+\frac{1}{2}-\frac{1}{2}\cos 2\theta\right)\mathrm{d}\theta$ $\int(1+\cos 2\theta)^2\,\mathrm{d}\theta=\int\left(1+2\cos 2\theta+\cos^2 2\theta\right)\mathrm{d}\theta=\int\left(1+2\cos 2\theta+\frac{1}{2}+\frac{1}{2}\cos 4\theta\right)\mathrm{d}\theta$		
	$\int(1+\sin\theta)^2\,\mathrm{d}\theta=\int\left(1+2\sin\theta+\sin^2\theta\right)\mathrm{d}\theta$ and uses $\sin^2\theta=\pm\frac{1}{2}\pm\frac{1}{2}\cos 2\theta$ $\int(1+\cos 2\theta)^2\,\mathrm{d}\theta=\int\left(1+2\cos 2\theta+\cos^2 2\theta\right)\mathrm{d}\theta$ and uses $\cos^2 2\theta=\pm\frac{1}{2}\pm\frac{1}{2}\cos 4\theta$		**M1(one)** **dM1(both)**
	Allows the Ms for $r_1^2\pm r_2^2$ but $(r_1\pm r_2)^2$ is M0dM0		
	$\int\left(1+2\sin\theta+\frac{1}{2}-\frac{1}{2}\cos 2\theta\right)\mathrm{d}\theta=\frac{3}{2}\theta-2\cos\theta-\frac{1}{4}\sin 2\theta(+c)$ $\int\left(1+2\cos 2\theta+\frac{1}{2}+\frac{1}{2}\cos 4\theta\right)\mathrm{d}\theta=\frac{3}{2}\theta+\sin 2\theta+\frac{1}{8}\sin 4\theta(+c)$		**A1(one)** **Requires 1 previous M mark** **A1(both)**
	Area of *R*: $\frac{1}{2}\left[\frac{3}{2}\theta-2\cos\theta-\frac{1}{4}\sin 2\theta\right]_{-\frac{\pi}{2}}^{\frac{\pi}{6}}+\frac{1}{2}\left[\frac{3}{2}\theta+\sin 2\theta+\frac{1}{8}\sin 4\theta\right]_{\frac{\pi}{6}}^{\frac{\pi}{2}}$ $=\frac{1}{2}\left(\frac{\pi}{4}-\sqrt{3}-\frac{\sqrt{3}}{8}-\left(-\frac{3\pi}{4}\right)\right)+\frac{1}{2}\left(\frac{3\pi}{4}-\left(\frac{\pi}{4}+\frac{\sqrt{3}}{2}+\frac{\sqrt{3}}{16}\right)\right)$ or $\frac{1}{2}\left(\pi-\frac{9\sqrt{3}}{8}\right)+\frac{1}{2}\left(\frac{\pi}{2}-\frac{9\sqrt{3}}{16}\right)$ A completely valid method using the $\frac{1}{2}$ twice and the correct limits, obtaining a numerical expression with trig terms evaluated. May not be consistent - if the limits are seen correctly on the square brackets accept the **sum** of two substitutions. If just $a\pi+b\sqrt{3}$ results it must be $\frac{3\pi}{4}-\frac{27}{32}\sqrt{3}$		**ddM1**
	$=\frac{3\pi}{4}-\frac{27}{32}\sqrt{3}$ Correct expression in this form. Requires all previous marks.		**A1**
			(6)
			Total 9