1. Fig. 7 shows a sketch of a village green ABC which is bounded by three straight roads. AB = 92 m, BC = 75 m and AC = 105 m.

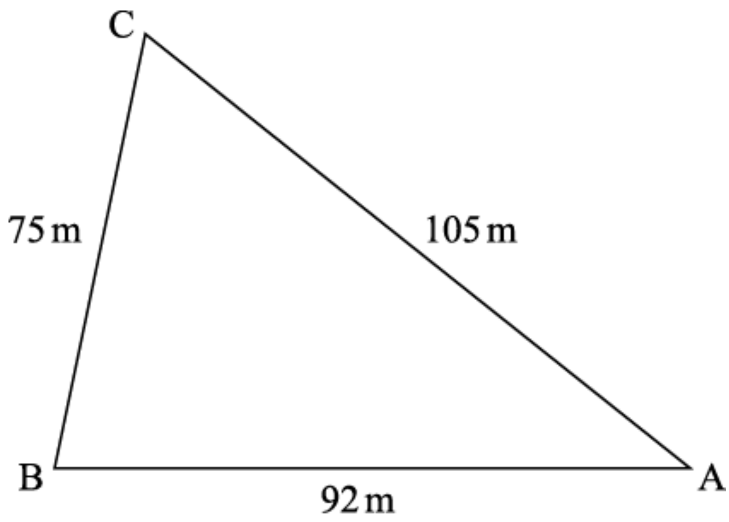


**Fig. 7**

Calculate the area of the village green.

[5]

2.

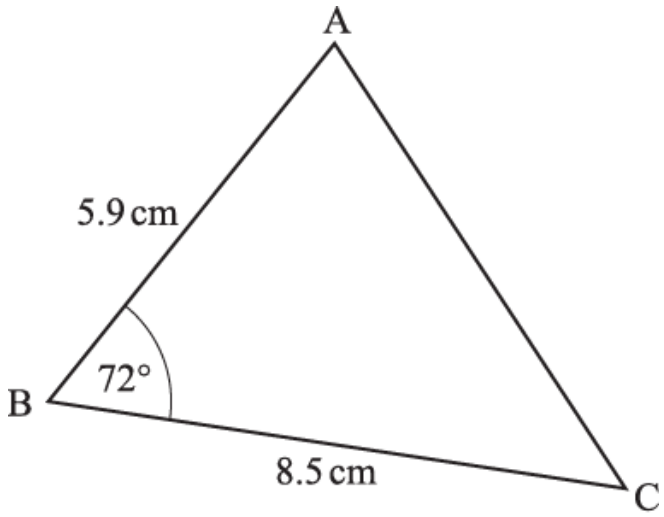


**Fig. 5**

Fig. 5 shows triangle ABC, where angle ABC = 72°, AB = 5.9 cm and BC = 8.5 cm. Calculate the length of AC.

[3]

3.

