1	**i**	Correct attempt at cos rule correct full method for C C = 141.1… bearing = [0]38.8 cao	M1 M1 A1 A1	any vertex, any letter or B4	 4
	ii	½ × 118 × 82 × sin their C or supp. 3030 to 3050 [m^2]	M1 A1	or correct use of angle A or angle B	2
	iiiA	sin (θ/2) = (½ × 189)/130 1.6276 → 1.63	M1 A1	or cosθ = (130^2+130^2-189^2)/(2x130x130) In all methods, the more accurate number to be seen.	2
	iiiB	0.5 × 130^2 × sin 1.63 0.5 × 130^2 × 1.63 their sector – their triangle AOB 5315 to 5340	M1 M1 M1 A1	condone their θ (8435) condone their θ in radians (13770) dep on sector > triangle	 4

2	9.0 or 8.96 or 8.960 13.2577	B3 B2	M1 for [BC^2=]6.8^2+4.1^2–2×4.1×6.8×cos108 A1 for 80.2(8..), 8.37(grads), 6.49 (rads) Correctly rounded to 3 or more sf M1 for 0.5×4.1×6.8×sin108 For complete long methods using BC, allow M1 and A1 for 13.2 to 13.3	 5 **[16]**

3 (a)	$10.6^2 + 9.2^2 - 2\times10.6\times9.2\times\cos68°$ o. QR = 11.1(3…) $\frac{\sin 68}{\text{their QR}} = \frac{\sin Q}{9.2}$ or $\frac{\sin R}{10.6}$ o. Q = 50.01..° or R = 61.98..° bearing = 174.9 to 175°	**M1** **A1** **M1** **A1** **B1**	 Or correct use of Cosine Rule 2 s.f. or better
3 (b) (i)	(*A*) ½ × 8 ^{2} × $\frac{2\pi}{3}$ = $\frac{6400\pi}{3}$	**M1** **A1**	 6702.(…) to 2 s.f. or more
3 (b) (ii)	DC = 80 sin($\frac{\pi}{3}$) = 80$\frac{\sqrt{3}}{2}$ Area = ½×their DA×40√3 or ½×40√3×80×sin(their DCA) o. area of triangle = 800√3 or 1385.64… to 3s.f. or more	**B1** **M1** **A1**	both steps required s.o.
3 (b) (iii)	area of ¼ circle = ½ × $\frac{\pi}{2}$ × $(40\sqrt{3})^2$ o. "6702" + "1385.6" – "3769.9" = 4300 to 4320	**M1** **M1** **A1**	[=3769.9…] i.e. their(b) (i) + their (b) (ii) – their ¼ circle o.e. 933⅓π + 800√3

4	**i**	AB = 7.8(0), 7.798 to 7.799 seen	2	M1 for correct use of sine rule For long methods M1A1 for art 7.8	
		area = 52.2 to 52.3	2	M1 for [2×][0.5 ×] their AB × 11.4 × sin 36°	4
	ii	tan 0.91 = ST/12.6	M1		
		ST = 12.6 × tan 0.91 and completion (16.208...)	E1	Accept 16.2 if ST is explicit but for long methods with pa check that their explicit expression = 16.2	
		area OSTR = [2×][0.5 ×]12.6 × their(16.2) nb 204. ….	M1		
		area of sector = $0.5 \times 12.6^2 \times 1.82$ =144.47…	M1 A1	oe using degrees soi by correct ans Accept 144, 144.5	
		Logo = 59.6 to 60.0	A1		
		arc = 12.6 × 1.82 [=22.9...]	M1	oe using degrees	
		perimeter = 55.3 to 55.4	A1		8

5	**iA**	$BC^2 = 348^2 + 302^2 - 2 \times 348 \times 302 \times \cos 72°$	M2	M1 for recognisable attempt at Cosine Rule	
		BC = 383.86…	A1	to 3 sf or more	
		1033.86…[m] or ft 650 + their BC	1	accept to 3 sf or more	4
	iB	$\frac{\sin B}{302} = \frac{\sin 72}{\text{their } BC}$	M1	Cosine Rule acceptable or Sine Rule to find C	
		B = 48.4..	A1		
		355 − their B o.e.	M1	or 247 + their C	
		answer in range 306 to307	A1		4
	ii	Arc length PQ = $\frac{224}{360} \times 2\pi \times 120$	M2	M1 for $\frac{136}{360} \times 2\pi \times 120$	
		o.e. or 469.1... to 3 sf or mo			
		QP = 222.5…to 3 sf or more	B1		
		answer in range 690 to 692 [m]	A1		4