N5 APPLICATIONS 1.1

This resource is to support pupils in passing the appropriate National 5 Assessment Standard. The questions and marking schemes used are from SQA past papers and as such test the topics in their entirety from grade A to C and *may* include other areas from the course. In addition the questions from **Paper 1** (P1) should be completed **without** the use of a calculator and questions from **Paper 2** (P2) permit the use of a calculator.

Each Assessment Standard is used to ensure pupils have the minimum competency on the specified sub-skills for the National 5 course. As such each Assessment Standard will test grade C work on that specific topic.

This resource is divided into two sections:

- Section A has an example on each sub skill for the relevant Assessment Standard and the marking scheme for these questions
- Section B has extra practice questions on this Assessment Standard and the marking scheme for these questions

Unit Assessment Standard	Sub skills	Section A – Question Number
Applications 1.1 Applying trigonometric skills to triangles which do not have a right angle	calculating the area of a triangle using trigonometry using the sine and cosine rules to find a side or angle using bearings with trigonometry	Q1 (working backwards) Q2 (Sine Rule) Q3 (Cosine Rule) Q4

FORMULAE LIST

The roots of $ax^2 + bx + c = 0$ are $x = \dfrac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$

Sine rule: $\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$

Cosine rule: $a^2 = b^2 + c^2 - 2bc\cos A$ or $\cos A = \dfrac{b^2 + c^2 - a^2}{2bc}$

Area of a triangle: $A = \frac{1}{2}ab\sin C$

Volume of a sphere: $V = \frac{4}{3}\pi r^3$

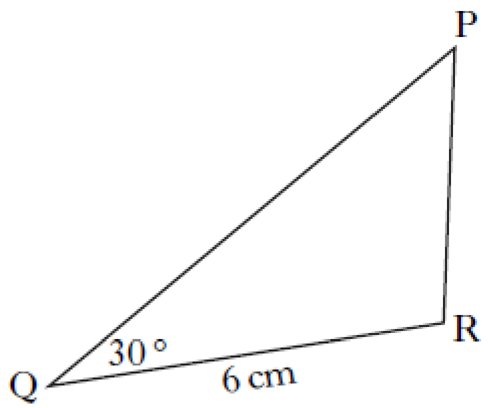
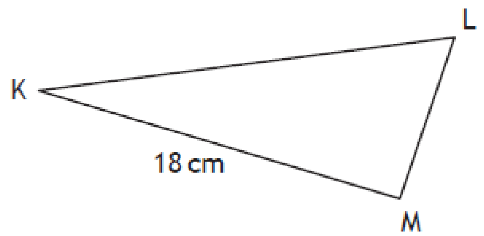
Volume of a cone: $V = \frac{1}{3}\pi r^2 h$

Volume of a pyramid: $V = \frac{1}{3}Ah$

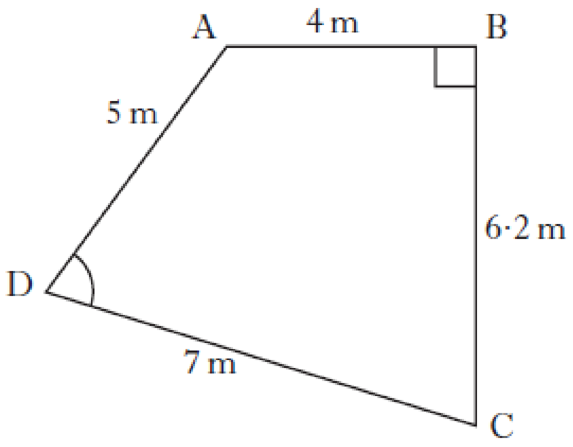
Standard deviation: $s = \sqrt{\dfrac{\Sigma(x-\bar{x})^2}{n-1}} = \sqrt{\dfrac{\Sigma x^2 - (\Sigma x)^2/n}{n-1}}$, where n is the sample size.

Section A

Section A

Q		Marks
1 **P2**	8. In triangle PQR: • QR = 6 centimetres • angle PQR = 30 ° • area of triangle PQR = 15 square centimetres.  Calculate the length of PQ.	3
2 **P1**	5. In triangle KLM • KM = 18 centimetres • sin K = 0·4 • sin L = 0·9 Calculate the length of LM. 	3

<table>
<tr>
<td>3
P2</td>
<td>
11. Quadrilateral ABCD with angle ABC = 90 ° is shown below.



