1	18.5 or 18.49 to 18.50…	**5**	**B2** for $\angle HOG = 112°$ soi or **B1FT** for $\angle OHG = 34°$ soi or $\angle HOG = 180 - 2 \times$ *their* $\angle OHG$ **M1** for $\frac{their112}{360} \times \pi \times 6^2$ oe **M1** for $\frac{1}{2} \times 6^2 \times \sin(their112)$ oe
2	7π final answer	**2**	**M1** for $\frac{360-80}{360} \times \pi \times 3^2$ oe If 0 scored, **SC1** for answer 2π
3(i)	17.2 or 17.15 to 17.16	**2**	**M1** for $\tan\left(\frac{130}{2}\right) = \frac{PR}{8}$ oe
3(ii)	47 to 47.4	**4**	**M1** for $[2\times]\frac{1}{2} \times their17.2 \times 8$ or $[2\times]\frac{1}{2} \times 8 \times \frac{8}{\cos 65} \times \sin 65$ or $\frac{1}{2} \times 8^2 \sin 130 + \frac{1}{2} their17.2^2 \sin 50$ oe AND **M2** for $\frac{their137 - \frac{130}{360} \times \pi \times 8^2}{their137}$ [× 100] oe or $\frac{\frac{130}{360} \times \pi \times 8^2}{their137} \times 100$ oe or **M1** for $\frac{130}{360} \times \pi \times 8^2$ oe
4	24	**4**	**M1** for $\frac{60}{360} \times \pi \times 3^2$ oe **AND** **M2** for $\frac{300}{360} \times \pi \times (6^2 - 3^2)$ oe **or** $\pi \times 6^2 - \pi \times 3^2 - \frac{60}{360} \times \pi \times (6^2 - 3^2)$ oe or **M1** for $\frac{300}{360} \times \pi \times 6^2$ oe **or** $\frac{300}{360} \times \pi \times 3^2$ oe **or** $\pi \times 6^2$ oe **or** $\pi \times 3^2$ oe

5(a)	13.8 or 13.78 to 13.79	**2**	**M1** for $\frac{1}{2}\times 6\times 6\times \sin 130$ oe After 0, **SC1** for answer 55.2 or 55.15 to 55.16
5(b)	15.7 or 15.70 to 15.71	**2**	**M1** for $\frac{180-130}{360}\times \pi \times 6^2$ oe After 0, **SC1** for answer 62.8 or 62.83 to 62.84
6(a)(i)	25.7 or 25.72 to 25.73	**2**	**M1** for $\frac{134}{360}\times 2\times \pi \times 11$ oe
6(a)(ii)	4.3[0] or 4.298…	**2**	**M1** for $\cos\left(\frac{134}{2}\right)=\frac{d}{11}$ or $\sin\left(\frac{180-134}{2}\right)=\frac{d}{11}$ oe
7(a)	7.54	**2**	**M1** for $\pi \times 0.4^2 \times 15$
7(b)	53.7	**4**	**M1** for $\frac{1}{2} \times 4.5^2 \times \sin 110$ oe **M1** for $\frac{250}{360}\times \pi \times 4.5^2$ or $\frac{110}{360}\times \pi \times 4.5^2$ **M1** for *their* 9.514 + *their* 44.18 oe
8(a)	32.56 to 32.58 or 32.6	**3**	**M2** for $\frac{72}{360}\times \pi \times 20 + 20$ oe or **M1** for $\frac{72}{360}\times \pi \times 20$ **A1** for 12.56 to 12.58 or 12.6 After 0 or 1, **SC1** for *their* 'arc length' + 10 + 10 soi
8(b)(i)	62.83 to 62.84 or 62.8	**2**	**M1** for $\frac{72}{360}\times \pi \times 10^2$
8(b)(ii)	4(.00) to 4.08 nfww	**3**	FT from *their* **(b)(i)** – (58.76 to 58.8) provided answer not negative **M2** for *their* **(b)(i)** – $2\times\frac{1}{2}\times 10\times 10\times \sin\left(\frac{72}{2}\right)$ oe or **M1** for [2×] $\frac{1}{2}\times 10\times 10\times \sin\left(\frac{72}{2}\right)$ oe soi

