

Question	Answer	Marks	AO Element	Notes	Guidance
1	30.2 or 30.20 to 30.21...	4		<p><b>M3</b> for</p> $\frac{1}{2} \times 10 \times 10 \times \sin 60$ $- \frac{60}{360} \times \pi \times \left(\frac{10}{2}\right)^2$ <p>or <b>M1</b> for</p> $\frac{k}{360} \times \pi \times \left(\frac{10}{2}\right)^2 \text{ oe}$ <p>and <b>M1</b> for</p> $\frac{1}{2} \times 10 \times 10 \times \sin c \text{ oe}$	
2	<p>[p =] 12</p> <p>[q =] <math>\frac{12}{5}</math> oe</p>	3		<p><b>B1</b> for [p =] 12</p> <p>and</p> <p><b>B2</b> for [q =] <math>\frac{12}{5}</math></p> <p>or <b>M1</b> for</p> $\frac{72}{360} [\times \pi] \times 2 \times 6 \text{ oe}$	

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3(a)(i)	$[h =] 253.8 \div 18 \div \left(\frac{6}{2}\right) \text{ or}$ $[h =] \frac{253.8 \times 2}{6 \times 18} \text{ or}$ $[h =] \frac{253.8}{18 \times \frac{6}{2}}$	<b>3</b>		<p>For <b>M3</b> no errors at any stage</p> <p><b>M2</b> for</p> $253.8 = \frac{1}{2} \times 6 \times h \times 18$ <p>oe (no previous errors)</p> <p>or <b>M1</b> for triangle area =</p> $\frac{1}{2} \times 6 \times h \text{ soi}$	
3(a)(ii)	38.1 or 38.06 to 38.08	<b>2</b>		<b>M1</b> for $\tan = \frac{4.7}{6}$ oe	
3(b)	358 or 357.9 to 358	<b>6</b>		<p><b>M1</b> for <math>6^2 + 4.7^2</math></p> <p><b>M1</b> for</p> $\sqrt{6^2 + 4.7^2} \times 18 \text{ [}\times 2\text{]}$ <p><b>M1</b> for <math>6 \times 18 \text{ [}\times 2\text{]}</math></p> <p><b>M1</b> for <math>4.7 \times 18</math></p> <p><b>M1</b> for <math>2 \times \frac{1}{2} \times 6 \times 4.7</math></p> <p>oe</p>	

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4(a)	132.26 to 132.28 or 132.3	5		<p><b>B1</b> for angle <math>ABO</math> or angle <math>CBO = 90</math> soi</p> <p><b>M1</b> for <math>\tan [XOB] = \frac{15}{8}</math></p> <p>oe</p> <p><b>M1</b> for</p> <p><math>\tan [BOY] = \frac{22.4}{8}</math> oe</p> <p><b>A1</b> for <math>[BOY = ]70.3\dots</math> or <math>[XOB = ] 61.9\dots</math></p>	
4(b)	18.4 or 18.5 or 18.43 to 18.48	2		<p><b>M1</b> for</p> <p><math>\frac{\text{their(a)}}{360} \times 2 \times \pi \times 8</math></p> <p>oe</p>	

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4(c)	75.7 to 75.9	4		<p><b>M1</b> for  <math>\frac{1}{2} (15 + 22.4) \times 8</math> oe</p> <p><b>M2</b> for  <math>\frac{\text{their(a)}}{360} \times \pi \times 8^2</math> oe</p> <p>or <b>M1</b> for one sector  either  <math>\frac{\text{inv tan} \left( \frac{15}{8} \right)}{360} \times \pi \times 8^2</math>  oe or  <math>\frac{\text{inv tan} \left( \frac{22.4}{8} \right)}{360} \times \pi \times 8^2</math>  oe</p>	
5(a)	75 000 × 60 × 20 oe	<b>M1</b>		Allow × 1200 for × 60 × 20	
5(b)	16.4 or 16.36 ...	3		<p><b>M2</b> for  <math>\frac{9 \times 10^7 \times 100}{1000 \times 55 \times 10^4}</math> oe</p> <p>or <b>B2</b> for answer 0.164  or 0.1636 ...</p> <p>or <b>B1</b> for answer figs 164  or 1636 ...</p> <p>or <b>M1</b> for  figs 9 ÷ figs 55</p>	