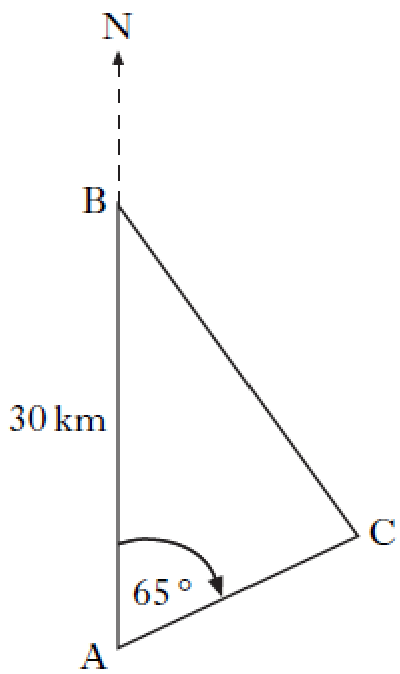
- AB = 4 metres
- BC = 6·2 metres
- CD = 7 metres
- AD = 5 metres

(*a*) Calculate the length of AC.

(*b*) Calculate the size of angle ADC.
</td>
<td>2
4</td>
</tr>
<tr>
<td>4
P2</td>
<td>
6. Brunton is 30 kilometres due North of Appleton.

From Appleton, the bearing of Carlton is 065 °.

From Brunton, the bearing of Carlton is 153 °.



Calculate the distance between Brunton and Carlton.
</td>
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<tr><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
</table>

Section A

MARKING SCHEME

Section A - MARKING SCHEME

1

Question No	Give 1 mark for each •	Illustrations of evidence for awarding each mark
8	**Ans: 10 cm**	
	• valid strategy in triangle PQR	• $A = \frac{1}{2} pr \sin Q$
	• substitution	• $15 = \frac{1}{2} \times 6 \times r \times \sin 30°$
	• solution	• 10
		3R

Notes:

(i) evidence for the 1st mark may be implicit in the substitution

(ii) for 5·77 (using $\frac{1}{2} pr \cos Q$) award a maximum of $\frac{2}{3}$

(iii) for 5 (using $\frac{1}{2} pr$) award $\frac{0}{3}$

2

Question	Expected Answer(s) Give one mark for each •	Max Mark	Illustrations of evidence for awarding a mark at each •
5.	Ans: 8 cm	3	
	•[1] correct substitution into sine rule		•[1] $\frac{LM}{0\cdot4} = \frac{18}{0\cdot9}$
	•[2] know how to solve		•[2] (LM =) $\frac{0\cdot4 \times 18}{0\cdot9}$
	•[3] correct calculation		•[3] (LM =) 8

Notes:

1. For $\frac{LM}{\sin 0\cdot4} = \frac{18}{\sin 0\cdot9} \rightarrow \frac{18 \sin 0\cdot4}{\sin 0\cdot9} = 8$ award 2/3 ×✓✓

2. For $\frac{LM}{\sin 0\cdot4} = \frac{18}{\sin 0\cdot9} \rightarrow \frac{LM}{0\cdot4} = \frac{18}{0\cdot9} \rightarrow \frac{18 \times 0\cdot4}{0\cdot9} = 8$ award 2/3 ×✓✓

3

11(a)	**Ans: 7·38 metres** • valid strategy • calculation	• $AC^2 = 6.2^2 + 4^2$ • 7.38
(b)	**Ans: 73.8°** • valid strategy • substitution into valid formula • processing • solution	• cosine rule • $\cos D = \dfrac{5^2 + 7^2 - 54.44}{2 \times 5 \times 7}$ • $\cos D = 0.279\cdots$ • 73.8°

NOTES:

(i) evidence for the 1st mark may be implicit in the substitution

4

Question No	Give 1 mark for each •	Illustrations of evidence for awarding each mark
6	**Ans: 27·2 km** • dealing with bearing • valid strategy • correct substitution • solution	• $\angle ABC = 27°$ • third angle and use of sine rule • $\dfrac{a}{\sin 65^\circ} = \dfrac{30}{\sin 88^\circ}$ • 27·2 **4RE**

Notes:

