

1(a)	83.4 or 83.36 to 83.43	4	<p>M1 for $160^2 + 95^2$ oe</p> <p>M2 for $[\cos =] \frac{107^2 + 165^2 - \text{their}34625}{2 \times 107 \times 165}$</p> <p>oe</p> <p>or M1 for $(\text{their}34625) =$ $107^2 + 165^2 - 2 \times 107 \times 165 \times \cos [\]$</p> <p>oe</p>
1(b)	9.2[2] or 9.218 to 9.219... nfw	4	<p>M2 for $107 \tan 8.2$ or $\frac{107}{\tan 81.8}$ or</p> <p>$\frac{107 \sin 8.2}{\sin 81.8}$ oe</p> <p>or M1 for $\tan 8.2 = \frac{\text{height}}{107}$ or</p> <p>$\tan 81.8 = \frac{107}{\text{height}}$ or</p> <p>$\frac{\sin 8.2}{\text{height}} = \frac{\sin 81.8}{107}$ oe</p> <p>M1 for $\tan [\] = \frac{\text{theirheight}}{95}$ oe</p>
2(a)	$20^2 - 11^2$ or $\sqrt{20^2 - 11^2}$ or $PQ^2 + 11^2 = 20^2 \rightarrow PQ^2 = 279$	M1	
	16.703...	A1	
2(b)	119.6 to 119.8	5	<p>M2 for $[QS =] \frac{16.70}{\tan 36}$ oe</p> <p>or M1 for $\tan 36 = \frac{16.70}{QS}$ oe</p> <p>AND</p> <p>M2 for $\cos[\dots] = \frac{11^2 + (\text{their}23)^2 - 30^2}{2 \times 11 \times \text{their}23}$ oe</p> <p>or M1 for $30^2 = 11^2 + (\text{their}23)^2 - 2 \times 11 \times \text{their}23 \times \cos[\dots]$</p> <p>oe</p>

2(c)	24.3[0...]	4	<p>B1 for $[PT\hat{Q} =] 43^\circ$ M2 for $\frac{16.7[0]\sin 97}{\sin(\text{their}43)}$ oe or M1 for $\frac{\sin 97}{PT} = \frac{\sin(\text{their}43)}{16.7[0]}$ oe</p>
3(a)	207.2 to 207.3 nfw	4	<p>B1 for $\angle BAD = 55$ soi nfw M2 for $\sin[] = \frac{290\sin(\text{their}55)}{350}$ or M1 for $\frac{350}{\sin(\text{their}55)} = \frac{290}{\sin[]}$ oe</p>
3(b)	17.6 to 17.8... nfw	5	<p>M1 for $CD = 350 \sin(70 - \text{their } 42.7)$ oe or $350 \sin(\text{their } (a) - 180)$ oe AND M3 for $\tan = \frac{290 \tan 10}{\text{their } CD}$ or M2 for [height of mast =] $290 \tan 10$ or M1 for $\tan 10 = \frac{[...]}{290}$</p>
4(a)(i)	41.4[0] or 41.39...	3	<p>M2 for $[\sin =] \frac{6.4 \times \sin 79}{9.5}$ or M1 for $\frac{6.4}{\sin[...]} = \frac{9.5}{\sin 79}$ oe</p>
4(a)(ii)	26.2[2...]	3	<p>Dep on 3 marks in (a)(i) or 41.4[0] used M1FT for $[\hat{C} =] 180 - 79 - \text{their } 41.4$ M1 for $\frac{1}{2} \times 6.4 \times 9.5 \times \sin(\text{their } \hat{C})$ oe</p>
4(b)(i)	63[.0] or 62.97...	3	<p>M2 for $[\cos =] \frac{9.8^2 + 8.2^2 - 9.5^2}{2 \times 9.8 \times 8.2}$ or M1 for $9.5^2 = 9.8^2 + 8.2^2 - 2 \times 9.8 \times 8.2 \times \cos[...]$</p>
4(b)(ii)	38.7 or 38.69...	2	<p>M1 for $\cos[...] = \frac{6.4}{8.2}$</p>

