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MATH TOPICAL WORKSHEETS

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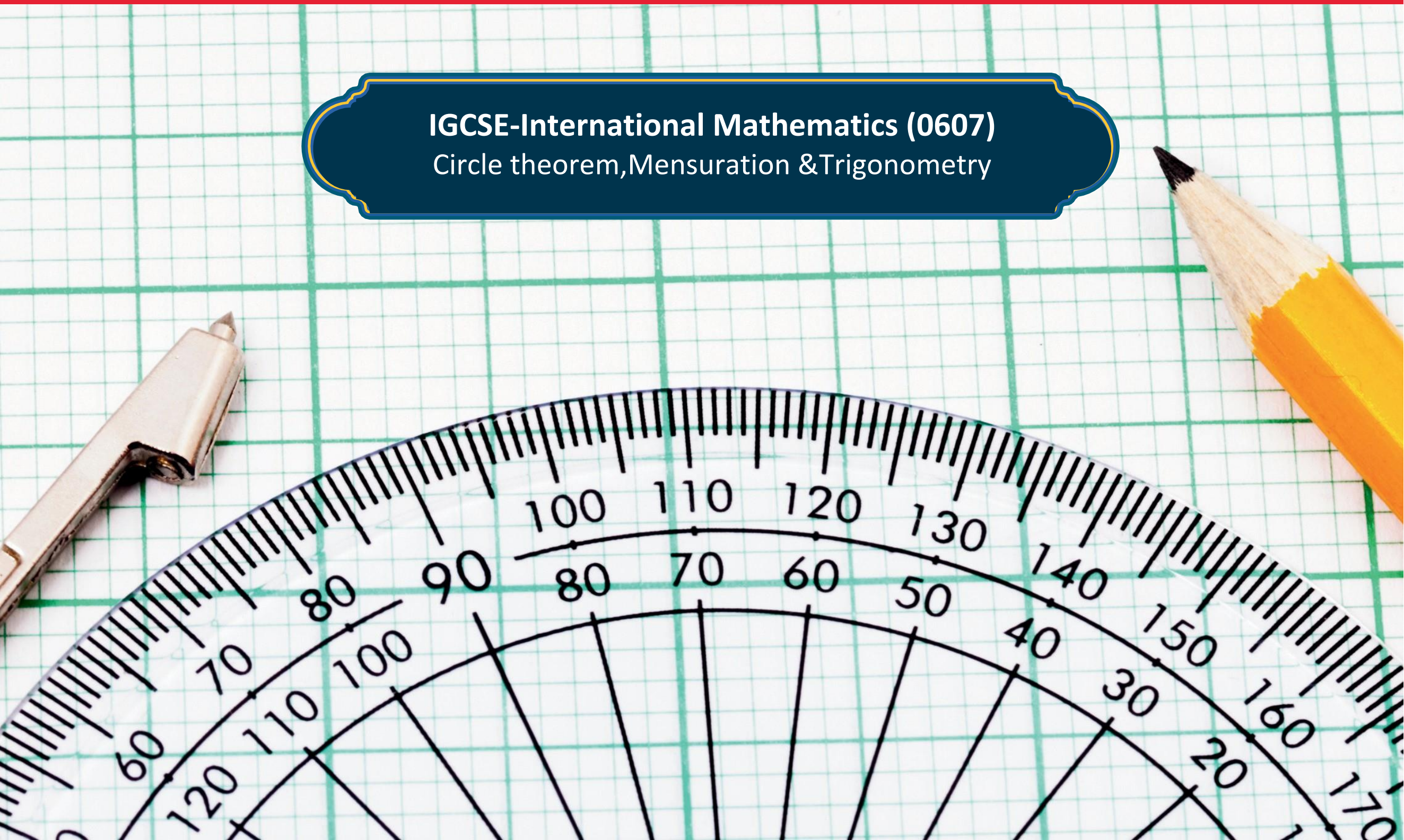
MATH TOPICAL WORKSHEETS

IGCSE-International Mathematics (0607)

Circle theorem,Mensuration &Trigonometry

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Circle theorem,Mensuration &Trigonometry



Paper-2 (MS)