(i) use of the sine rule is the only valid strategy

(ii) where the angle sum of triangle ABC is greater than 180° only the first mark is available

(iii) **beware: some candidates assume $\angle BCA = 90°$ and use $\sin 65^\circ = \dfrac{BC}{30}$ to give BC = 27·18 km: in this case, only the first mark is available**

4

Section B

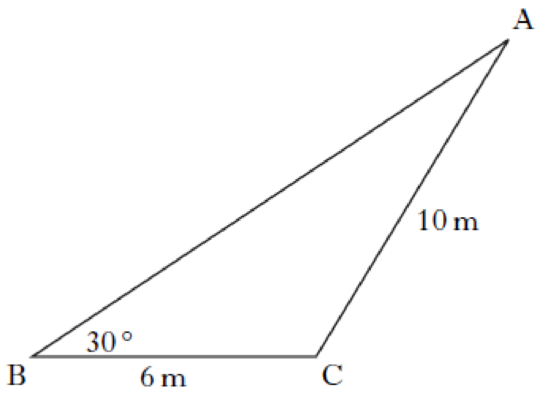
Section B

Paper 1 Questions

<table>
<tr><th>Q</th><th></th><th>Marks</th></tr>
<tr><td>1</td><td>

11. In triangle ABC:

- BC = 6 metres
- AC = 10 metres
- angle ABC = 30°.

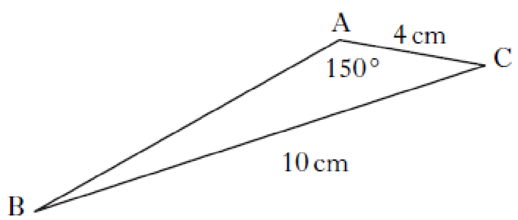


Given that $\sin 30° = 0{\cdot}5$, show that $\sin A = 0{\cdot}3$.

</td><td>3</td></tr>
<tr><td>2</td><td>

10. In triangle ABC

- AC = 4 centimetres
- BC = 10 centimetres
- angle BAC = 150°



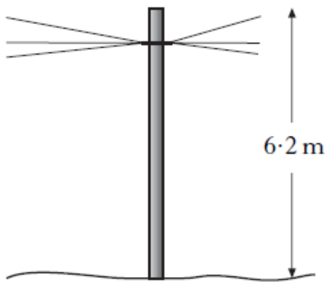
Given that $\sin 30° = \frac{1}{2}$, show that $\sin B = \frac{1}{5}$.

</td><td>4</td></tr>
</table>

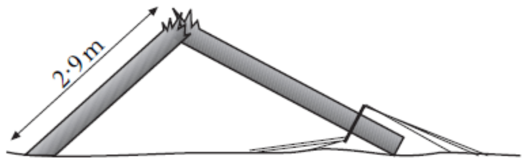
<u>Paper 2 Questions</u>

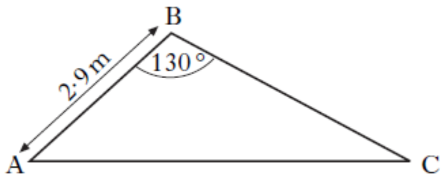
<table>
<tr><th>Q</th><th></th><th>Marks</th></tr>
<tr><td>3</td><td>

7. A telegraph pole is 6·2 metres high.



The wind blows the pole over into the position as shown below.





AB is 2·9 metres and angle ABC is 130°.

Calculate the length of AC.

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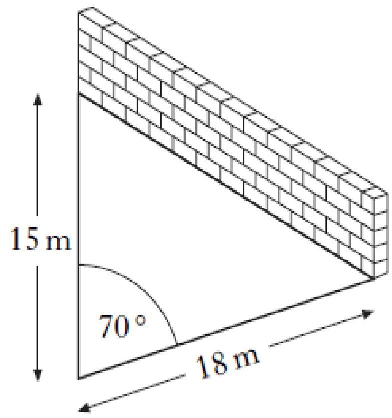
<tr><td>4</td><td>

8. A farmer builds a sheep-pen using two lengths of fencing and a wall.



The two lengths of fencing are 15 metres and 18 metres long.

(*a*) Calculate the area of the sheep-pen, when the angle between the fencing is 70°.