5(a)	$FC^2 = \left(\frac{10}{2}\right)^2 + \left(\frac{6}{2}\right)^2 \text{ oe}$ or $EX^2 = 12^2 - \left(\frac{6}{2}\right)^2$ or $EY^2 = 12^2 - \left(\frac{10}{2}\right)^2$	M2	M1 for $AC^2 = 10^2 + 6^2 \text{ oe}$ or $EX^2 + \left(\frac{6}{2}\right)^2 = 12^2$ or $EY^2 + \left(\frac{10}{2}\right)^2 = 12^2$
	$[EF^2 =] 12^2 - \text{their } FC^2 \text{ oe}$ or $[EF^2 =] \text{their } EX^2 - \left(\frac{10}{2}\right)^2$ or $[EF^2 =] \text{their } EY^2 - \left(\frac{6}{2}\right)^2$	M1	Dep on M2
	10.49 or 10.488...	A1	
5(b)	210 or 209.7 to 209.8	2	M1 for $\frac{1}{3} \times 6 \times 10 \times 10.5$
5(c)	29.0 or 28.95 to 28.96	3	M2 for $[\cos =] \frac{12^2 + 12^2 - 6^2}{2 \times 12 \times 12}$ or $2\sin^{-1}\left(\frac{3}{12}\right)$ or M1 for $6^2 = 12^2 + 12^2 -$ $2 \times 12 \times 12 \cos E$ or $\sin = \frac{3}{12}$
5(d)	34.9 or 34.85 to 34.86	2	FT $72\sin(\text{their } (c))$ M1 for $\frac{1}{2} \times 12 \times 12 \times \sin(\text{their } 29.0)$ or $\frac{1}{2}\sqrt{12^2 - 3^2} \times 6 \text{ oe}$
6(a)	33.7 or 33.69...	2	M1 for $\tan = \frac{8}{12} \text{ oe}$
6(b)	8.51 or 8.513...	2	M1 for $\sin 70 = \frac{8}{QL} \text{ oe}$
6(c)	1.3	2	M1 for $\frac{1.6}{TS} = \frac{8}{6.5} \text{ oe}$

7(a)	[0]67.3 or [0]67.29...	4	B3 for [$\angle SPR =$] 25.3 or 25.29... or M2 for [$\sin SPR =$] $\frac{146 \sin 108}{325}$ or M1 for $\frac{146}{\sin SPR} = \frac{325}{\sin 108}$ oe AND M1 for <i>their SPR</i> +42
7(b)(i)	[$QR^2 =$] $280^2 + 325^2 - 2 \times 280 \times 325 \times \cos 38$	M1	
	= 201.5... [= 202]	A2	A1 for [$QR^2 =$] 40 607.[...]
8(a)	80 000	2	B1 for answer figs 8 or 400 000 seen or figs5 : figs4 seen
8(b)	235 to 240	1	
8(c)	Correct position of <i>C</i>	2	B1 for bearing of 120° from <i>A</i> or 195° from <i>B</i>
8(d)	2.56 to 2.96	2	Dep on 2 marks in (c) B1FT for correct measurement of <i>their AC</i>
8(e)(i)	38.8 or 38.78 to 38.79	3	M2 for $\sin[\dots] = \frac{4 \sin 70}{6}$ or $\sin^{-1}\left(\frac{4 \sin 70}{6}\right)$ or M1 for $\frac{4}{\sin[\dots]} = \frac{6}{\sin 70}$ oe
8(e)(ii)	29.2 or 29.18 to 29.19	3	M2 for $\frac{6}{12\frac{1}{3}} \times 60$ oe or M1 for $\frac{6}{\text{their time}}$ or $\frac{6000}{\text{their time}}$
9(a)	6.84 or 6.839 to 6.84[0]	3	B2 for 46.7 to 46.8 or M1 for $15^2 + 14^2 - 2 \times 14 \times 15 \times \cos 27$
9(b)	21[.0] or 20.97 to 20.98	3	M2 for $\frac{1000}{\frac{1}{2} \times 14 \times 15 \times \sin 27}$ oe or M1 for $\frac{1}{2} \times 14 \times 15 \times \sin 27$ oe isw
9(c)	6.36 or 6.355 to 6.356	2	M1 for $\sin 27 = \frac{h}{14}$ oe

10(a)	$\sin CAB = \frac{3.7 \sin 42}{2.8}$ <p>OR</p> $C\hat{A}B = \sin^{-1}\left(\frac{3.7 \sin 42}{2.8}\right)$ <p>OR</p> $\frac{\sin CAB}{3.7} = \frac{\sin 42}{2.8} \text{ and}$ $\sin = 0.88[42\dots]$	M2	M1 for $\frac{3.7}{\sin CAB} = \frac{2.8}{\sin 42}$ oe
	$C\hat{A}B = 62.15[4\dots]$	A1	
10(b)	[0]17.2°	2	M1 for 135 + 62.2 – 180 oe
10(c)	10.5 to 10.6	4	<p>B3 for 4.05 to 4.06</p> <p>OR</p> <p>M2 for</p> $\sqrt{2.8^2 + 3.7^2 - 2 \times 2.8 \times 3.7 \times \cos(180 - 42 - 62.2)}$ <p>oe</p> <p>or M1 for</p> $2.8^2 + 3.7^2 - 2 \times 2.8 \times 3.7 \times \cos(180 - 42 - 62.2)$ <p>oe</p> <p>OR</p> <p>M2 for $\frac{2.8 \sin(180 - 42 - 62.2)}{\sin 42}$ oe</p> <p>or M1 for $\frac{\sin(180 - 42 - 62.2)}{AB} = \frac{\sin 42}{2.8}$ oe</p> <p>OR</p> <p>M2 for $\frac{3.7 \sin(180 - 42 - 62.2)}{\sin 62.2}$ oe</p> <p>or M1 for $\frac{\sin(180 - 42 - 62.2)}{AB} = \frac{\sin 62.2}{3.7}$ oe</p> <p>OR</p> <p>B1 for $A\hat{C}B = 75.8$</p>