Question	Answer	Marks	Partial Marks
1	[amplitude =] 6 [period =] 60	2	B1 for each If 0 scored, SC1 if answers reversed
2	7	3	B1 for $\cos 60 = 0.5$ M1 for $5^2 + 8^2 - 2 \times 5 \times 8 \times \cos 60$
3	[x =] 70 [y =] 110 [z =] 35	4	B1 for $x = 70$ B1 for $y = 110$ B2 for $z = 35$ or M1 for angle $CAB = 35$ or angle $CDB = 35$
4	(a) 82 Opposite angles of a cyclic quadrilateral [add up to 180] oe	2	B1 for each
	(b) No and any mention of Alternate Segment Theorem oe	1	
5	(a) 70	1	
	(b) 70	1	
	(c) 30	1	their(b) – 40

6

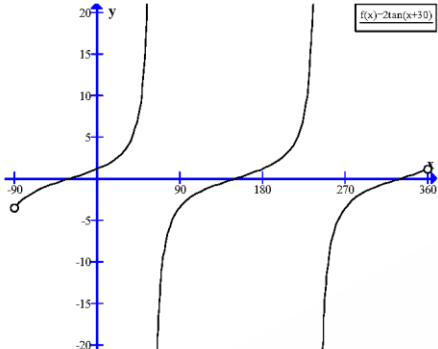
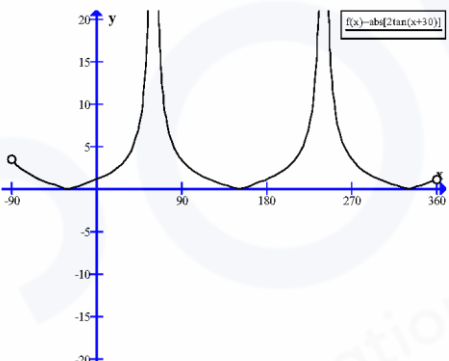
	$3x^3 + \frac{1}{3} \times 3x^3$ oe	M1	e.g. $3x^3$ [+] x^3
	$4x^3 = 32000$	M1	
	$x^3 = 8000$ leading to $x = 20$	A1	or $x = \sqrt[3]{8000}$ leading to $x = 20$

7

	$[a =] 20$ $[b =] 5$	5	B1 for $a = 20$ soi M2 for $x = \frac{2.5}{\tan 30}$ oe or M1 for $\tan 30 = \frac{2.5}{x}$ oe B1 for $\tan 30 = \frac{1}{\sqrt{3}}$ or $\tan 60 = \sqrt{3}$
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Paper-4 (MS)

Question	Answer	Marks	Partial Marks
1.		2	M1 for $\sqrt{120^2 + 90^2}$
(a)	150		
(b)	$\tan^{-1} \frac{90}{120}$ oe 53.13... or 36.86 to 36.87 or 106.26 73.739...	M1 A1 A1	i.e. trig ratio for any appropriate angle or M1 [cos =] $\frac{150^2 + 150^2 - 180^2}{2 \times 150 \times 150}$ A1 0.28 oe
(c)	25 300 or 25 270 to 25 281	3	M2 for $\frac{73.74}{360} \times \pi \times 150^2 + 2 \times \frac{1}{2} \times 120 \times 90$ oe or M1 for $\frac{73.74}{360} \times \pi \times 150^2$ or $2 \times \frac{1}{2} \times 120 \times 90$ oe
(d)	6.74 to 6.75 or 7	3	M2 for <i>their</i> (c) $\times 8 \times 2 \div 60\,000$ oe or M1 for <i>their</i> (c) $\times 8 \times 2 \div$ figs 6 or <i>their</i> (c) $\times 8 \div 60\,000$ or <i>their</i> (c) $\times 2 \div 60\,000$
2		2	M1 for $\frac{AB}{150} = \cos 55$ oe
(a)	86 [.0] or 86.03 to 86.04		
(b)	246° or 245.5 to 245.6	4	M2 for [cos =] $\frac{120^2 + 150^2 - 235^2}{2 \times 120 \times 150}$ (120.6) or M1 for $235^2 = 120^2 + 150^2 - 2 \times 120 \times 150 \cos \theta$ M1 for 125 + <i>their</i> 120.6
(c)	13 000 or 13 030 to 13 035	3	M2 for $\frac{1}{2} \times 150 \times \text{their } 86 \times \sin 55$ oe $+ \frac{1}{2} \times 120 \times 150 \times \sin(\text{their } DAC)$ oe or M1 for 1 of above areas soi by 5283 to 5285. ... or 7746. ...

