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The Sine & Cosine Rules

Solutions & Answer Key

Full worked solutions, marking scheme & answer key

IGCSE Mathematics

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Prepared by

Nikolas Agisilaou

Companion to the *Student Worksheet*

Contents

4 Part IV — Complete Solutions **2**
4.1 Solutions — Labelling and Choosing the Rule 2
4.2 Solutions — The Sine Rule: Finding a Missing Side 4
4.3 Solutions — The Sine Rule: Finding a Missing Angle 6
4.4 Solutions — The Ambiguous Case (SSA) 8
4.5 Solutions — The Cosine Rule: Finding a Missing Side 9
4.6 Solutions — The Cosine Rule: Finding a Missing Angle 11
4.7 Solutions — Area of a Triangle 13
4.8 Solutions — Multi-Step Problems and Applications 15
4.9 Solutions — Mixed Review 18
4.10 Marking Scheme — Examination-Style Practice 21

5 Part V — Common Mistakes & Learning Tips **24**

6 Part VI — Final Answer Key **26**

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Note

About this booklet. These are the complete solutions to every question in *The Sine & Cosine Rules — Student Worksheet*. Question numbers match exactly: labelling and rule choice L1–L4, Sine Rule for sides S1–S6, Sine Rule for angles N1–N5, the ambiguous case B1–B4, Cosine Rule for sides C1–C6, Cosine Rule for angles G1–G5, area of a triangle T1–T6, applications A1–A6, the Mixed Review MR1–MR10, and the examination questions Q1–Q8 of Part III.
Each solution names the rule being applied and works one step at a time. Part V collects the common mistakes to watch for, and Part VI is a quick answer key for fast marking.
A note on rounding. All working is carried out with full calculator accuracy and rounded only at the final step. Where an intermediate value is quoted (for example $\sin B = 0.8390\ldots$) the dots indicate that the unrounded value was kept in the calculator. A student who rounds an intermediate value may be one or two units out in the last digit — allow this, provided the method is correct.

4 Part IV — Complete Solutions

Note

Each solution names the rule being applied and shows the steps in order, exactly as the notes recommend. Depth is scaled to difficulty — brief for basic questions, fuller for the harder ones.

4.1 Solutions — Labelling and Choosing the Rule

Solution L1

The angles of a triangle add to 180°:

$$F = 180° - 47° - 61° = \boxed{72°}.$$

Under the standard convention each side is named after the angle it faces, so the side opposite angle F is side f, which is the side joining the other two vertices: $\boxed{DE}$.

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Solution L2

Side l is opposite angle $\boxed{L}$ — lowercase letters always face the matching capital.
We are given two sides (k and l) and one angle (K). The angle K lies opposite k, so it is *not* between the two known sides. The data is therefore $\boxed{\text{SSA}}$, which means the Sine Rule applies and the ambiguous case must be checked.

Solution L3

(a) Two sides and the included angle (SAS), finding the third side $\Rightarrow$ $\boxed{\text{Cosine Rule}}$.
(b) Two angles and a side (AAS) $\Rightarrow$ $\boxed{\text{Sine Rule}}$. First find $B = 180° - 41° - 96° = 43°$, which pairs b with its opposite angle.
(c) All three sides (SSS), finding an angle $\Rightarrow$ $\boxed{\text{Cosine Rule}}$ in its rearranged form.
(d) Two sides with the angle between them, area required $\Rightarrow$ $\boxed{\text{Area} = \frac{1}{2}ac\sin B}$.

Solution L4

The Sine Rule can only be used when at least one *complete pair* — a side together with the angle opposite it — is known.
Here the known angle is A, and the side opposite A is a, which is exactly what we are trying to find. The two sides we do know, b and c, face angles B and C, and neither of those angles is given. So every fraction the student could write contains two unknowns and cannot be solved.
The angle $55°$ lies *between* the two known sides, so the data is SAS and the correct choice is

$$\boxed{a^2 = b^2 + c^2 - 2bc\cos A \quad \text{(the Cosine Rule)}}.$$

Common Mistake

Before choosing a rule, count your complete pairs. No complete pair means the Sine Rule is unusable, however tempting it looks.

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Preview ends here

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