11(a)	Need to see 2.58 rounded from a correctly obtained 2 581 or better.	3	<p>Method 1 M2 for $AY = 3.65 \cos 45$ or $(3.65 \div 2) \div \sin 45$ or M1 for e.g. $\frac{AY}{3.65} = \cos 45$ or $\sin 45 = \frac{3.65 \div 2}{AY}$</p> <p>Method 2 M1 for such as $AY^2 + AY^2 = 3.65^2$ or $3.65^2 + 3.65^2 = AC^2$ soi</p> <p>M1 for $AY^2 = \frac{3.65^2}{2}$ oe</p> <p>A1 for $AY = 2.580[9\dots]$</p>
11(b)	7.93	2	M1 for $7.5^2 + 2.58^2$
11(c)	26.6° or $2 \sin^{-1}\left(\frac{0.5 \times 3.65}{\text{their } 7.93}\right)$	3FT	<p>M2 for $2 \sin^{-1}\left(\frac{0.5 \times 3.65}{\text{their } 7.93}\right)$ or $\cos [\dots] = \frac{\text{their } 7.93^2 + \text{their } 7.93^2 - 3.65^2}{2 \times \text{their } 7.93^2}$ Or M1 for $\sin [\dots] = \frac{0.5 \times 3.65}{\text{their } 7.93}$ or $3.65^2 = \text{their } 7.93^2 + \text{their } 7.93^2 - 2 \times \text{their } 7.93^2 \times \cos [\dots]$</p>
11(d)(i)	11.18 or 11.2	2	M1 for $\tan 77 = \frac{XY}{2.58}$ oe
11(d)(ii)	80.7°	2FT	M1 for $\tan [\dots] = \frac{\text{their } 11.2}{3.65 \div 2}$
12(a)	14.96 to 15[.0] nfw	3	<p>M2 for $15.1^2 - 2^2 (= 224.01)$ or M1 for $DC^2 + 2^2 = 15.1^2$ or $15.1^2 - \text{their } 2^2$ with horizontal line seen or B1 for horizontal line and 2 soi</p>
12(b)	97.46 to 97.55		<p>M2 for $\cos [A] = \frac{9^2 + 11^2 - 15.1^2}{2 \times 9 \times 11}$ oe or B1 for $15.1^2 = 9^2 + 11^2 - 2 \times 9 \times 11 \times \cos [A]$ oe</p>

13(a)	7.387 to 7.392	2	M1 for $\sin 38 = \frac{PQ}{12}$ soi or $\frac{PQ}{\sin 38} = \frac{12}{\sin 90}$ soi
13(b)	71(.0) to 71.02, 108.98 to 109(.0) nfw	4	B3 for one correct or M2 for $\sin S = \frac{12\sin 52}{10}$ or $\frac{12\cos 38}{10}$ or M1 for $\frac{\sin S}{12} = \frac{\sin 52}{10}$ oe or $[PR=]12\cos 38$ or $[PR=]12\sin 52$ or $[PR=] \sqrt{12^2 - (\text{their}(a))^2}$ and SC1 for two answers that add to 180
14(a)	137	1	
14(b)	085	1	
15 (a)	326 ft	4ft	M2 for $65^2 = 110^2 + 70^2 - 2 \times 110 \times 70 \times \cos \widehat{ACB}$ soi or M1 for the cosine rule with one error. and A1 for 33.9 or 146.1 or 59.2 and B1 ft for $360 - \text{their } \widehat{ACB}$ oe SC 2 for 109.1 or 37.0
(b)	92.2	3	M2 for $\frac{AD}{\sin(70 + 58) \text{ or } (180 - (70 + 58))} = \frac{110}{\sin 70}$ oe soi or M1 for $70 + 58$ or $180 - (70 + 58)$
(c) (i)	13.6 or 13.7	2	M1 for $\tan YBC = \frac{17}{70}$ or $\tan BYC = \frac{70}{17}$
16 (a)	173.8 to 174 m	3	B1 for 9 and 115 soi M1 for $\frac{AB}{\sin 115} = \frac{30}{\sin 9}$ or better
(b)	51.4 to 51.5	4	B3 for 38.5 to 38.6 or M2 for $\cos DFE = \frac{75^2 + 180^2 - 130^2}{2 \times 75 \times 180}$ or M1 for $130^2 = 75^2 + 180^2 - 2 \times 75 \times 180 \cos F$