3	(a) Correct curve with no overlaps at 60 and 240, x intercepts at approximately -30, 150, 330  (b) 38.2 or 38.19 to 38.2 218 or 218.1 to 218.2 (c) $x = 60$ $x = 240$	3	B2 for 'correct' but with overlaps and/or inaccurate intercepts B1 for 1 branch correct
	(d) <i>their (a)</i> with negative y parts reflected in x-axis 	2FT	B1FT for 1 branch correct
4	(a) 42.[0] or 41.98 to 41.99 (b) $\tan = \frac{\sqrt{9^2 + 10^2}}{20}$ oe 33.91 to 33.93 (c) 12.4 or 12.39 to 12.40... nfwv	2	M1 for $\tan = \frac{9}{10}$ oe
		M2	or M1 for $\sqrt{9^2 + 10^2}$ or $\sqrt{9^2 + 10^2 + 20^2}$
		A1	
		3	M1 for $20^2 + 22^2 - 2 \times 20 \times 22 \cos 33.9$ A1 for 153 to 154

5	(a) $\frac{\sqrt{8}}{3}$ or $\frac{2\sqrt{2}}{3}$ or $\sqrt{\frac{8}{9}}$ (b) (i) $[\cos B] = \frac{9^2 + 10^2 - 11^2}{2 \times 9 \times 10}$ oe (ii) $0.5 \times 9 \times 10 \times \text{their exact (a)}$ Leading to $30\sqrt{2}$	3	M2 for $\frac{\sqrt{3^2 - 1^2}}{3}$ or M1 for $3^2 - 1^2$ If 0 scored, SC1 for 0.943 or 0.9428... or $\sqrt{0.889}$ 2 M1 for $11^2 = 9^2 + 10^2 - 2 \times 9 \times 10 \times \cos B$ M2 M1 for $0.5 \times 9 \times 10 \times \text{their (a)}$ (their (a) must be < 1) A1 Cancelling seen or $\frac{180\sqrt{2}}{6}$ or $\frac{90\sqrt{2}}{3}$ or $\frac{60\sqrt{2}}{2}$ seen
6	(a) $360 - (155 + 115)$ oe (b) 36.9 or 36.86 to 36.87 (c) 100 or 99.93 to 100.04 (d) 94.0 or 94.1 or 94.01 to 94.06 (e) 123 or 123.4 to 123.5	1 2 2 4 4	e.g. $25 + 65$ with those angles marked on diagram M1 $\tan [C] = \frac{60}{80}$ oe M1 for $60^2 + 80^2$ oe B1FT for $ACD = 63.1$ to 63.13 M1 for $75^2 + (\text{their } 100)^2 - 2 \times 75 \times \text{their } 100 \times \cos \text{their } 63.1$ A1 for 8838 to 8846 M2 for $\frac{75 \sin(\text{their } 63.1)}{\text{their } 94.1}$ or for $[\cos] = \frac{(\text{their } 100)^2 + (\text{their } 94.1)^2 - 75^2}{2 \times (\text{their } 100) \times (\text{their } 94.1)}$ or M1 for $\frac{\sin CAD}{75} = \frac{\sin(\text{their } 63.1)}{\text{their } 94.1}$ or for $75^2 = (\text{their } 100)^2 + (\text{their } 94.1)^2 - 2(\text{their } 100)(\text{their } 94.1)$ A1 for 45.3 or 45.4 or 45.29 to 45.37

7

(a)	804 or 804.2 to 804.4	3	M1 for $\frac{1}{3}\pi \times 8^2 \times 16$ M1 for $\frac{4}{3}\pi \times 4^3$
(b)	450 or 449.5 to 449.6...	3	M2 for $\pi \times 8 \times \sqrt{8^2 + 16^2}$ or M1 for $\sqrt{8^2 + 16^2}$ or $\pi \times 8 \times \text{their } l$
(c)	8.94 or 8.944...	4	P is point of contact between slant edge and circle. B2 for $PV = 8$ nfw or M1 for $\frac{8}{4} = \frac{16}{PV}$ oe M1 for $OV^2 = 4^2 + PV^2$ OR B2 for $l = \sqrt{320}$ oe or M1 for $l^2 = 8^2 + 16^2$ M1 for $\frac{8}{4} = \frac{l}{OV}$ soi OR x is semi-vertical angle of cone M1 for $\tan x = \frac{8}{16}$ oe M2 for $\frac{4}{\sin x}$ or M1 for $\frac{4}{OV} = \sin x$