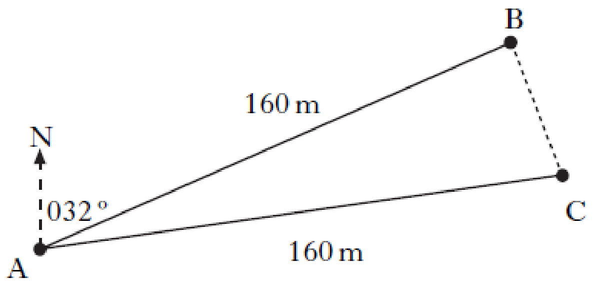
(*b*) What angle between the fencing would give the farmer the largest possible area?

</td><td>3
(2.1)

1
(2.2)</td></tr>
</table>

5

9. Jane is taking part in an orienteering competition.



She should have run 160 metres from A to B on a bearing of 032 °.

However, she actually ran 160 metres from A to C on a bearing of 052 °.

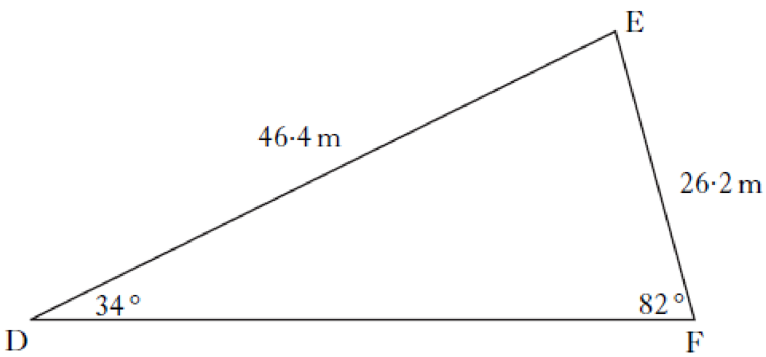
(*a*) Write down the size of angle BAC. 1

(*b*) Calculate the length of BC without using right-angled triangles. 3

(*c*) What is the bearing from C to B? 2 (2.2)

6

8. As part of their training, footballers run around a triangular circuit DEF. 4 (2.1) (2.2)



- ∠EDF = 34 °
- ∠DFE = 82 °
- DE = 46·4 metres
- EF = 26·2 metres

How many **complete** circuits must they run to cover **at least** 1000 metres?

<table>
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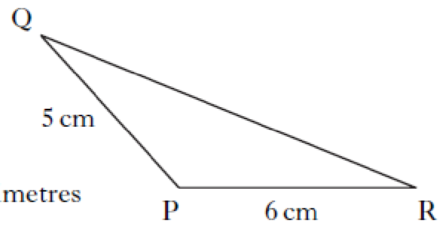
10. In triangle PQR:

- PQ = 5 centimetres
- PR = 6 centimetres
- area of triangle PQR = 12 square centimetres
- angle QPR is **obtuse**.



Calculate the size of angle QPR.

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<td>8</td>
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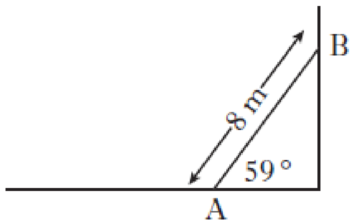
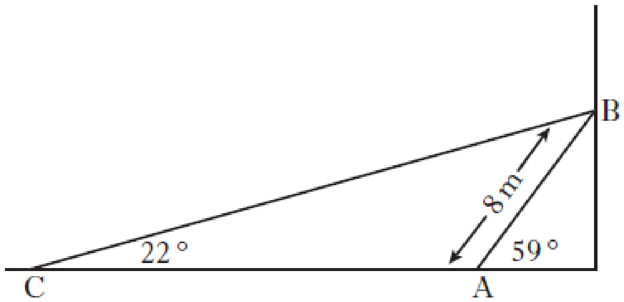
7. A heavy metal beam, AB, rests against a vertical wall as shown.

The length of the beam is 8 metres and it makes an angle of 59° with the ground.



A cable, CB, is fixed to the ground at C and is attached to the top of the beam at B.

The cable makes an angle of 22° with the ground.



Calculate the length of cable CB.

