Trigonometry As level Edexcel Maths Past Papers Answers

01.

Question	Scheme		Marks	AOs
a	Finds third angle of triangle and uses or states $\frac{x}{\sin 60°} = \frac{30}{\sin "50°"}$	Finds third angle of triangle and uses or states $\frac{y}{\sin 70°} = \frac{30}{\sin "50°"}$	M1	2.1
	So $x = \frac{30\sin 60°}{\sin 50°}$ $(= 33.9)$	So $y = \frac{30\sin 70°}{\sin 50°}$ $(= 36.8)$	A1	1.1b
	Area = $\frac{1}{2} \times 30 \times x \times \sin 70°$ or $\frac{1}{2} \times 30 \times y \times \sin 60$		M1	3.1a
	$= 478\text{ m}^2$		A1ft	1.1b
			(4)	
(b)	Plausible reason e.g. Because the angles and the side length are not given to four significant figures Or e.g. The lawn may not be flat		B1	3.2b
			(1)	
			(5 marks)	

Notes

(a) M1: Uses sine rule with their third angle to find one of the unknown side lengths
A1: finds expression for, or value of either side length
M1: Completes method to find area of triangle
A1ft: Obtains a correct answer for their value of x or their value of y.

(b) B1: As information given in the question may not be accurate to 4sf or the lawn may not be flat so modelling by a plane figure may not be accurate.

02.

Question	Scheme	Marks	AOs
a	Uses $15=\frac{1}{2}\times5\times10\times\sin\theta$	M1	1.1b
	$\sin\theta=\frac{3}{5}$ oe	A1	1.1b
	Uses $\cos^2\theta=1-\sin^2\theta$	M1	2.1
	$\cos\theta=\pm\frac{4}{5}$	A1	1.1b
		(4)	
(b)	Uses $BC^2=10^2+5^2-2\times10\times5\times"-\frac{4}{5}"$	M1	3.1a
	$BC=\sqrt{205}$	A1	1.1b
		(2)	
		(6 marks)	

Notes

(a)

M1: Uses the formula $\text{Area}=\frac{1}{2}ab\sin C$ in an attempt to find the value of $\sin\theta$ or θ

A1: $\sin\theta=\frac{3}{5}$ oe This may be implied by $\theta=$ awrt 36.9° or awrt 0.644 (radians)

M1: Uses their value of $\sin\theta$ to find two values of $\cos\theta$ This may be scored via the formula $\cos^2\theta=1-\sin^2\theta$ or by a triangle method. Also allow the use of a graphical calculator or good candidates may just write down the **two values**. The values must be symmetrical $\pm k$

A1: $\cos\theta=\pm\frac{4}{5}$ or ±0.8 Condone these values appearing from $\pm0.79....$

(b)

M1: Uses a suitable method of finding the longest side. For example chooses the negative value (or the obtuse angle) and proceeds to find BC using the cosine rule. Alternatively works out BC using both values and chooses the larger value. If stated the cosine rule should be correct (with a minus sign). Note if the sign is +ve and the acute angle is chosen the correct value will be seen. It is however M0 A0

A1: $BC=\sqrt{205}$

03.

Question	Scheme	Marks	AOs
a	Uses $18\sqrt{3}=\frac{1}{2}\times 2x\times 3x\times \sin 60°$	M1	1.1a
	Sight of $\sin 60°=\frac{\sqrt{3}}{2}$ and proceeds to $x^2=k$ oe	M1	1.1b
	$x=\sqrt{12}=2\sqrt{3}$ *	A1*	2.1
		(3)	
(b)	Uses $BC^2=(6\sqrt{3})^2+(4\sqrt{3})^2-2\times 6\sqrt{3}\times 4\sqrt{3}\times \cos 60°$	M1	1.1b
	$BC^2=84$	A1	1.1b
	$BC=2\sqrt{21}$ (cm)	A1	1.1b
		(3)	
			(6 marks)

Notes

(a)

M1: Attempts to use the formula $A=\frac{1}{2}ab\sin C$.

If the candidate writes $18\sqrt{3}=\frac{1}{2}\times 5x\times \sin 60°$ **without** sight of a previous correct line then this would be M0

M1: Sight of $\sin 60°=\frac{\sqrt{3}}{2}$ or awrt 0.866 and proceeds to $x^2=k$ oe such as $px^2=q$

This may be awarded from the correct formula or $A=ab\sin C$

A1*: Look for $x^2=12\Rightarrow x=2\sqrt{3}$, $x^2=4\times 3\Rightarrow x=2\sqrt{3}$ or $x=\sqrt{12}=2\sqrt{3}$

This is a given answer and all aspects must be correct including one of the above intermediate lines. It cannot be scored by using decimal equivalents to $\sqrt{3}$

Alternative using the given answer of $x=2\sqrt{3}$

M1: Attempts to use the formula $A=\frac{1}{2}\times 4\sqrt{3}\times 6\sqrt{3}\sin 60°$ oe

M1: Sight of $\sin 60°=\frac{\sqrt{3}}{2}$ and proceeds to $A=18\sqrt{3}$

A1*: Concludes that $x=2\sqrt{3}$

(b)

M1: Attempts the cosine rule with the sides in the correct position.