8

(a)	Correct sketch showing bearings and distances	3	B1 for 310° bearing approx correct (270 to 360) and marked B1 for 250° bearing approx correct (180 to 270) and marked B1 for distances correctly marked
(b)	120	1	
(c)	$40^2 + 65^2 - 2 \times 40 \times 65 \times \cos \text{their } 120$	M1	<i>their</i> 120 must be between 0 and 180 Allow $\cos 120 = \frac{40^2 + 65^2 - []^2}{2 \times 40 \times 65}$
	91.78 to 91.79	A2	A1 for 8425 or $5\sqrt{337}$
(d)	288 or 287.8...	4	M2 for $\frac{40 \sin(\text{their } 120)}{91.8}$ oe or M1 for $\frac{\sin \theta}{40} = \frac{\sin(\text{their } 120)}{91.8}$ oe If cosine rule used, M2 for explicit expression or M1 for implicit. A1 for 22.2 or 22.16 to 22.17... If 0 scored SC2 for answer 108 or 107.8...

9

(a)(i)	$\frac{1}{2} \times x \times (x+2) \times \frac{\sqrt{3}}{2}$ oe or better final answer	2	M1 for $\frac{1}{2} \times x \times (x+2) \times \sin 60$
(a)(ii)	equating to $18\sqrt{3}$ and correct elimination of $\sqrt{3}$	M1	Dependent on correct answer used from (a)(i) or answer to (a)(i) contains sin60 but is otherwise correct.
	Completion with at least one step	A1	No errors or omissions
(b)(i)	7.54 or 7.544... , -9.54 or -9.544...	2	B1 for each If 0 scored, M1 for substitution in formula or sketch or $(x+1)^2 - 73$ or better
(b)(ii)	6.53 or 6.54 or 6.529 to 6.536...	2	M1 for $\sin 60 = \frac{[]}{their 7.54}$ oe

10

(a)	192	2	M1 for $\frac{1}{3} \times (\sqrt{72})^2 \times 8$ oe
	cm ³	1	
(b)	12	2	M1 for $(\sqrt{72})^2 + (\sqrt{72})^2$ oe
(c)	10	3	M2 for $8^2 + (0.5 \text{ their (b)})^2$ or M1 for $[PD \text{ oe}] 0.5 \times \text{their (b)}$
(d)	53.1 or 53.13	2	M1 for $\tan = \frac{8}{0.5 \times \text{their (b)}}$ or $\sin = \frac{8}{\text{their (c)}}$ or $\cos = \frac{0.5 \times \text{their (b)}}{\text{their (c)}}$
(e)(i)	$\sqrt{82}$ or 9.06 or 9.055...	3	M2 for $8^2 + (0.5 \times \sqrt{72})^2$ or $(\text{their (c)})^2 - (0.5 \times \sqrt{72})^2$ or M1 for $(0.5 \times \sqrt{72})^2$
(e)(ii)	62.1 or 62[.0] or 62.00 to 62.10	2	M1 for $\tan = \frac{8}{0.5 \times \sqrt{72}}$ oe
(f)	4 cao	3	M2 for $\sqrt[3]{\frac{24}{\text{their (a)}}}$ or $\sqrt[3]{\frac{\text{their (a)}}{24}}$ soi by 2 or $\frac{1}{2}$ or M1 for $\frac{24}{\text{their (a)}}$ or $\frac{\text{their (a)}}{24}$ soi by 8 or $\frac{1}{8}$

11	(a) 0.278 or 0.2781 to 0.2782	3 M2 for $0.5 \times 0.6 \times 0.8 \times \sin 105 \times 1.2$ oe or M1 for $0.5 \times 0.6 \times 0.8 \times \sin 105$
	(b) 3.48 to 3.49	5 M2 for $\sqrt{0.6^2 + 0.8^2 - 2 \times 0.6 \times 0.8 \times \cos 105}$ or M1 for $0.6^2 + 0.8^2 - 2 \times 0.6 \times 0.8 \times \cos 105$ A1 for 1.12 or 1.117... M1 for <i>their</i> $1.117 \times 1.2 + 2 \times \text{their area of } ABC + 0.6 \times 0.12 + 0.8 \times 1.2$
	(c) 0.0348 to 0.0349	3 FT <i>their</i> (b) $\div 100$ M2 for <i>their</i> (b) $\div \sqrt[3]{\frac{2170}{2.17}} \times \left(\sqrt[3]{\frac{2170}{2.17}}\right)^2$ oe or M1 for $\frac{2170}{2.17}$ or $\frac{2.17}{2170}$ or $(\sqrt[3]{k})^2$ implied by <i>their</i> (b) $\div 1000$