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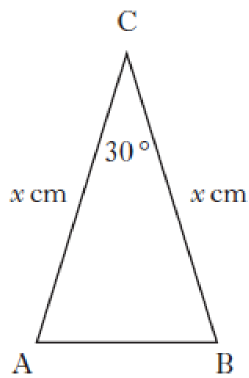
<td>4
(2.1)
(2.2)</td>
</tr>
<tr>
<td>9</td>
<td>

5. ABC is an isosceles triangle with angle ACB = 30°.

AC = BC = x centimetres.



The area of triangle ABC is 9 square centimetres.

Calculate the value of x. without using right-angled triangles.

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<td>3</td>
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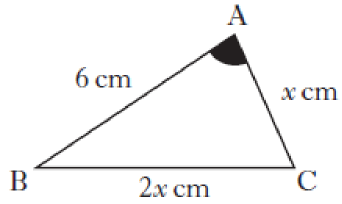
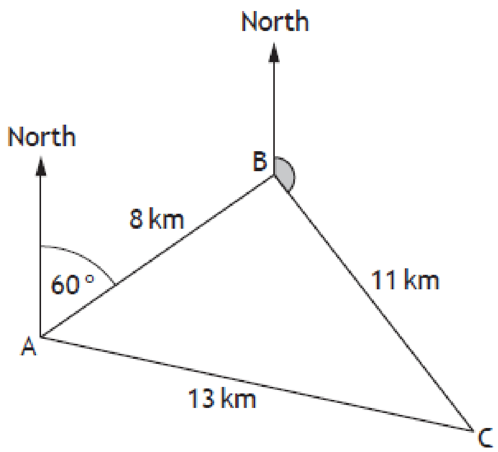
10	**14.** In triangle ABC: • $\cos A = 0{\cdot}5$ • AB = 6 centimetres • BC = $2x$ centimetres • AC = x centimetres.  Show that $x^2 + 2x - 12 = 0$.	3
11	**10.** In a race, boats sail round three buoys represented by A, B, and C in the diagram below.  B is 8 kilometres from A on a bearing of 060°. C is 11 kilometres from B. A is 13 kilometres from C. (a) Calculate the size of angle ABC.	3

Section B

MARKING SCHEME

Section B – Marking Scheme

Marking Scheme

Paper 1

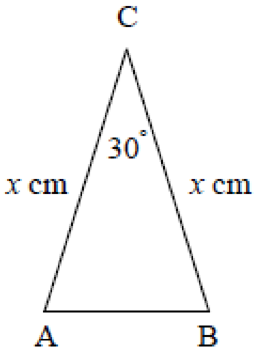
Q				Marks
1	11	**Ans: 0.3** • correct use of sine rule • rearranging • simplification	• $\frac{10}{\sin 30^\circ} = \frac{6}{\sin A}$ • $\sin A = \frac{6\sin 30^\circ}{10}$ • 0.3 **3RE**	
	NOTES: (i) candidates who assume that $\sin A = 0.3$ may be awarded a maximum of $\frac{1}{3}$ (1st mark)			
2	10	**Ans: proof** • correct application of sine rule • rearranging • dealing with sin150° • completion	• $\frac{10}{\sin 150^\circ} = \frac{4}{\sin B}$ • $10\sin B = 4\sin 150^\circ$ • $10\sin B = 4 \times \frac{1}{2}$ • $\sin B = \frac{1}{5}$ **4RE**	
	NOTES: (i) the 4th mark cannot be awarded where $\sin B > 1$			

Paper 2

Q				Marks
3	7	**Ans: 5.62 m** • method • strategy • substitution • solution	• $BC = 3.3$ • use of cosine rule • $AC^2 = 2.9^2 + 3.3^2 - 2 \times 2.9 \times 3.3 \cos 130^\circ$ • 5.62 **4 RE**	
		Notes: (i) accept solutions in radians or gradians (ii) for any attempt involving Pythagoras or sine rule, only the 1st mark is available		
4	8 (a)	**Ans: 126.9 m^2** • valid strategy • substitution • solution	• $\frac{1}{2}ab\sin C$ • $\frac{1}{2} \times 15 \times 18 \times \sin\ 70^\circ$ • 126.9 **3KU**	
		Notes: (i) evidence for the 1st mark may be implicit in the substitution		
	(b)	**Ans: 90°** • solution	• 90° **1RE**	