This can be scored from $BC^2=(3x)^2+(2x)^2-2\times 3x\times 2x\times \cos 60°$ as long as there is some attempt to substitute x in later. Condone slips on the squaring

A1: $BC^2=84$ Accept $BC^2=7\times 12$, $BC=\sqrt{84}$ or $BC=2\sqrt{21}$

If they replace the surds with decimals they can score the A1 for $BC^2=$ awrt 84.0

A1: $BC=2\sqrt{21}$

Condone other variables, say $x=2\sqrt{21}$, but it cannot be scored via decimals.

04.

Question	Scheme	Marks	AOs
a	States $\frac{\sin\theta}{12}=\frac{\sin 27}{7}$	M1	1.1b
	Finds $\theta=$ awrt 51° or awrt 129°	A1	1.1b
	$=$ awrt 128.9°	A1	1.1b
		(3)	
(b)	Attempts to find part or all of AD Eg $AD^2=7^2+12^2-2\times12\times7\cos101.9=(AD=15.09)$ Eg $(AC)^2=7^2+12^2-2\times12\times7\cos(180-\text{"}128.9\text{"}-27)$ Eg $12\cos27$ or $7\cos\text{"}51\text{"}$	M1	1.1b
	Full method for the total length = $12+7+7+\text{"}15.09\text{"}=$	dM1	3.1a
	$=42$ m	A1	3.2a
		(3)	

(6 marks)

Notes

(a)

M1: States $\frac{\sin\theta}{12}=\frac{\sin 27}{7}$ oe with the sides and angles in the correct positions

Alternatively they may use the cosine rule on $\angle ACB$ and then solve the subsequent quadratic to find AC and then use the cosine rule again

A1: awrt 51° or awrt 129°

A1: Awrt 128.9° only (must be seen in part a))

(b)

M1: Attempts a "correct" method of finding either AD or a part of AD eg (AC or CD or forming a perpendicular to split the triangle into two right angled triangles to find AX or XD) which may be seen in (a).
You should condone incorrect labelling of the side.
Look for attempted application of the cosine rule

$$(AD)^2=7^2+12^2-2\times12\times7\cos(\text{"}128.9\text{"}-27)$$
$$\text{or } (AC)^2=7^2+12^2-2\times12\times7\cos(180-\text{"}128.9\text{"}-27)$$

Or an attempted application of the sine rule $\frac{(AD)}{\sin(\text{"}128.9\text{"}-27)}=\frac{7}{\sin 27}$

$$\text{Or } \frac{(AC)}{\sin(180-\text{"}128.9\text{"}-27)}=\frac{7}{\sin 27}$$

Or an attempt using trigonometry on a right-angled triangle to find part of AD

$$12\cos 27 \text{ or } 7\cos"51"$$

This method can be implied by sight of awrt 15.1 or awrt 6.3 or awrt 8.8 or awrt 10.7 or awrt 4.4

dM1: A complete method of finding the TOTAL length.
There must have been an attempt to use the correct combination of angles and sides.
Expect to see $7+7+12+"AD"$ found using a correct method.
This is scored by either $7+7+12+"AD"$ if $\angle ACB = 128.9°$ in a) or
$7+7+12+\text{awrt}\,15.1$ by candidates who may have assumed $\angle ACB = 51.1°$ in a)

A1: Rounds correct 41.09 m (or correct expression) up to 42 m to find steel **bought**

Candidates who assumed $\angle ACB = 51.1°$ (acute) in (a):
Full marks can still be achieved as candidates may have restarted in (b) or not used the acute angle in their calculation which is often unclear. We are condoning any reference to $AC = 15.1$ so ignore any labelling of the lengths they are finding.

