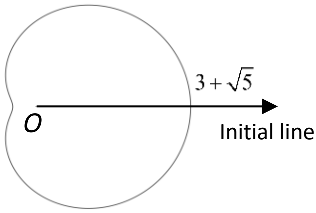
Question	Scheme	Marks	AOs
4(a)	 Recalls correct shape for the type of curve.	B1	1.2
	Correct position with labelling of pole, initial line and point.	B1	1.1b
		(2)	
(b)	$\frac{\mathrm{d}}{\mathrm{d}\theta}(r\sin\theta)=\frac{\mathrm{d}}{\mathrm{d}\theta}\left(3\sin\theta+\sqrt{5}\sin\theta\cos\theta\right)=A\cos\theta+B\cos 2\theta$ (oe)	M1	1.1b
	$\frac{\mathrm{d}}{\mathrm{d}\theta}(r\sin\theta)=\frac{\mathrm{d}}{\mathrm{d}\theta}\left(3\sin\theta+\sqrt{5}\sin\theta\cos\theta\right)=3\cos\theta+\sqrt{5}\cos 2\theta$ (oe)	A1	1.1b
	$\frac{\mathrm{d}y}{\mathrm{d}x}=0\Rightarrow 3\cos\theta+\sqrt{5}\left(2\cos^2\theta-1\right)=0\Rightarrow 2\sqrt{5}\cos^2\theta+3\cos\theta-\sqrt{5}=0$ $\Rightarrow\cos\theta=\frac{-3\pm\sqrt{9-4\left(2\sqrt{5}\right)\left(-\sqrt{5}\right)}}{4\sqrt{5}}=\ldots$	M1	3.1a
	$\cos\theta=\frac{-3\pm 7}{4\sqrt{5}}$, quadrant 1 needs $\cos\theta>0$ so $\cos\theta=\frac{1}{\sqrt{5}}$	A1	2.3
		(4)	
(c)	$r=4$	B1	1.1b
		(1)	
		(7 marks)	

Notes:

(a)

B1: Recalls the correct cardioid shape for this type of polar curve.

B1: Correctly placed with the pole, initial line and point where curve crosses the initial line all indicated in some way.

(b)

M1: Uses $y=r\sin\theta$ with the curve and attempts to differentiate. Accept any correct form but may have slips in coefficients, so e.g. as shown or $A\cos\theta+B\cos^2\theta+C\sin^2\theta$ can score M1.

A1: Correct differentiation. Accept equivalents, e.g. $3\cos\theta+\sqrt{5}\cos^2\theta-\sqrt{5}\sin^2\theta$

M1: Sets their derivative equal to zero and attempts to find $\cos\theta$ (allow if $r\cos\theta$ was used)

A1: Selects the correct value for $\cos\theta$. If the other value is given it is A0 unless clearly rejected.

(c)

B1: Correct value for *r*