1(a)	$9.7^2 + 3.8^2 - 2 \times 9.7 \times 3.8 \times \cos 73°$ or $94.09 + 14.44 - 73.72 \cos 73°$ or 86.976... or 86.98 or 87	M1	oe
	$\sqrt{\text{their } 86.976...}$	M1dep	
	9.3(2...) or 9.33	A1	
	$\frac{\sin x}{\text{their } 9.32...} = \frac{\sin 42}{8}$ or $\sin^{-1}[0.7778, 0.7804]$	M1	oe their 9.32... must be their length of the vertical line
	[51, 51.3]	A1ft	ft their 9.3(2...) or 9.33
	Additional Guidance		
	Their 9.32... must come from M1M1 or be clearly identified in working or on the diagram as the length of the vertical line		

Question	Answer	Mark	Comments
2(a)	Correct explanation	B1	eg (it should be) $\frac{31}{\sin x}$
	Additional Guidance		
	x and 31 should be swapped		B1
	She has used 31 as an angle		B1
	She has used x as a length		B1
	It should be $\frac{\sin x}{31}$ $\left(= \frac{\sin 72}{54}\right)$		B1

Q	Answer	Mark	Comments
3	105	B1	may be seen on the diagram
	$12^2 + 28^2 - 2 \times 12 \times 28 \times \cos$ their 105 or [1101, 1102]	M1	oe eg $144 + 784 - 672 \cos$ their 105 or $928 - 672 \cos$ their 105 their 105 cannot be 0 or 90 their 105 must be < 180
	$\sqrt{\text{their } [1101, 1102]}$	M1dep	
	[33.19, 33.2] or 33	A1ft	ft B0M2
	Additional Guidance		
	Follow through answers must be rounded to 2 sf or better		

Q	Answer	Mark	Comments
4	$\frac{\sin x}{17} = \frac{\sin 64}{23}$ or $\sin x = \frac{17\sin 64}{23}$ or $\sin x = \frac{15.279...}{23}$ or $\frac{\sin x}{17} = 0.039...$ or $\sin x = 0.66(4...)$	M1	oe $\frac{17}{\sin x} = \frac{23}{\sin 64}$ or $\frac{17}{\sin x} = [25.58, 25.6]$
	$(x =) \sin^{-1} \frac{17\sin 64}{23}$ or $(x =) \sin^{-1} 0.66(4...)$	M1dep	
	[41.29, 41.64] or 42 or 41 from correct working	A1	
	Additional Guidance		
	Answer from accurate drawing		M0M0A0

Q	Answer	Mark	Comments
5	**Alternative method 1** Works out AC and uses it in triangle ABC		
	$\cos 37 = \frac{AC}{4}$	M1	oe eg $\sin 53 = \frac{AC}{4}$ allow [0.798, 0.8] for cos 37 or sin 53
	$(AC =)\ 4 \times \cos 37$ or $(AC =)$ [3.19, 3.2]	M1dep	oe eg $(AC =)\ 4 \times \sin 53$ allow [0.798, 0.8] for cos 37 or sin 53 may be seen on diagram
	$\sin x = \frac{\text{their [3.19, 3.2]}}{9.3}$ or $(x =) \sin^{-1}$ [0.34, 0.3441]	M1dep	oe eg $\cos x = \frac{\sqrt{9.3^2 - \text{their [3.19, 3.2]}^2}}{9.3}$ or $(x =) 90 - \cos^{-1}$ [0.34, 0.3441]
	[19.87, 20.13]	A1	
	Alternative method 2 Works out angle ADC and uses it in triangle ABD		
	(angle $ADC =$) $90 - 37$ or (angle $ADC =$) 53	M1	oe eg (angle $ADC =$) $180 - 90 - 37$ may be seen on diagram
	$\frac{\sin x}{4} = \frac{\sin(90-37)}{9.3}$	M1dep	oe eg $\frac{4}{\sin x} = \frac{9.3}{\sin 53}$
	$(\sin x =) \frac{\sin(90-37)}{9.3} \times 4$ or $(x =) \sin^{-1}$ [0.34, 0.3441]	M1dep	oe
	[19.87, 20.13]	A1	

