1			$27 = ½\ r^2 \times 1.5$ oe	**M1**	or $27 = \frac{85.943669...}{360} \times \pi r^2$	angle in degrees rounded to 2 sf or more
			$r = 6$ soi	**A1**	may be embedded in formula for arc length	may be implied by later work eg 9 or 21
			their $r \times 1.5$	**M1**	or their $\frac{85.943639}{360} \times 2\pi \times$ their r	if r is incorrect, we must **see** their $r \times 1.5$ [$+ 2r$] for **M1** if r is correct, **M1** may be implied by 9 or 21
			21 [cm] cao	**A1** **[4]**	allow full marks for recovery from working with rounded value of θ in degree form	**B4** for 21 unsupported www

2			$½ \times 12.4^2 \times 2.1$ (= 161.448)	M1*	or $\pi \times \frac{120.32}{360} \times 12.4^2$	angle in degrees to 3 sf or better
			$½ \times 12.4^2 \times \sin 2.1$ (= 66.3 to 66.4) or $½ \times 21.5(121..) \times 6.16(9…)$	M1*	angle in degrees to 3 sf or better	may be implied by 2.81(7168325…) (degrees) or 2.53(5559362) (grad)
			their 161.448 – their 66.36	M1dep*		
			95 to 95.1	A1		if unsupported, B4 for 95.08(446) r.o.t. to 4 sf or better
				[4]		

3			$45 = ½ r^2 \times 1.6$ oe $r^2 = 90/1.6$ oe $r = 7.5$ or exact equivalent cao (their 7.5) × 1.6 27	M1 M1 A1 M1 A1 **[5]**	$45 = \pi r^2 \times \frac{91.673...}{360}$ or B3 www $2\pi \times (\text{their } r) \times \frac{91.673...}{360}$ or B2 www	 allow recovery to 7.5 if working in degrees, but A0 for (eg) 7.49 12 implies M1

4	(i) rc AC = 2.1×1.8 = 3.78 c.a.o. area = their 3.78×5.5 = 20.79 or 20.8 i.s.w.	**M1** **A1** **M1 dep*** **A1**	$\frac{103}{360} \times 2\pi \times 2.1$ dependent on first M1	103° or better 3.78 must be seen but may be embedded in area formula
4	(ii) BD = 2.1 c $\pi - 1.8$) or 2.1cos1.3(4159…..) or 2.1sin0.2(292…) r.o.t to 1 d.p. or more = 0.48	**M2** **A1**	**M1** for $\cos(\pi - 1.8) = \frac{\text{BD}}{2.1}$ o. allow any answer which rounds to 0.48	**M2** for BD = 2.1 cos 76.8675…° or 2.1sin13.1324…rounded to 2 or more sf or **M2** for CD = 2.045... r.o.t. to 3 s.f. or better and BD = $\sqrt{(2.1^2 - 2.045^2)}$
4	(iii) sector area = triangle area = 0.487 to 0.491 24.5	**M2** **M2** **A1**	**M1** for $½ \times 2.1^2 \times 1.8$ **M1** for $½ \times 2.1 \times$ their $0.48 \times \sin(\pi - 1.8)$ *or* $½ \times$ their $0.48 \times 2.045..$ r.o.t. to 3 s.f. or better allow any answer which rounds to 24.5	or equivalent with degrees for first two Ms N.B. 5.5 × 3.969 = 21.8295 so allow M2 for 21.8295 may be sin 1.8 instead of sin ($\pi - 1.8$) N.B. 5.5 × area = 2.6785 to 2.7005 so allow M2 for a value in this range

5	(i) 2.4 (ii) 138	2 2	M1 for 43.2 ÷ 18 M1 for their (i) × $\frac{360}{\pi}$ or θ = $\frac{43.2 \times 360}{36\pi}$ o.e. or for other rot versions of 137.50…	4

6	210 c.a.o.	2	1 for π rads = 180° soi	2

7	sector area = 28.8 or $\frac{144}{5}$ [cm^2] c.a. area of triangle = ½ × 6^2 × sin 1.6 o. their sector – their triangle s.o.i. 10.8 to 10.81 [cm^2]	2 M1 M1 A1	M1 for ½ × 6^2 × 1.6 must both be areas leading to a positive answer	5

8	(i) $-\sqrt{3}$ (ii) $\frac{5}{3}\pi$	1 2	Accept any exact form accept $\frac{5\pi}{3}$,1 ⅔π. M1 π rad = 180° used correctly	3

9	θ = 0.72 o.e 13.6 [cm]	2 3	M1 for 9 = ½ × 25 × θ No marks for using degrees unless attempt to convert B2 ft for 10 + 5 × their θ or for 3.6 found or M1 for s = 5 θ soi	5