9 (a) (i)	Dependent on 4 fig. term calculated using any version of π.	**3**	M1 for arc length $\frac{48}{360}\times 2\pi R$ soi and M1 for $R = 20\times\frac{360}{48}\times\frac{1}{2\pi}$ oe
(ii)	239	**2**	M1 for $\frac{48}{360}\times\pi R^2$
(iii)	20.7	**2**	M1 for $2\pi r = \frac{312}{360}\times 2\pi R$ oe

10 a)	320	3*	**M2** for $\frac{a}{360}\times\pi\times(3r)^2 = 8\pi r^2$ oe OR **M1** for $\frac{a}{360}\times\pi\times(3r)^2$ oe seen or for $8\pi r^2$ seen
(b)	$6r + \frac{16\pi r}{3}$ final answer	2*	**C1** for $kr + \frac{16\pi r}{3}$, where $k \geqslant 0$ OR **M1 FT** for $\frac{their320}{360}\times 2\pi\times 3r$ oe or for $6r + \frac{their320}{360}\times n\pi r$ oe where n is a positive integer

11a) (i)	2.62	**2**	**M1** for $\frac{25}{360}\times 2\pi\times 6$
(ii)	7.85	**2**	**M1** for $\frac{25}{360}\times\pi\times 6^2$
(b) (i)	39.3	**1ft**	
(ii)	88.8	**3ft**	**B1** for 30 or 60 or **M1** for 5× (a)(i) and indep **M1** for 2×(a)(ii)

12i)	4 (π) cao	2	**B1** for $\pi\times 6^2$ or for $\frac{40}{360}$
(ii)	$12 + \frac{4}{3}\pi$ final answer	2	**B1** for (a =) 12, or for (b =) $\frac{4}{3}$
(iii)	8	1ft	

13(a)	10	**1**	
(b)	216	**2**	**M1** for $\pi \times 6 \times 10 = \frac{x}{360} \times \pi r^2$ or $2 \times \pi \times 6 = \frac{x}{360} \times 2\pi r$ where $r = 10$ or *their*(a). Where radians are used, method must include multiplication by $\frac{180}{\pi}$.
14i)	6.126 to 6.13	2	**M1** for $\frac{1}{2} \times 4 \times 4 \times \sin 130$ Or $\frac{1}{2} PQ \times$ perpendicular height (numerical)
(ii)	38.2 to 38.3	3	**M1** for $\frac{(360-130)}{360} \times \pi \times 4^2$ soi by 32.11 or $\frac{130}{360} \times \pi \times 4^2$ soi by 18.15 And **M1** for '*their* major sector area' + '*their* triangle area' Or for '*their* circle area' – '*their* minor sector area' + '*their* triangle area'
15 **(a)**	44.5	**3**	**M1** for numerical $\frac{\theta}{360} \times 2\pi \times 6$ oe and **M1** for *their* arc + 12 If second **M** not scored, **A1** for 32.46 or 5.24 soi. **SC1** after 0 for 2π6 seen (= 37.7)
(b)	97.4	**2**	**M1** for numerical $\frac{\theta}{360} \times \pi \times 6^2$ **SC1** after 0 for π6² (= 113) seen
16 **(a)**	220	**3**	**M1** for $\frac{150}{360} \times 2\pi r$ and **B1** for their arc *AD* + their arc *BC* + 50
(b)	2130	**3**	**M2** for $\frac{150}{360}$ π $(45^2 - 20^2)$ or **M1** for $\frac{150}{360}$ πr^2
(c)	8.33	**2**	**M1** for $2\pi r$ = *their* arc *AD* from **(a)** soi