5 cont	Additional Guidance	
	Up to M3 may be awarded for correct work with no answer or incorrect answer, even if this is seen amongst multiple attempts	
	Allow any unambiguous notation for angles eg allow B for x	
	Alt 1 Allow any unambiguous notation for AC eg y (condone x if clearly referring to AC)	
	Alt 1 1st M1 must be an equation where AC is the only variable eg $AC^2 + (4\sin 37)^2 = 4^2$	M1
	Alt 1 A calculation that leads to AC scores M1M1 eg $\sqrt{4^2 - (4\sin 37)^2}$	M1M1
	Alt 1 3rd M1 must have $\sin x$ (or $\cos x$) as the subject or be a calculation that leads to x	
	Alt 2 53 only marked at angle BAC on diagram	M0

Q	Answer	Mark	Comments
6(a)	$35^2 + 65^2 - 2 \times 35 \times 65 \times \cos 100$	M1	oe valid trigonometric method used must be correct
	$\sqrt{35^2 + 65^2 - 2\times35\times65\times\cos100}$ $= 78.9(\ldots)$ or $\sqrt{6240.(0992...)} = 78.9(\ldots)$	A1	$CA = 78.99429858$
	Additional Guidance		
	Using sine rule with $CA = 79$ to obtain AB or BC		M0A0

Q	Answer	Mark	Comments
6(b)	**Alternative method 1 – sine rule to find *ACB***		
	$\frac{\sin ACB}{35} = \frac{\sin 100}{79}$	M1	oe 79 may be 78.9(…)
	$\sin ACB = 35 \times \frac{\sin 100}{79}$ or $\sin ACB = 35 \times 0.0124\ldots$ or $\sin ACB = 0.436\ldots$	M1dep	oe
	$ACB = [25.8, 26]$	A1	
	234.(…)	A1ft	ft 360 – 100 – their *ACB* with M2 scored
	Alternative method 2 – cosine rule to find *ACB*		
	$35^2 = 79^2 + 65^2 - 2 \times 79 \times 65 \times \cos ACB$	M1	oe 79 may be 78.9(…)
	$\cos ACB = \frac{79^2 + 65^2 - 35^2}{2\times79\times65}$ or $\cos ACB = \frac{9241}{10270}$ or $\cos ACB = 0.899\ldots$	M1dep	
	$ACB = [25.8, 26]$	A1	
	234.(…)	A1ft	ft 360 – 100 – their *ACB* with M2 scored

6(b) cont	**Alternative method 3 – sine rule to find *BAC***		
	$\frac{\sin BAC}{65} = \frac{\sin 100}{79}$	M1	oe 79 may be 78.9(…)
	$\sin BAC = 65 \times \frac{\sin 100}{79}$ or $\sin BAC = 65 \times 0.0124\ldots$ or $\sin BAC = 0.81(0\ldots)$	M1dep	oe
	$BAC = [54.1, 54.3]$	A1	
	234.(…)	A1ft	ft their $BAC + 180$ with M2 scored
	Alternative method 4 – cosine rule to find *BAC*		
	$65^2 = 79^2 + 35^2 - 2 \times 79 \times 35 \times \cos BAC$	M1	oe 79 may be 78.9(…)
	$\cos BAC = \frac{79^2 + 35^2 - 65^2}{2 \times 79 \times 35}$ or $\cos BAC = \frac{3241}{5530}$ or $\cos BAC = 0.586\ldots$	M1dep	
	$BAC = [54.1, 54.3]$	A1	
	234.(…)	A1ft	ft their $BAC + 180$ with M2 scored
	Additional Guidance		
	$CA = 79$ is given in part (a) or 78.9(…) can be used. There is no follow through from part (a).		
	Accept any notation for the angle eg $\sin x$ or $\sin C$ for angle ACB		
	Correct work for part (b) seen in part (a) may be awarded method marks in part (b)		

Q	Answer	Mark	Comment
7	247 – 170 or 77	M1	oe may be on diagram
	$23 \times 1\frac{1}{2}$ or 34.5	M1	oe eg 23 + 11.5 or $23 \times 90 \div 60$ or 23×1.5 may be on diagram
	(their 34.5)^2 + 60^2 – 2 × their 34.5 × 60 × cos (their 77) or [3858, 3859]	M1dep	oe dep on at least one M scored
	$\sqrt{\text{their [3858, 3859]}}$ or 62.1(…)	M1dep	oe eg $\sqrt{34.5^2 + 60^2 - 2 \times 34.5 \times 60 \times \cos 77}$ dep on 3rd M1
	No and 62.1(…)	A1	oe eg 62.1 and the ship is further away accept No and 62 with M4 scored
	Additional Guidance		
	Up to M2 may be awarded for correct work with no answer, or incorrect answer, even if this is seen amongst multiple attempts		
	2nd M1 Do not accept 23 × 1.30 unless recovered		