12	(a)	60.3 or 60.25 to 60.26	2	M1 for $\tan = \frac{7}{4}$ oe
	(b)	54.5 or 54.46...	3	M2 for $\tan = \frac{7}{\frac{1}{2}\sqrt{6^2+8^2}}$ oe or M1 for 6^2+8^2 or 3^2+4^2 oe
	(c)	8.6[0] or 8.602...	2	M1 for $7^2 + (\text{their } 5)^2$ oe
	(d)	69.6 or 69.58 to 69.59	2	M1 for $\cos = \frac{3}{\text{their } PC}$ oe
	(e)	6.49 or 6.493...	3	M2 for $\frac{6\sin(\text{their}(\mathbf{d}))}{\sin 60}$ oe or M1 for $\frac{\sin 60}{6} = \frac{\sin(\text{their}(\mathbf{d}))}{BX}$

13

(a)	$\tan 41 = \frac{FB}{5.5}$ oe	M1	e.g. $\frac{\sin 49}{5.5} = \frac{\sin 41}{FB}$
	$= 4.7810.. [= 4.781]$	A1	
(b)	37.6 or 37.63 to 37.64	2	M1 for $\tan[FCB] = \frac{4.781}{6.2}$ oe
(c)	$[CD =] \frac{4.781}{\tan 18} - 6.2$ oe	M2	M1 for $\tan 18 = \frac{4.781}{BD}$ oe
	8.5144...	A1	
(d)	14.6 or 14.58 to 14.60	3	B2 for 212.7... or M1 for $[AD^2 =] 5.5^2 + (8.514 + 6.2)^2 - 2 \times 5.5 \times (8.514 + 6.2) \times \cos 78$
(e)	39.5 or 39.6 or 39.54 to 39.6[0]	2	M1 for $0.5 \times 5.5 \times (8.514 + 6.2) \times \sin 78$

14	(a)	11.2 or 11.19 to 11.20	3	M2 for $\sqrt{8.1^2 + 9.6^2 - 2 \times 8.1 \times 9.6 \times \cos 78}$ OR M1 for $8.1^2 + 9.6^2 - 2 \times 8.1 \times 9.6 \times \cos 78$ A1 for 125 or 125.4...
	(b)	$\sin DAC = \frac{9.6 \times \sin 78}{\text{their(a)}} \text{ oe}$	M2	M1 for $\frac{9.6}{\sin DAC} = \frac{\text{their(a)}}{\sin 78} \text{ oe}$
		56.97 to 57.05...	A1	
	(c)	14.8 or 14.79 to 14.81	3	M2 for $BC = \frac{\text{their(a)} \times \sin(57+15)}{\sin 46}$ or M1 for $\frac{BC}{\sin(57+15)} = \frac{\text{their(a)}}{\sin 46} \text{ oe}$
	(d)	35.0 to 35.3	4	B1 for angle $ACB = 62$ soi M1 for area $ABC = 0.5 \times \text{their(a)} \times \text{their(c)} \times \sin \text{their}(62)$ or $0.5 \times \text{their(c)} \times (13.7 \text{ or } 13.74 \text{ to } 13.75) \times \sin 46$ or $0.5 \times \text{their(a)} \times (13.7 \text{ or } 13.74 \text{ to } 13.75) \times \sin(57+15)$ M1 for area $ADC = 0.5 \times 8.1 \times 9.6 \times \sin 78 \text{ oe}$

15

(a)(i)	42	1	
(a)(ii)	71	1	
(a)(iii)	109	1	FT 180 – <i>their</i> (ii)
(a)(iv)	29	1	
(a)(v)	38	1	
(b)	74.2 or 74.21 to 74.25...	5	M1 for $[AB =] 2 \times 11 \cos 19$ oe M2 for $[AD =] \frac{\text{their}AB \times \sin(\text{their}42)}{\sin(\text{their}109)}$ or $[BD =] \frac{\text{their}AB \times \sin(\text{their}29)}{\sin(\text{their}109)}$ or M1 for $\frac{AD}{\sin \text{their}42} = \frac{\text{their}AB}{\sin \text{their}109}$ or $\frac{BD}{\sin \text{their}29} = \frac{\text{their}AB}{\sin \text{their}109}$ and M1 for $[Area =] 0.5 \times \text{their}AB \times \text{their}AD \times \sin(\text{their}29)$ or $[Area =] 0.5 \times \text{their}AB \times \text{their}BD \times \sin(\text{their}42)$ or $[Area =] 0.5 \times \text{their}AD \times \text{their}BD \times \sin(\text{their}109)$