17	(a) (i)	2.67	2	M1 $\frac{AD}{3} = \cos 27$ oe	
	(ii)	4.57	3	M2 for $CD = \frac{3}{\sin 41}$ oe or M1 for $\frac{3}{CD} = \sin 41$ oe	
	(b)	53.1 126.9	3	M1 for $\frac{1}{2} \times 3 \times 5 \times \sin P\hat{Q}R = 6$ oe and A1 for 53.1 or SC1 for supplementary angles from $\sin P\hat{Q}R = k$.	
18	280, 295, 310		3*	C2 for two correct values OR B2 for two from 70° , 40° and 55° seen OR B1 for 70° seen or for 10° or 120° correctly positioned on diagram	
19	(a)	(\pm) 9.3(0) to 9.31	4	M2 for $BC^2 = 8^2 + 11^2 - 2 \times 8 \times 11 \cos 56$ Or M1 for $8^2 + 11^2 \pm (2) \times 8 \times 11 \cos 56$ B1 for 86.5 to 86.6	
	(b)	122.2 to 122.3	3	M2 for $(\sin ADC) = \frac{11 \sin 30}{6.5}$, or 57.7 to 57.8, or 58 Or M1 for $\frac{\sin ADC}{11} = \frac{\sin 30}{6.5}$ oe	
20	(a) (i)	11.05 confirmed		1	
	(ii)	39.1° or 39.2°		2	M1 for $\frac{1}{2} \times 5 \times 7 \times \sin PQR$
	(iii)	136.3°		3	M1 for $8 \times 2 \times \sin ZWX = \frac{1}{2} \times 4 \times 6 \times \sin 67$ oe and A1 for 43.7° soi or M1 for $180 - \text{their } 43.7$ soi
21	(a)	35°		1	
	(b)	286.7 to 287		2	M1 for $\sin \text{their } 35 = \frac{x}{500}$ or better
	(c)	(0) 31 to (0)31.2		3	M1 for $\tan \theta = \frac{335}{500}$ or $\frac{500}{335}$ B1 for $\hat{SPQ} = 33.8 - 34$

22	<p>(a) 42.3</p> <p>(b) 83.9</p> <p>(c) 814</p> <p>(d) 17.2</p>	3	<p>M2 for $\frac{30 \sin 58}{\sin 37}$ or</p> <p>M1 for $\frac{AB}{\sin 58} = \frac{30}{\sin 37}$ oe</p>
23	<p>(a) 43(.0)</p> <p>(b) (\pm) 2.5(0)</p> <p>(c) (i) 245</p> <p>(ii) 16.7</p>	2	<p>M1 for $\sin x = \frac{3.73}{5.47}$ (0.6819) oe</p>
24	<p>(a) (0)57°</p> <p>(b) 237°</p> <p>(c) 237.5</p>	1	<p>1 ft</p> <p>ft their (a) + 180</p>
		4	<p>M3 for $\sqrt{30^2 + 64^2 - 2 \times 30 \times 64 \cos(180 - 58)}$</p> <p>M2 for $30^2 + 64^2 - 2 \times 30 \times 64 \cos(180 - 58)$ or</p> <p>M1 for $30^2 + 64^2 + 2 \times 30 \times 64 \cos(180 - 58)$ and</p> <p>A1 for 54.4</p>
		2	<p>M1 for $\frac{1}{2} \times 30 \times 64 \sin((180 -)58)$ oe</p>
		3	<p>M2 for $30 \sin 58 \tan 34$ or</p> <p>M1 for $\frac{H}{\text{their } AP} = \tan 34$ or $\tan 56$ or</p> <p>B1 for $AP = 30 \sin 58$ (= 25.4) oe soi</p>
		1	<p>M2 for $5.32^2 + 3.73^2 - 2 \times 5.32 \times 3.73 \times \cos 25$</p> <p>or M1 for $\cos 25 = \frac{3.73^2 + 5.32^2 - x^2}{2 \times 3.73 \times 5.32}$ or</p> <p>for $5.32^2 + 3.73^2 + 2 \times 5.32 \times 3.73 \times \cos 25$</p> <p>A1 for 6.246 seen or 8.84</p>
		2	<p>B1 for $\tan y = \frac{30}{100}$ or $\frac{100}{30}$ ($y = 73.3$)</p>