Q	Answer	Mark	Comment
8	$\frac{EP}{\sin 35} = \frac{29}{\sin 114}$ or $\frac{29 \sin 35}{\sin 114}$	M1	oe eg $\frac{\sin 35}{EP} = \frac{\sin 114}{29}$ or $\frac{EP}{\sin 35}$ = [31.7, 31.7445]
	[18.2, 18,21]	A1	accept 18 with M1 scored
	Additional Guidance		
	EP may be *PE* or x etc		
	Do not regard 31 as a misread of 35		

Q	Answer	Mark	Comments
9	**Alternative method 1: only uses trigonometry**		
	$\cos 52 = \frac{x}{23.7}$	M1	oe eg $\sin(90-52) = \frac{x}{23.7}$ or $\frac{x}{\sin 38} = \frac{23.7}{\sin 90}$ accept [0.61, 0.62] for cos 52 or sin 38
	$23.7 \times \cos 52$	M1dep	oe eg $23.7 \times \sin 38 \div \sin 90$ accept [0.61, 0.62] for cos 52 or sin 38
	[14.59, 14.6]	A1	SC1 [18.4, 18.723]
	Alternative method 2: uses trigonometry and Pythagoras		
	23.7^2 and $(23.7 \times \sin 52)^2$ **or** [561.6, 561.7] and [338, 351]	M1	oe accept [0.78, 0.79] for sin 52 accept [18.4, 18.723] for $23.7 \times \sin 52$
	$\sqrt{23.7^2 - (23.7 \times \sin 52)^2}$ or $\sqrt{[210.6, 223.7]}$	M1dep	oe accept [0.78, 0.79] for sin 52 accept [18.4, 18.723] for $23.7 \times \sin 52$
	[14.59, 14.6]	A1	SC1 [18.4, 18.723]
	Additional Guidance		
	M1 may be awarded for correct work with no answer or incorrect answer, even if this is seen amongst multiple attempts		
	SC1 is from a diagonal making an angle of 38° with x		

Q	Answer	Mark	Comments
10(a)	$\frac{\sin x}{11} = \frac{\sin 35}{7}$ or $\frac{11}{\sin x} = \frac{7}{\sin 35}$	M1	oe equation
	$\sin x = \frac{11\sin 35}{7}$ or $\sin x = 0.901...$ or $\sin^{-1}\frac{11\sin 35}{7}$ or $\sin^{-1} 0.901...$	M1dep	oe equation with $\sin x$ as the subject
	[64.2, 64.4] with correct working seen	A1	
	Additional Guidance		
	0.901... may be seen as 0.9 for M marks		
	Only using $x = 64$ in sine rule		M0
	[64.2, 64.4] with no appropriate working		M0M0A0

Q	Answer	Mark	Comments
10(b)	No and correct reason indicating that 35° is a different angle or No and correct reason indicating that 7 cm is a different side	B1	oe eg correct reasons 35 is between 7 and 11 this time 35 is not opposite 7 A is SSA but B is SAS
	Additional Guidance		
	Ignore irrelevant reasons with a correct reason		
	'Yes' ticked		B0
	'No' ticked and states:		
	(A and B are) not congruent		B1
	This triangle is SAS but the other one is not		B1
	The sides are not opposite the same angles		B1
	35 is in a different position compared to the sides		B1
	35 is in a different position		B0
	7 is in a different position compared to the angles		B1
	7 is in a different position		B0
	7 was opposite 35 and is now adjacent		B1
	7 was opposite and is now adjacent		B0
	Sides and angles are in different places		B0
	Sides are in different places		B0
	There is no value opposite the 35		B0
	The angle is in a different position compared to the sides		B0
	It is a different size		B0
	It is a different shape		B0
	w is 72(.3…) or use of sine rule (question says 'without further calculation')		B0