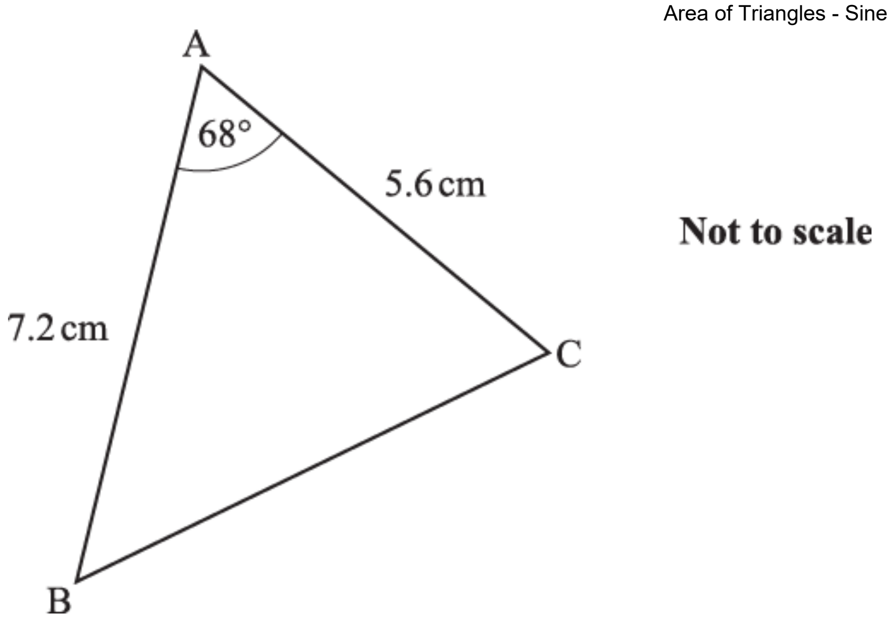


Fig. 4

Fig. 4 shows triangle ABC, where AB = 7.2 cm, AC = 5.6 cm and angle BAC = 68°.
Calculate the size of angle ACB.

[5]

4. A triangular field has sides of length 100 m, 120 m and 135 m.

(a) Find the area of the field. [5]

(b) Explain why it would not be reasonable to expect your answer in (a) to be accurate to the nearest square metre. [1]

5. The sides of a triangle are of length 47, 53 and 94 units. Calculate the size of the largest angle. [3]

6. Fig. 6 shows a triangle with angle $\theta$ marked

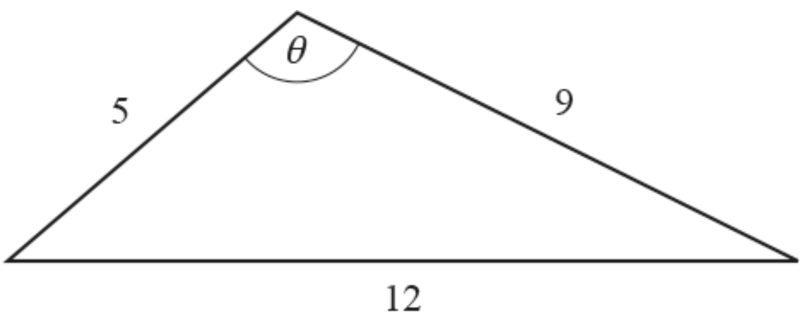


Fig. 6

Calculate the size of angle $\theta$, giving your answer correct to the nearest degree.

7. Triangle ABC is shown in Fig. 1.

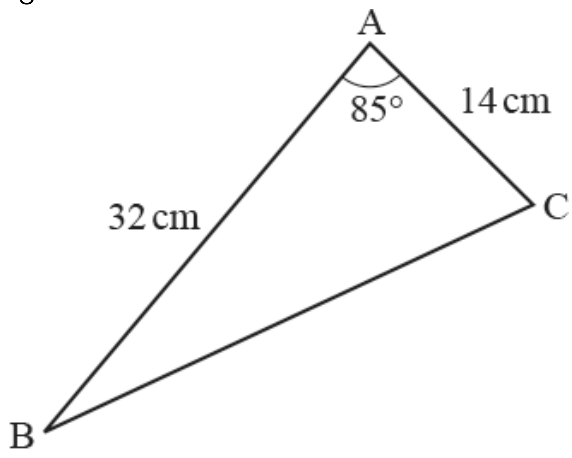


Fig. 1

Find the perimeter of triangle ABC. [3]