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6	28.3 or 28.27 to 28.28	3		<p><b>M2</b> for  <math>\frac{76}{360} \times 2\pi \times 8.5 + 2 \times 8.5</math>                      oe</p> <p>or <b>M1</b> for <math>\frac{76}{360} \times 2\pi \times 8.5</math>                      oe</p>	
7(a)	3770 or 3769 to 3770. ...	2		<p><b>M1</b> for <math>\frac{1}{3} \times \pi \times 10^2 \times 36</math></p>	

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7(b)	3.68 or 3.683 to 3.684 ...	4		<p><b>M3</b> for <math>[r^3 = ]</math>  <math>\frac{1}{2} \times their(\mathbf{a}) \times \frac{3}{4\pi \times 9}</math>                      oe</p> <p>or <b>M2</b> for  <math>\frac{4\pi r^3}{3} + \frac{4\pi (2r)^3}{3}</math>  <math>= \frac{1}{2} \times their(\mathbf{a})</math></p> <p>or for  <math>\frac{4\pi r^3}{3}</math>  <math>= \frac{1}{1+8} \times \frac{1}{2} \times their(\mathbf{a})</math></p> <p>or <b>M1</b> for  <math>\frac{4\pi r^3}{3} + \frac{4\pi (2r)^3}{3}</math>                      or <math>\frac{1}{2} \times \frac{\pi \times 10^2 \times 36}{3}</math>                      or <math>\frac{1}{2} \times their(\mathbf{a})</math> seen                      or ratio of vols = 1 : 2<sup>3</sup> oe                      seen</p>	

[illegible]

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8(c)	11.7 or 11.66 ... or 11.67	3		<p><b>M2dep</b> for  <math>(4 (\text{their} 2.5 - 1))^2</math>  <math>+ (2 \times \text{their} 2.5 + 5)^2</math></p> <p>or <b>M1dep</b> for  <math>4 (\text{their} 2.5 - 1)</math> or  <math>2 \times \text{their} 2.5 + 5</math></p> <p>OR</p> <p><b>B1</b> for <math>\sqrt{20x^2 - 12x + 41}</math></p> <p>and <b>M1dep</b> for  substituting <math>x = \text{their } 2.5</math>  into <math>\sqrt{20x^2 - 12x + 41}</math>  at any stage</p>	
9(a)	427 or 427.2 to 427.3...	2		<b>M1</b> for $\pi \times 8 \times 17$	
9(b)	1010 or 1005....	4		<p><b>M2</b> for <math>\sqrt{17^2 - 8^2}</math> oe</p> <p>or <b>M1</b> for  <math>h^2 + 8^2 = 17^2</math> oe</p> <p><b>M1</b> for  <math>\frac{1}{3} \times \pi \times 8^2 \times \text{their } h</math>  oe</p>	
9(c)	804 or 804.2 to 804.4 or 808	1		<b>FT</b> <i>their (b)</i> $\times 0.8$	



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9(d)	396 or 395.6 to 395.8 or 392	1		<b>FT</b> 1200 – <i>their</i> (c)	
10	81.7 or 81.71 to 81.72...	2		<b>M1</b> for $\pi \times 5.1^2$	
11(a)	25	2		<b>M1</b> for $\frac{90 \times 1000}{60 \times 60}$ oe	
11(b)	1.25	1		<b>FT</b> $\frac{\textit{their(a)}}{20}$ correctly evaluated	
11(c)	1250	2		<b>2FT</b> for <i>their</i> (a) $\times 50$ correctly evaluated or <b>M1</b> for one area e.g. $\frac{1}{2}(40 + 60) \times 25$ , $25 \times 40$ , $\frac{1}{2} \times 25 \times 20$ , $\frac{1}{2}(40 + 60) \times 90$ , $90 \times 40$ , $\frac{1}{2} \times 90 \times 20$ , $\frac{1}{2}(40 + 60) \times \textit{their} 25$ , $\textit{their} 25 \times 40$ , $\frac{1}{2} \times \textit{their} 25 \times 20$	
12	628 or 628.3 to 628.4  cm <sup>3</sup>	3		<b>B2</b> for 628 or 628.3 to 628.4  or <b>M1</b> for $5^2 \times 8 \times \pi$  <b>B1</b> for cm <sup>3</sup>	