5		9 (a)	**Ans:** **20°** • solution	• 20° **1KU**		
		NOTES:				
		(b)	**Ans:** **55.6 m** • strategy • substitution/processing • solution	• use of sine rule cosine rule median and right angled triangle • correct application of valid strategy • 55.6 **3 RE**		
		NOTES: (i) accept solutions in radians or gradians (ii) for any attempt involving right angled trigonometry in ΔABC award 0/3				
		(c)	**Ans:** **312°** • strategy • process	• one of $180^\circ + 80^\circ$ $180^\circ + 52^\circ$ $52^\circ + 80^\circ$ • 312° **2RE**		
6		8	**Ans:** **9** • stating $\angle DEF$ • valid strategy • finding third side • solution	• 64° • $\frac{e}{\sin 64^\circ} = \frac{26.2}{\sin 34^\circ}$ or $e^2 = 26{\cdot}2^2 + 46{\cdot}4^2 - 2 \times 26{\cdot}2 \times 46{\cdot}4 \cos 64^\circ$ • 42·1 • 9 **4RE**		

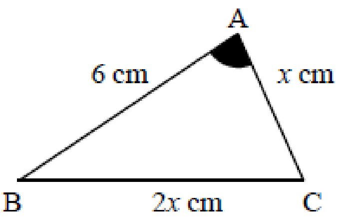
7	10	**Ans: $126 \cdot 9^\circ$** • valid strategy • rearranging • starting to solve • obtuse angle	• $\frac{1}{2} \times 6 \times 5 \times \sin x^\circ = 12$ • $\sin x^\circ = \frac{12}{15}$ • $x = \sin^{-1}\left(\frac{12}{15}\right) = 53 \cdot 1^\circ$ • $126 \cdot 9^\circ$ **4RE**		
8	7	**Ans: 18·3 metres** Method 1 • strategy • processing • processing • solution Method 2 • strategy • strategy • processing • solution	• $\sin 59^\circ = \frac{x}{8}$ • $x = 6 \cdot 86$ • $\sin 22^\circ = \frac{6 \cdot 86}{BC}$ • $BC = 18 \cdot 3$ • $\angle BAC = 121^\circ$ • $\frac{a}{\sin 121^\circ} = \frac{8}{\sin 22^\circ}$ • $a = \frac{8 \sin 121^\circ}{\sin 22^\circ}$ • $a = 18 \cdot 3$ **4RE**		

9		**5**			ABC is an isosceles triangle with angle ACB $= 30^\circ$. AC = BC = x centimetres.  The area of triangle ABC is 9 square centimetres. Calculate the value of x. **Ans:** $x = 6$	**3**			
					•[1] correct substitution into area formula		•[1] $9 = \frac{1}{2} \times x^2 \times \sin 30^\circ$		
					•[2] processing		•[2] 36		
					•[3] solution	**(RE)**	•[3] $x = 6$		

Notes:

(i) accept $9 = \frac{1}{2}\text{ab}\sin 30^\circ$ for first mark

10

14	In triangle ABC: • $\cos A = 0{\cdot}5$ • $AB = 6$ centimetres • $BC = 2x$ centimetres • $AC = x$ centimetres  Show that $x^2 + 2x - 12 = 0$			
	Ans: $\mathbf{x^2 + 2x - 12 = 0}$	**3**		
	•[1] substitution into cosine rule		•[1]	$(2x)^2 = x^2 + 6^2 - 2 \times x \times 6 \times 0{\cdot}5$
	•[2] processing		•[2]	$4x^2 = x^2 - 6x + 36$
	•[3] completion of proof	**(RE)**	•[3]	$x^2 + 2x - 12 = 0$

Notes:

(i) $2x^2$ is to be treated as bad form for the 1st mark

(ii) the final mark is given only for an explicit statement

11

Question			Expected Answer(s) Give one mark for each •	Max Mark	Illustrations of evidence for awarding a mark at each •
10.	(a)		Ans: 84·8°	3	
			•[1] substitute correctly into cosine rule		•[1] $\cos B = \dfrac{8^2 + 11^2 - 13^2}{2 \times 8 \times 11}$
			•[2] calculate cos B correctly		•[2] cos B = 0·09.......
			•[3] calculate angle ABC correctly		•[3] 85 or 84·8.......

Notes:

1. For 1·48 (uses RAD) or 94·2 (uses GRAD), with working award 3/3
2. The 2nd mark can be awarded for $\cos^{-1}\left(\dfrac{16}{176}\right)$