END OF QUESTION paper

# Mark scheme

| Question | | | Answer/Indicative content | Marks | Part marks and guidance | |
|---|---|---|---|---|---|---|
| 1 | | | $\cos A = \frac{105^2 + 92^2 - 75^2}{2 \times 105 \times 92}$ oe | M1 | or $\cos B = \frac{75^2 + 92^2 - 105^2}{2 \times 75 \times 92}$ oe | or $\cos C = \frac{105^2 + 75^2 - 92^2}{2 \times 105 \times 75}$ oe |
| | | | 0.717598…soi | A1 | 0.2220289…soi | 0.519746…soi |
| | | | A = 44.14345…° soi<br>[0.770448553…] | A1 | B = 77.1717719……° soi<br>[1.346901422] | C = 58.6847827…°soi<br>[1.024242678 …]<br><br>ignore minor errors due to premature rounding for second **A1**<br>condone *A*, *B* or *C* wrongly attributed |
| | | | ½ × 92 × 105 × sin (*their* A) | M1 | or ½ × 75 × 92 × sin (*their* B) | or ½ × 75 × 105 × sin (*their* C) |
| | | | 3360 or 3361 to 3365 | A1 | **Examiner's Comments**<br><br>Nearly all candidates adopted the expected approach successfully and achieved full marks. A few rounded the angle prematurely and lost the final mark. Some lost the last two marks by using "cos" instead of "sin" in the area formula, and similarly a very few candidates used "sin" instead of "cos" in the Cosine Rule. Most candidates went on to use the correct sides with the angle that had been found. After using the Cosine Rule successfully a few candidates opted for ½ base × height and about half of these did so successfully. A tiny minority of candidates used Hero's formula successfully. Only | **or**<br>**M3** for<br>$\sqrt{136(136-75)(136-105)(136-92)}$<br>**A2** for correct answer<br>3360 or 3363 – 3364 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | a small number treated the triangle as right angled and failed to score. | |
| | | | Total | 5 | | |
| 2 | | | $5.9^2 + 8.5^2 - 2 \times 5.9 \times 8.5 \times \cos 72$ | M1 | | |
| | | | 107 − 31 or better | M1 | 76.(….) or 204.(…..) (radians) | or 64.(…..) (grad)<br>NB 6.76 cos 72 or 2.08 (8954882..) scores M1M0 |
| | | | 8.7(2…) | A1 | **Examiner's Comments**<br>The cosine rule was very well understood and most candidates scored full marks. A small number left the calculator in radian mode and lost the final mark; a very small number tried to use Pythagoras or lost their way after earning the first method mark. | if M0M0, B3 for 8.72 or better if unsupported or 8.7 (2…) if obtained from other valid method |
| | | | Total | 3 | | |
| 3 | | | $5.6^2 + 7.2^2 - 2 \times 5.6 \times 7.2 \times \cos 68$ seen | M1 | may be implied by 53 or BC in range | |
| | | | 53 or 53.0 | M1 | may be implied by BC in range | **NB** 52.9917243; (allow 47.7 to 47.71 from calculator in radian mode; may be implied by 6.90 to 6.91) |
| | | | [BC =] 7.3 or 7.27 to 7.28 | A1 | **NB** 7.27954… | |
| | | | $\sin C = \frac{7.2 \times \sin 68}{\text{their } BC}$ | M1 | or $[\cos C] = \frac{\text{their } BC^2 + 5.6^2 - 7.2^2}{2 \times 5.6 \times \text{their } BC}$ | |
| | | | 66 or awrt 66.5 | A1 | allow 1.2 or awrt 1.16 (radians);<br>**A0** for eg 1.2 degrees | **NB** $\sin C = 0.917053…$<br>$\cos C = 0.398766…$ |
| | | | *Alternatively*<br>eg if the perpendicular from B to AC, BX, is used | | | eg if perpendicular from C to AB, CY, is used, mark as follows |
| | | | 7.2 × cos 68 seen | M1* | if unsupported, **B2** for 2.70 or better | 5.6 × cos 68 seen |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | 2.7 or 2.697 to 2.70 | A1 | | 2.1 or 2.097 to 2.10 |
| | | | XC = 5.6 – their AX | M1dep* | **NB** 2.902832527 | BY = 7.2 – their AY |
