Question Number	Scheme	Notes	Marks
7	$r=\sqrt{3}\sin\theta \quad (0 \leqslant \theta \leqslant \pi)$ $\qquad r=3\cos\theta \quad \left(-\frac{\pi}{2} \leqslant \theta \leqslant \frac{\pi}{2}\right)$		
(a)	$\sqrt{3}\sin\theta=3\cos\theta \Rightarrow \tan\theta=\sqrt{3}$ $\Rightarrow \theta=\frac{\pi}{3}, \quad r=\frac{3}{2}$ or $\left(\frac{3}{2},\frac{\pi}{3}\right)$	B1: Either correct coordinate B1: Both correct coordinates and no others	B1 B1
			(2)
(b)	$\int\left(\sqrt{3}\sin\theta\right)^2 \mathrm{d}\theta=K\int \pm\frac{1}{2}\pm\frac{1}{2}\cos 2\theta \,\mathrm{d}\theta=\ldots$ or $\int\left(3\cos\theta\right)^2 \mathrm{d}\theta=M\int \pm\frac{1}{2}\pm\frac{1}{2}\cos 2\theta \,\mathrm{d}\theta=\ldots$	Uses one of $\sin^2\theta=\pm\frac{1}{2}\pm\frac{1}{2}\cos 2\theta$ or $\cos^2\theta=\pm\frac{1}{2}\pm\frac{1}{2}\cos 2\theta$ in an attempt to integrate r^2 for one of the equations.	M1
	$\int\left(\sqrt{3}\sin\theta\right)^2 \mathrm{d}\theta=K\int \frac{1}{2}-\frac{1}{2}\cos 2\theta \,\mathrm{d}\theta=\ldots$ and $\int\left(3\cos\theta\right)^2 \mathrm{d}\theta=M\int \frac{1}{2}+\frac{1}{2}\cos 2\theta \,\mathrm{d}\theta=\ldots$	Uses both $\sin^2\theta=\frac{1}{2}-\frac{1}{2}\cos 2\theta$ and $\cos^2\theta=\frac{1}{2}+\frac{1}{2}\cos 2\theta$ in an attempt to integrate r^2 for both of the equations to correct form.	M1
	$\int\left(\sqrt{3}\sin\theta\right)^2 \mathrm{d}\theta=\frac{3}{2}\left(\theta-\frac{1}{2}\sin 2\theta\right)$ and $\int\left(3\cos\theta\right)^2 \mathrm{d}\theta=\frac{9}{2}\left(\theta+\frac{1}{2}\sin 2\theta\right)$	Fully correct expression after integration ignoring limits (accept equivalent expressions)	A1
	$\frac{1}{2}\int_0^{\frac{\pi}{3}}\left(\sqrt{3}\sin\theta\right)^2 \mathrm{d}\theta=\frac{3}{4}\left[\text{"}\theta-\frac{1}{2}\sin 2\theta\text{"}\right]_0^{\frac{\pi}{3}}=\ldots$ or $\frac{1}{2}\int_{\frac{\pi}{3}}^{\frac{\pi}{2}}\left(3\cos\theta\right)^2 \mathrm{d}\theta=\frac{9}{4}\left[\text{"}\theta+\frac{1}{2}\sin 2\theta\text{"}\right]_{\frac{\pi}{3}}^{\frac{\pi}{2}}=\ldots$	Full process for at least one of the two areas required, including correct area formula, with their attempt to apply the double angle formula, and evidence of correct limits applied.	M1
	Area of $R=\frac{1}{2}\int_0^{\frac{\pi}{3}}3\sin^2\theta \,\mathrm{d}\theta+\frac{1}{2}\int_{\frac{\pi}{3}}^{\frac{\pi}{2}}9\cos^2\theta \,\mathrm{d}\theta$ $=\frac{3}{4}\left[\frac{\pi}{3}-\frac{1}{2}\sin\frac{2\pi}{3}-(0-0)\right]+\frac{9}{4}\left[\frac{\pi}{2}+0-\left(\frac{\pi}{3}+\frac{1}{2}\sin\frac{2\pi}{3}\right)\right]$	Full and correct process for the area of R. Formulae and limits must all be correct, and evidence of limits applied, with areas added.	DM1
	$\frac{\pi}{4}-\frac{3\sqrt{3}}{16}+\frac{3\pi}{8}-\frac{9\sqrt{3}}{16}=\frac{5\pi}{8}-\frac{3\sqrt{3}}{4}$	Correct answer. Allow $a=\frac{5}{8}, \quad b=-\frac{3}{4}$	A1
			(6)
			Total 8

Additional Notes

(a)

B1: One correct coordinate, do not be concerned about the method for this mark. Allow for $\theta=\frac{\pi}{3}$ seen and isw if they go on to use $\theta=\frac{\pi}{3}$ for this mark.

B1: Both coordinates correct, and no extras. Again, do not be concerned about the method. Condone if given in the wrong order in a coordinate pair.

(b)

M1: Starts correct process to find one of the two areas. Must be using r^2 for one of the two curves, attempt a double angle formula $\sin^2\theta = \pm\frac{1}{2} \pm \frac{1}{2}\cos 2\theta$ or $\cos^2\theta = \pm\frac{1}{2} \pm \frac{1}{2}\cos 2\theta$ and any attempt to integrate the result (no matter how poor, ie a changed function). Condone errors with the coefficient not being squared.

M1: A full process to find the integral of r^2 for **both** curves with **correct** double angle formulae used, so $\sin^2\theta = \frac{1}{2} - \frac{1}{2}\cos 2\theta$ and $\cos^2\theta = \frac{1}{2} + \frac{1}{2}\cos 2\theta$ and reaches correct for each, but again allow if slips occur in the coefficient.

A1: Fully correct integration for r^2 for **both** curves. The coefficients must have been correctly dealt with. Note the $\frac{1}{2}$ may be included throughout.

M1: For a full correct process to find at least one of the areas. Must be using $\frac{1}{2}\int_{\alpha}^{\beta} r^2 \,\mathrm{d}\theta$ including the $\frac{1}{2}$ and with **correct** limits for the area applied (condone not showing subtracted 0's), but condone slips in the coefficients when squaring and condone if incorrect double angle formula attempts were made.

Note: Some candidates may attempt to find only one area and double the result. If the area formula is clearly seen or applied before doubling this is acceptable as an attempt for the full process for one area.

DM1: Depends on all previous method marks. Fully correct process for **both** areas and adds the results. This may be done separately or in one expression throughout the working.

A1: Correct answer.