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13(a)	$\pi \times 6 \times 12 + \pi \times 6^2 = 108\pi$	<b>M2</b>		<b>M1</b> for $\pi \times 6 \times 12$	
13(b)	$[x = ] 5.2[0]$ or 5.196...  $[y = ] 6$	<b>4</b>		<b>B2</b> for $x$ correct or <b>M1</b> for $4\pi x^2 = 108\pi$ seen <b>B2</b> for $y$ correct or <b>M1</b> for $\frac{1}{2}(4\pi y^2) + \pi y^2$ or better seen	
14	204 or 203.5 to 203.6... nfw	<b>4</b>		<b>M2</b> for $\pi \times 1.5^2 \times 8 \times 60 \times 60$  or <b>M1</b> for $\pi \times 1.5^2$ <b>M1</b> for dividing <i>their</i> volume by 1000  If 0 scored <b>SC1</b> for an answer figs 204 or figs 2035 to 2036 without working	

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15(a)	4.79 or 4.788 to 4.789	3		<p><b>M2</b> for <math>\sqrt[3]{\frac{230 \times 3}{2 \times \pi}}</math> oe</p> <p>or <b>M1</b> for</p> $230 = \frac{2}{3} \times \pi \times r^3$ <p>oe</p> <p>If 0 scored <b>SC1</b> for answer 3.8[0...]</p>	
15(b)(i)	8.7[0] or 8.702 to 8.704	3		<p><b>M2</b> for</p> $(300 - 230) \div (1.6^2 \pi)$ <p>or <b>M1</b> for <math>\pi \times 1.6^2 \times h</math></p>	
15(b)(ii)	6.4	3		<p><b>M2</b> for</p> $1.6 \times \sqrt[3]{\frac{19200}{300}}$ <p>oe</p> <p>or <b>M1</b> for sf <math>\sqrt[3]{\frac{19200}{300}}</math></p> <p>or <math>\sqrt[3]{\frac{300}{19200}}</math> oe</p> <p>or for <math>\left(\frac{1.6}{r}\right)^3 = \frac{300}{19200}</math></p>	

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16(a)	116.6 or 116.56 to 116.57	4		<b>M1</b> for $\sin [EAD] = \frac{6}{12}$ oe <b>M1</b> for $\tan [BAC] = \frac{6}{12}$ oe <b>B1</b> for [angle <i>DAC</i> ] = 60	
16(b)	13.4 or 13.41 to 13.42	2		<b>M1</b> for $12^2 + 6^2$	
16(c)	10.4 or 10.39...	3		<b>M2</b> for $\sqrt{12^2 - 6^2}$ or <b>M1</b> for $AE^2 + 6^2 = 12^2$	
16(d)	130 or 129.5... to 129.6	4		<b>M1</b> for $0.5 \times 6 \times \text{their } AE$ oe <b>M1</b> for $0.5 \times 12 \times 12 \times \sin 60$ oe <b>M1</b> for $0.5 \times 6 \times 12$ oe	
17(a)	<b>M1</b> for $x^2 + (2x - 3)^2 = 6^2$ oe or $x^2 + 4x^2 - 6x - 6x + 9 = 36$ <b>B1</b> for $4x^2 - 6x - 6x + 9$ or better <b>A1</b> for $5x^2 - 12x - 27 = 0$	3		Dep on <b>M1B1</b> with no errors or omissions	

Question	Answer	Marks	AO Element	Notes	Guidance
17(b)	<p><b>B2</b> for</p> $\frac{-(-12) \pm \sqrt{(-12)^2 - 4(5)(-27)}}{2 \times 5}$ <p>or better</p> $\text{or } \frac{12}{10} \pm \sqrt{\left(\frac{12}{10}\right)^2 + \frac{27}{5}}$ <p><b>B2</b> for -1.42, 3.82 final answers</p>	<b>4</b>		<p><b>B1</b> for</p> $\sqrt{(-12)^2 - 4(5)(-27)}$ <p>or for <math>\left(x - \frac{12}{10}\right)^2</math> oe or</p> $\frac{-(-12) + \sqrt{q}}{2 \times 5}$ oe or $\frac{-(-12) - \sqrt{q}}{2 \times 5}$ oe or <p>both</p> <p><b>B1</b> for each</p> <p>If <b>B0</b>, <b>SC1</b> for answers  -1.4 or -1.415... to  -1.415 <b>and</b> 3.8 or 3.815  to 3.815...  or answers -1.41 and  3.81  or -1.42 and 3.82 seen in  working  or for -3.82 and 1.42 as  final ans</p>	
17(c)	14.4 or 14.5 or 14.44 to 14.46	<b>2</b>		<p><b>2FT</b> for <math>3 \times</math> <i>their</i> positive  root + 3 evaluated to 3sf  or better</p> <p><b>M1</b> for <math>3 \times</math> <i>their</i> positive  root + 3 oe</p>	