Diagram of the correct triangle with lengths and angles:

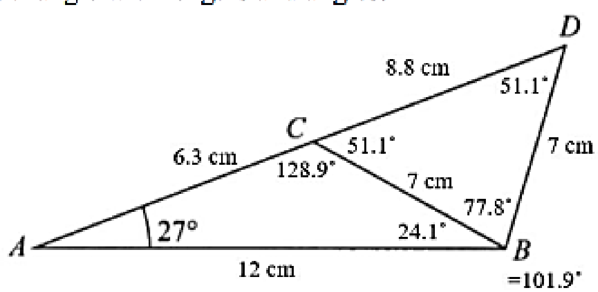
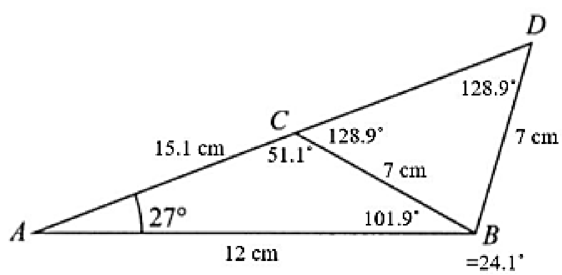


Diagram using the incorrect acute angle:



05.

Question	Scheme	Marks	AOs
a	Sets $50 = 7\times 14\sin(SPQ)$ oe	B1	1.2
	Finds $180° - \arcsin\left("\frac{50}{98}"\right)$	M1	1.1b
	$= 149.32°$	A1	1.1b
		(3)	
(b)	Method of finding SQ $SQ^2 = 14^2 + 7^2 - 2\times 14\times 7\cos"149.32"$	M1	1.1b
	$= 20.3$ 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 $90° + \arccos\left(\frac{h}{7}\right)$ or $90° + \arccos\left(\frac{h_1}{14}\right)$	M1	1.1b
	awrt $149.32°$	A1	1.1b

Notes

(a)

B1: Sets $50 = 7\times 14\sin(SPQ)$ oe

M1: Attempts the correct method of finding obtuse $\angle SPQ$. See scheme.

A1: awrt $149.32°$

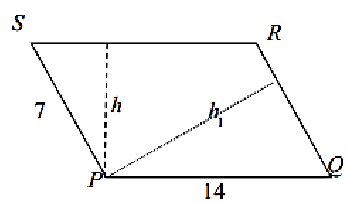
(b)

M1: A correct method of finding SQ using their $\angle SPQ$.

$SQ^2 = 14^2 + 7^2 - 2\times 14\times 7\cos"149.32"$ 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 $90° + \arccos\left(\frac{h}{7}\right)$ or $90° + \arccos\left(\frac{h_1}{14}\right)$

A1: awrt $149.32°$

06.

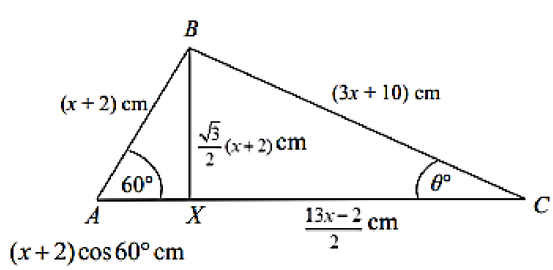
Question	Scheme	Marks	AOs
a (i)	$(3x+10)^2=(x+2)^2+(7x)^2-2(x+2)(7x)\cos 60°$ oe	M1	3.1a
	Uses cos 60° = ½, expands the brackets and proceeds to a 3 term quadratic equation	dM1	1.1b
	$17x^2-35x-48=0$ *	A1*	2.1
		(3)	
(ii)	$x=3$	B1	3.2a
		(1)	
(b)	$\frac{5}{\sin ACB}=\frac{19}{\sin 60°}\Rightarrow \sin ACB=...\left(\frac{5\sqrt{3}}{38}\right)$ or e.g. $5^2=21^2+19^2-2\times 19\times 21\cos ACB\Rightarrow \cos ACB=...\left(\frac{37}{38}\right)$	M1	1.1b
	$\theta=$ awrt 13.2	A1	1.1b
		(2)	
		(6 marks)	

(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° = ½, expands the brackets and proceeds to a 3TQ. You may see the use of cos 60° = ½ 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 $\left(=\frac{21\sqrt{3}}{38}\right)$ 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)

07.

Question	Scheme	Marks	AOs
a	Angle $ACB = 33°$	B1	1.1b
	Attempts $\{AB^2 =\} 8.2^2 + 15.6^2 - 2 \times 8.2 \times 15.6 \cos 33°$	M1	1.1b
	Distance = awrt 9.8 {km}	A1	1.1b
		(3)	
(b)	• 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 distance^2

Award for $8.2^2 + 15.6^2 - 2 \times 8.2 \times 15.6 \cos ...$ where ... must be a value.

A1: awrt 9.8 {km} isw

(a) **Alternative**

B1: $\{\overrightarrow{AB} =\} \pm \begin{pmatrix} 15.6\cos 51 - 8.2\cos 18 \\ 15.6\sin 51 - 8.2\sin 18 \end{pmatrix}$ **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 $\overrightarrow{AB}$ (as above) **and** uses Pythagoras to find distance or distance^2

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