

Q	Marking instructions	AO	Marks	Typical solution
7(a)	<p>Forms an expression for the area of one sector or both sectors</p> <p>e.g $\frac{1}{2}r^2\left(\frac{\pi-\theta}{2}\right)$ or $r^2\left(\frac{\pi-\theta}{2}\right)$</p> <p>or $\frac{1}{2}r^2(\pi-\theta)$</p> <p>OE</p> <p>Allow substitution of $r = 2.5$ Condone $r = 5$ Condone missing brackets</p>	3.1b	M1	<p>Area of sectors =</p> $2 \times \frac{1}{2}(2.5)^2 \left(\frac{\pi-\theta}{2}\right)$ <p>Area of rhombus =</p> $2 \times \frac{1}{2}(2.5)^2 \sin \theta$ $A = (2.5)^2 \left(\frac{\pi-\theta}{2}\right) + (2.5)^2 \sin \theta$ $A = \frac{25}{8}(\pi-\theta) + \frac{25}{4} \sin \theta$
	<p>Forms an expression for the area of half rhombus or full rhombus</p> <p>e.g $\frac{1}{2}r^2 \sin \theta$ or $r^2 \sin \theta$</p> <p>Allow substitution of $r = 2.5$ Condone $r = 5$</p>	3.1b	M1	$A = \frac{25}{8}(\pi-\theta + 2 \sin \theta)$
	<p>Substitutes $r = 2.5$ to get a correct expression for area of both sectors or full rhombus</p> <p>Condone missing brackets</p>	1.1b	A1	
	<p>Completes reasoned argument by calculating correct total area with at least one correct intermediate step and no error seen to show the given result.</p> <p>AG</p> <p>Allow recovery of missing brackets</p>	2.1	R1	
	Subtotal		4	

Q	Marking instructions	AO	Marks	Typical solution
7(b)(i)	Differentiates wrt θ Condone sign errors and omission of $\frac{25}{8}$	3.1a	M1	$\frac{dA}{d\theta} = -\frac{25}{8} + \frac{25}{4}\cos\theta$ <p>Max area occurs when $\frac{dA}{d\theta} = 0$</p> $-\frac{25}{8} + \frac{25}{4}\cos\theta = 0$ $\frac{25}{4}\cos\theta = \frac{25}{8}$ $\cos\theta = \frac{1}{2} \quad \therefore \theta = \frac{\pi}{3}$ <p>When $\theta = \frac{\pi}{3}$</p> $\frac{d^2A}{d\theta^2} = -5.41 < 0 \text{ so maximum.}$
	Obtains $\frac{25}{8}(-1+2\cos\theta)$ OE	1.1b	A1	
	Explains maximum or stationary or turning occurs when $\frac{dA}{d\theta} = 0$ Label $\frac{dA}{d\theta}$ must be seen	2.4	E1	
	Equates their $\frac{25}{8}(-1+2\cos\theta)$ to 0 and rearranges to obtain a value for $\cos\theta$ or θ when cos is not seen Condone omission of $\frac{25}{8}$	1.1a	M1	
	Obtains $\cos\theta = \frac{1}{2}$ or $\cos^{-1}\left(\frac{1}{2}\right)$ OE and shows that $\theta = \frac{\pi}{3}$ AG	2.2a	A1	
	Uses second derivative to obtain $-\frac{25\sqrt{3}}{8}$ or AWRT -5 and completes argument to show maximum occurs when $\theta = \frac{\pi}{3}$ Allow gradient test To be awarded R1, marks M1A1M1A1 must be scored as the minimum	2.4	R1	
	Subtotal			

Q	Marking instructions	AO	Marks	Typical solution
7(b)(ii)	Substitutes $\theta = \frac{\pi}{3}$ into $A = \frac{25}{8}(\pi - \theta + 2\sin\theta)$ fully or AFWF [11.9, 12]	3.4	M1	$A = \frac{25}{8}\left(\pi - \frac{\pi}{3} + 2\sin\frac{\pi}{3}\right)$ $= \frac{25}{8}\left(\frac{2\pi}{3} + \sqrt{3}\right)$
	Obtains the correct exact area ACF with $\sin\frac{\pi}{3}$ evaluated ISW	1.1b	A1	
	Subtotal		2	

Q	Marking instructions	AO	Marks	Typical solution
7(c)	States the angle would be the same or the angle will still be $\frac{\pi}{3}$ or (b)(i) stays the same Condone the answer will be the same	3.5c	E1	<p>The angle would be the same.</p> <p>The area would be quadrupled.</p>
	States the area would be quadrupled or area is $\frac{25}{2}\left(\frac{2\pi}{3} + \sqrt{3}\right)$ or their answer in (b)(ii) multiplied by 4 OE Allow (b)(ii) increased by scale factor of 4	3.5c	E1	
	Subtotal		2	

Question 7 Total	14		
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