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17(d)	39.5 or 39.46 to 39.54...	2		<b>M1</b> for trig statement seen to find either angle $\sin = \frac{\text{their } x}{6}$ oe or $\sin = \frac{\text{their } (2x - 3)}{6}$ oe	
18(a)	<b>M2</b> for $8^2 + 7^2 - 2 \times 7 \times 8 \times \cos 78$ oe <b>A2</b> for 9.471.. to 9.472	4		<b>M1</b> for correct implicit version <b>A1</b> for 89.7...	
18(b)	46.3 or 46.29 to 46.30...	3		<b>M2</b> for $[\sin OAC =] \frac{7 \sin 78}{9.47}$ or <b>M1</b> for $\frac{\sin OAC}{7} = \frac{\sin 78}{9.47}$	
18(c)	<b>M1</b> for $29.5 - (7 + 8 + 9.47)$ <b>M3</b> for $\frac{360 \times (29.5 - (7 + 8 + 9.47))}{2 \times \pi \times 7}$ <b>B1</b> for 41.15 to 41.171..	5		<b>M2</b> for $\frac{x}{360} \times 2 \times \pi \times 7$ $= \text{their arc length}$ oe or <b>M1</b> for $\frac{x}{360} \times 2 \times \pi \times 7$ oe	

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18(d)	45[.0] or 44.98 to 45.01 nfw	4		<p><b>M3</b> for</p> $\frac{1}{2} \times 8 \times 7 \times \sin 78^\circ \text{ oe}$ $\frac{41.2}{360} \times \pi \times 7^2 \text{ oe}$ <p>OR</p> <p><b>M1</b> for</p> $\frac{1}{2} \times 8 \times 7 \times \sin 78^\circ \text{ oe or}$ $\frac{1}{2} \times 8 \times 9.47 \times \sin \text{ their}$ <p><b>(b)</b> oe</p> <p><b>M1</b> for <math>\frac{41.2}{360} \times \pi \times 7^2</math> oe</p>	
19(a)	24	2		<b>B1</b> for angle $PRQ = 24$	
19(b)	29.4 or 29.40 to 29.41	3		<p><b>M2</b> for</p> $\frac{360 - 48}{360} \times 2 \times \pi \times 5.4$ <p>or <b>B2</b> for answer (minor arc) 4.52 or 4.523 to 4.524...</p> <p>or <b>M1</b> for</p> $\frac{48}{360} \times 2 \times \pi \times 5.4$	
20	2.24	2		<b>M1</b> for $0.5 \times 1.6 \times 2.8$	

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21	2.71 or 2.709 to 2.710	3		<p><b>M2</b> for</p> $\sqrt[3]{500 \div \left(6 \times \frac{4}{3} \pi\right)} \text{ oe}$ <p>or <b>M1</b> for</p> $500 = 6 \times \frac{4}{3} \pi r^3 \text{ oe}$ <p>If 0 scored, <b>SC1</b> for answer 4.92 or 4.923 to 4.924</p>	



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22(a)	1930 or 1940 or 1933.4 to 1935.3	5		<p><b>B1</b> for interior angle 120 soi or angle at centre 60 soi or for correct use of Pythagoras' with 7 and 3.5 or with 14 and 7</p> <p><b>M3</b> for  <math>6 \times \frac{1}{2} \times 7^2 \times \sin 60 \times 15.2</math>                      oe or complete other                      methods</p> <p>or <b>M2</b> for  <math>6 \times \frac{1}{2} \times 7^2 \times \sin 60</math> oe</p> <p>OR</p> <p><b>M1</b> for <math>\frac{1}{2} \times 7^2 \times \sin 60</math>                      oe or other partial area of                      hexagon</p> <p><b>M1dep</b> for <i>their</i> area <math>\times</math>                      15.2 evaluated</p>	

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22(b)	893 or 892.8 to 893.0...	3		<p><b>M2</b> for  <math>6 \times 7 \times 15.2</math>  <math>+ 2 \times 6 \times \frac{1}{2} \times 7^2 \times \sin 60</math>                      oe                      or for <math>6 \times 7 \times 15.2 +</math>  <math>2 \times</math> <i>their</i> area of hexagon                      from <b>(a)</b> oe                      or M1 for <math>[6 \times] 7 \times 15.2</math>                      oe                      or <math>2 \times</math> <i>their</i> area of                      hexagon from <b>(a)</b> oe</p>	
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