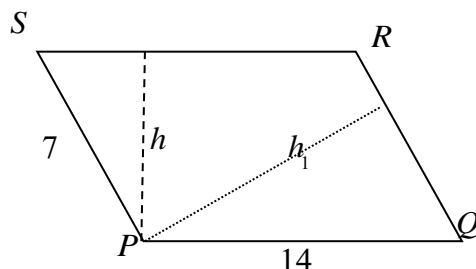


Question	Scheme	Marks	AOs
1 (a)	Sets $50 = 7 \times 14 \sin(\angle SPQ)$ oe	B1	1.2
	Finds $180^\circ - \arcsin\left(\frac{50}{98}\right)$	M1	1.1b
	$= 149.32^\circ$	A1	1.1b
		(3)	
(b)	Method of finding SQ $SQ^2 = 14^2 + 7^2 - 2 \times 14 \times 7 \cos 149.32^\circ$	M1	1.1b
	$= 20.3 \text{ cm}$	A1	1.1b
		(2)	

(5 marks)

Alt(a)	States or uses $14h = 50$ or $7h_1 = 50$	B1	1.2
	Full method to find obtuse $\angle SPQ$. In this case it is $90^\circ + \arccos\left(\frac{h}{7}\right)$ or $90^\circ + \arccos\left(\frac{h_1}{14}\right)$	M1	1.1b
	awrt 149.32°	A1	1.1b

Notes**(a)****B1:** Sets $50 = 7 \times 14 \sin(\angle SPQ)$ oe**M1:** Attempts the correct method of finding obtuse $\angle SPQ$. See scheme.**A1:** awrt 149.32° **(b)****M1:** A correct method of finding SQ using their $\angle SPQ$. $SQ^2 = 14^2 + 7^2 - 2 \times 14 \times 7 \cos 149.32^\circ$ scores this mark.**A1:** awrt 20.3 cm (condone lack of units)**Alt(a)****B1:** States or uses $14h = 50$ or $7h_1 = 50$ **M1:** Full method to find obtuse $\angle SPQ$.In this case it is $90^\circ + \arccos\left(\frac{h}{7}\right)$ or $90^\circ + \arccos\left(\frac{h_1}{14}\right)$ **A1:** awrt 149.32°

Question	Scheme	Marks	AOs	
2(a)(i)	$(3x+10)^2 = (x+2)^2 + (7x)^2 - 2(x+2)(7x)\cos 60^\circ$ oe	M1	3.1a	
	Uses $\cos 60^\circ = \frac{1}{2}$, expands the brackets and proceeds to a 3 term quadratic equation	dM1	1.1b	
	$17x^2 - 35x - 48 = 0$ *	A1*	2.1	
		(3)		
	(ii)	$x = 3$	B1	3.2a
			(1)	
(b)	$\frac{5}{\sin ACB} = \frac{19}{\sin 60^\circ} \Rightarrow \sin ACB = \dots \left(\frac{5\sqrt{3}}{38} \right)$ or e.g. $5^2 = 21^2 + 19^2 - 2 \times 19 \times 21 \cos ACB \Rightarrow \cos ACB = \dots \left(\frac{37}{38} \right)$	M1	1.1b	
	$\theta = \text{awrt } 13.2$	A1	1.1b	
		(2)		

(6 marks)**Notes**

(a)(i) Mark (a) and (b) together

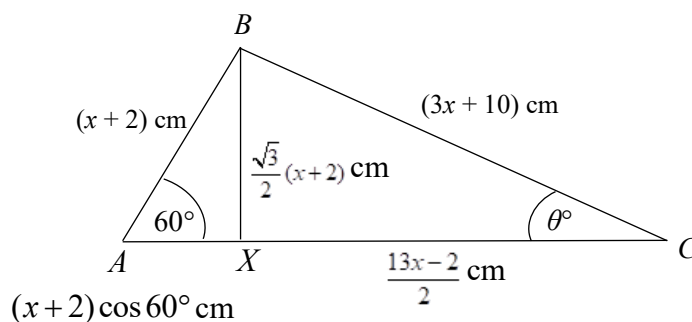
M1: Recognises the need to apply the cosine rule and attempts to use it with the sides in the correct positions and the formula applied correctly. Condone invisible brackets and slips on $3x+10$ as $3x-10$.

Alternatively, uses trigonometry to find AX and then equates two expressions for the length BX . You may see variations of this if they use Pythagoras or trigonometry to find BX and then apply Pythagoras to the triangle BXC . See the diagram below to help you.