| | | | $\tan C = \left[\dfrac{BX}{XC}\right] = \dfrac{7.2 \times \sin 68}{\text{their XC}}$ | M1 | | $\tan B = \left[\dfrac{CY}{BY}\right] = \dfrac{5.6 \times \sin 68}{\text{their BY}}$ |
| | | | 66 or awrt 66.5 | A1 | allow 1.2 or awrt 1.19 (radians);<br>**A0** for eg 1.2 degrees<br><br>**Examiner's Comments**<br><br>This was very well done; the majority of candidates obtained full marks and almost all achieved at least 4 marks. A few worked with rounded numbers and then over-specified their final answer, thus losing the final accuracy mark, and a few left their calculator in radian mode and usually lost both accuracy marks. | C [= 90 – B] = 66 or awrt 66.5 |
| | | | **Total** | 5 | | |
| 4 | | a | $\cos A = \dfrac{100^2 + 120^2 - 135^2}{2 \times 100 \times 120}$<br><br>cos $A$ = 0.2572916…..<br><br>[$A$ = ] 75.09058… | M1(AO3.1a)<br><br>A1(AO1.1)<br><br>A1(AO1.1) | cos $B$ = $\dfrac{100^2 + 135^2 - 120^2}{2 \times 100 \times 135}$<br>OR<br>cos $C$ = $\dfrac{120^2 + 135^2 - 100^2}{2 \times 120 \times 135}$<br><br>cos $B$ = 0.512037….. OR cos $C$ = | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | Area = $\frac{1}{2}\times100\times120\times\sin(\textit{their } A)$<br><br>5800 [m²] | M1(AO3.1a)<br><br>A1(AO1.1)<br><br>[5] | 0.698302…..<br>(may be implied)<br>*B* = 59.200…<br>**OR** *C* = 45.7090…<br><br>Area = $\frac{1}{2}\times100\times135\times\sin(\textit{their } B)$ **OR** $\frac{1}{2}\times100\times135\times\sin(\textit{their } C)$<br><br>Accept answers to greater degree of accuracy | |
| | | b | E.g. The sides might only be to the nearest 5 metres so the possible areas cover quite a big range<br><br>E.g. The sides are no more accurate than to the nearest metre, so could be half a metre out. Taking half a metre off each side would lose more than 1 m² of area | E1(AO3.2b)<br><br>[1] | Correct explanation | |
| | | | Total | 6 | | |
| 5 | | | Use of cosine rule | M1(AO 3.1)<br><br>A1(AO 1.1) | allow if lengths incorrectly placed | NB 21.23606 or 0.370(6393…); or 18.73589 or 0.327(0030…) |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | $\cos\theta = \dfrac{47^2 + 53^2 - 94^2}{2 \times 47 \times 53}$<br>140°<br>or 2.44 radians | A1(AO 1.1)<br>[3] | NB – 0.76635889…<br>allow 140.0,140.03 or 140.028 or 2.444, 2.4440 or 2.44395 | |
| | | | Total | 3 | | |
| 6 | | | $\cos\theta = \dfrac{9^2 + 5^2 - 12^2}{2 \times 5 \times 9}$<br>$-\dfrac{38}{90}$ oe soi<br>115° | M1 (AO3.1)<br>A1 (AO1.1)<br>A1 (AO1.1)<br>[3] | May be implied by 114.97… degrees or 2.0066917… radians | |
| | | | Total | 3 | | |
| 7 | | | $[BC^2] = 32^2 + 14^2 - 2 \times 32 \times 14\cos 85°$<br>[BC] = 33.8 cm<br>Perimeter = 79.8cm | M1(AO 3.1a)<br>A1(AO 1.1)<br>A1(AO 1.1)<br>[3] | Use of cosine rule to find BC<br>Accept 80 | 1141.9…<br>33.79… |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | provided 3 or more sf seen as BC<br><br>Examiner's Comments<br><br>For the majority of candidates this provided a straightforward start to the paper. The few candidates who did not score full marks either misread the question and only found the length of *BC*, did not give sufficient accuracy in their answer. A small minority of candidates did not recall accurately the Cosine Rule.<br><br>AfL<br><br>This question is in degrees, but many questions at A Level involve the use of radians. It is important that candidates are confident switching between units on their calculators. The specification advice to explicitly write down any expressions to be evaluated by calculator would ensure partial credit where the incorrect setting on the calculator is used. | |
| | | | Total | 3 | | |