16

(a)	[Angle between] tangent [and] radius / diameter [=90] oe	1	
(b)(i)	134	2	M1 for $360 - 90 - 90 - 46$ oe
(b)(ii)	23	2	M1 for $(180 - \text{their} (i)) \div 2$ oe
(b)(iii)	67	2	FT $(\text{their} (i)) \div 2$ M1 for $(\text{their} (i)) \div 2$ oe
(b)(iv)	113	2	FT $180 - \text{their} (iii)$ or $(360 - \text{their} (i)) \div 2$ M1 for $180 - \text{their} (iii)$ or $(360 - \text{their} (i)) \div 2$ oe
(c)	44	3	M2 for $180 - 67 - 23 - 23 - 23$ oe or $360 - 226 - 67 - 23$ oe or B1 for angle $OBC = 23$ or 226 seen

17

(a)	90	1	
(b)	94	2	M1 for $180 - 43 - 43$ or 2×47
(c)	22	2	B1 for $CAB = 65$ or $ACB = 47$
(d)	112	2	M1 for $180 - \text{their } ABC$
(e)	34	2	FT <i>their</i> (d) M1 for $(180 - \text{their}(\mathbf{d}))/2$
(f)	16	2	B1 for $BCT = 99$

18

(a)	$(1/3) \times 9^2 \times h$ or $\frac{1}{3}81h$ or $27h$ oe	1	
(b)	$\frac{10}{h} = \frac{a}{9}, \frac{9}{h} = \frac{a}{10} \left[a = \frac{90}{h} \right]$ oe	1	
(c)(i)	$[V =] \frac{1}{3}9^2h - \frac{1}{3}a^2 \times 10$ oe isw	1	FT <i>their</i> (a)
(c)(ii)	$[V =] \frac{1}{3}b^2(h-1)$ oe isw	1	
(c)(iii)	$\frac{1}{3}9^2h - \frac{1}{3}\left(\frac{90}{h}\right)^2 \times 10 = \frac{1}{3}\left(\frac{h-1}{h}\right)^2 9^2(h-1)$ oe	M2	M1 for $\frac{h-1}{h} = \frac{b}{9}$ oe
	$h - \frac{1000}{h^2} = \frac{(h-1)^3}{h^2}, \quad h^3 - 1000 = (h-1)^3$	A1	No errors or omissions seen
(c)(iv)	18.8 or 18.75 to 18.76 cao	2	B1 for 18.8 or 18.75 to 18.76 and negative root as final answers M1 for [quadratic/cubic]sketch(es)

19

(a)	$\frac{45}{360} \times 2\pi \times 22.5 = 2\pi r$ or $\frac{45}{360} \times \pi \times 22.5^2 = \pi \times r \times 22.5$	M2	or M1 for $\frac{45}{360} \times 2\pi \times 22.5$ or $\frac{45}{360} \times \pi \times 22.5^2$
	2.812 to 2.813	A1	
(b)	241 or 240.7 to 241.0...	5	M3 for $\frac{45}{360} \times \pi (32.5^2 - 22.5^2)$ oe or M2 for $\frac{45}{360} \times \pi \times 32.5^2$ or $\frac{45}{360} \times \pi \times 22.5^2$ and M1 for $\pi \times 2.81^2$
(c)	963 or 964 or 962.8 to 963.6	2	FT <i>their</i> (b) $\times 4$ B1 for length scale factor = 2, $\sqrt[3]{8}$, $\frac{1}{2}$ soi, or area factor = 2^2 oe

20

(a)(i)	1690 or 1687 or 1687.1 to 1687.3	3	M2 for $18 \times 12^2 - 18 \times \pi \times 4^2$ or M1 for either term correct
(a)(ii)	$1.69[0] \times 10^3$	1	FT <i>their</i> (i)
(b)	1500 or 1503 to 1504	4	M1 for $[4 \times] 18 \times 12$ M1 for $[2 \times] (12^2 - \pi \times 4^2)$ M1 for $\pi \times 2 \times 4 \times 18$
(c)(i)	56.5 or 56.6 or 56.54 to 56.56	1	
(c)(ii)	2.38 or 2.380 to 2.382	2	M1 for $\frac{3 \times \text{their}(c)}{4 \times \pi}$