The angles and lengths must be in the correct positions. Cos 60 may be $\frac{1}{2}$ from the start

dM1: Uses $\cos 60^\circ = \frac{1}{2}$, expands the brackets and proceeds to a 3TQ. You may see the use of $\cos 60^\circ = \frac{1}{2}$ in earlier work, but they must proceed to a 3TQ as well to score this mark. It is dependent on the first method mark.

A1*: Obtains the correct quadratic equation with the $= 0$ with no errors seen in the main body of their solution. Condone the recovery of invisible brackets as long as the intention is clear. You do not need to explicitly see cos 60 to score full marks.



(a)(ii)

B1: Selects the appropriate value i.e. $x = 3$ only. The other root must **either** be rejected if found **or** $x = 3$ must be the only root used in part (b). Can be implied by awrt 13.2 in (b)

(b)

M1: Using their value for x this mark is for either:

- applying the sine rule correctly (or considers 2 right angled triangles) and proceeding to obtain a value for $\sin ACB$ or
- applying the cosine rule correctly and proceeding to obtain a value for $\cos ACB$.

Condone slips calculating the lengths AB , BC and AC . At least one of them should be found correctly for their value for x

(Also allow if the sine rule or cosine rule is applied correctly to find a value for $\sin ABC$

$$\left(= \frac{21\sqrt{3}}{38} \right) \text{ or } \cos ACB \left(= -\frac{11}{38} \right)$$

A1: awrt 13.2 (answers with little working eg just lengths on the diagram can score M1A1)

Question	Scheme	Marks	AOs
3 (a)	Angle $ACB = 33^\circ$	B1	1.1b
	Attempts $\{AB^2 =\} 8.2^2 + 15.6^2 - 2 \times 8.2 \times 15.6 \cos 33^\circ$	M1	1.1b
	Distance = awrt 9.8 {km}	A1	1.1b
		(3)	
(b)	<ul style="list-style-type: none"> Explains that the road is not likely to be straight {and therefore the distance will be greater}. Explains that there are likely to be objects in the way {that they must go around and therefore the distance travelled will be greater}. The {bases of the} masts are not likely to lie in the same {horizontal} plane {and so the distance will be greater}. 	B1	3.2b
		(1)	
(4 marks)			

Notes:**(a)**

B1: 33 seen anywhere but allow $72 - 39$. May be indicated on a diagram (including incorrectly) or on the given Figure 1 and it might be named incorrectly.

M1: Uses the given model and attempts to use the cosine rule to find the distance or distance²
Award for $8.2^2 + 15.6^2 - 2 \times 8.2 \times 15.6 \cos \dots$ where \dots must be a value.

A1: awrt 9.8 {km} isw

(a) Alternative

B1: $\{\overline{AB} =\} \pm \begin{pmatrix} 15.6 \cos 51 - 8.2 \cos 18 \\ 15.6 \sin 51 - 8.2 \sin 18 \end{pmatrix}$ or $\pm \begin{pmatrix} 15.6 \sin 39 - 8.2 \sin 72 \\ 15.6 \cos 39 - 8.2 \cos 72 \end{pmatrix}$ o.e.

May be implied by calculation that leads to $\begin{pmatrix} \text{awrt } \pm 2.0 \\ \text{awrt } \pm 9.6 \end{pmatrix}$ e.g. $\begin{pmatrix} 9.8 \\ 12.1 \end{pmatrix} - \begin{pmatrix} 7.8 \\ 2.5 \end{pmatrix}$

Note: they may find components separately and condone, e.g., $\begin{pmatrix} \text{awrt } \pm 9.6 \\ \text{awrt } \pm 2.0 \end{pmatrix}$

M1: Attempts to find \overline{AB} (as above) **and** uses Pythagoras to find distance or distance²

A1: awrt 9.8 {km} isw

(b)

B1: A valid reason based on the assumptions, i.e., the plane is not really horizontal **or** the journey not being in a straight line.

Do not accept answers referencing the accuracy of the answer to part (a) being to 1d.p. or the accuracy of the values given in the question, **but** ignore if there is a separate, valid reason.

Some examples:

“Because it is unlikely the bearings are exact” – B0 see above.

“Because they may not walk in a straight line because they could take another longer or shorter route as their route could be more curved” – B0 – incorrect comment about there being a shorter route.

“Because they won’t travel in one direction due to the roads” – B1 BOD

“Impossible and unrealistic to walk in a straight line” – B1