

C4.2 Geometrical constructions

Name: _____ Class: _____ Date: _____ Total: 20 marks

KEY WORDS construct 作图 • compasses 圆规 • net 展开图 • face 面 • cuboid 长方体

Objective

Use geometrical constructions to solve Core IGCSE Mathematics problems.

You must be able to:

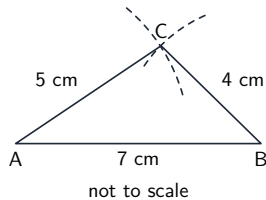
- Construct SSS triangles with visible compass arcs
- Measure lines and angles accurately
- Interpret and draw nets with matching face dimensions

1 Key knowledge and worked examples

■ **Key knowledge: Geometrical constructions**

Use a ruler for straight edges and a protractor to measure or draw angles. For a triangle given three sides, use a ruler and compasses only: draw the base, draw arcs of the two remaining radii from the endpoints, join their intersection. Leave construction arcs visible. A net folds into a solid without overlap; match shared edges and count all faces. Core does not require perpendicular or angle bisectors.

■ **Worked example: Geometrical constructions**



Construct a triangle with sides 7, 5 and 4 cm.

- Draw $AB = 7$ cm. With centre A, draw an arc of radius 5 cm; with centre B, radius 4 cm.
- Label an intersection C and join AC and BC. Keep both arcs.
- A cuboid $3 \times 2 \times 1$ cm has two faces of each size 3×2 , 3×1 , 2×1 .
- From its net, $S = 2(3 \times 2 + 3 \times 1 + 2 \times 1) = 22 \text{ cm}^2$ and $V = 3 \times 2 \times 1 = 6 \text{ cm}^3$.

■ **Method check**

Compass arcs locate points at fixed distances. A valid net must fold into the solid with every edge matched and no overlapping faces.

2 Practice

2.1 Draw a line 6.4 cm long and an angle of 65° with a ruler and protractor. [2]

2.2 Construct a triangle with sides 6, 4 and 3 cm using ruler and compasses. Keep the arcs. [2]

2.3 Draw a net of a cube of edge 2 cm on squared paper. [2]

2.4 A cuboid net has two 4×3 , two 4×2 and two 3×2 cm rectangles. Find its surface area. [2]

3 Exam-style questions

3.1 Apply the geometrical constructions methods below. Show working and include units where appropriate.

(a) Construct triangle ABC with $AB = 8$ cm, $AC = 5$ cm and $BC = 5$ cm. Keep construction arcs. [2]

(b) Measure angle ABC using a protractor. [2]

(c) A triangular prism has this triangle as cross-section and length 10 cm. Describe the shapes and dimensions of its five net faces. [2]

3.2 A triangular prism has length 7 cm. Its triangular ends have sides 3, 4 and 5 cm.

(a) Construct one triangular end using only ruler and compasses. Leave all arcs visible.[3]

(b) Describe the five faces needed for a net and find its total surface area. The 3 cm and 4 cm sides meet at a right angle. [3]

Solutions

Award method and answer marks as indicated; accept equivalent correct methods.

2.1

- **Line 6.4 cm; angle 65°** , allowing normal drawing accuracy. Align the protractor centre and baseline.

2.2

- **Base 6 cm; arcs of radii 4 and 3 cm from its endpoints; join the intersection to both ends.**

2.3

- **Six 2 cm squares in a valid net**, for example four in a row with one above and one below the second square.

2.4

- $S = 2(12 + 8 + 6) = \mathbf{52}$ cm².

3.1

(a)

- **Base AB 8 cm; equal 5 cm arcs from A and B; join the crossing C.**

(b)

- The base angle is about 37° (accept 35° to 39° for a drawing).

(c)

- **Two triangles with sides 8, 5, 5 cm; one 8×10 cm rectangle; two 5×10 cm rectangles.**

3.2

(a)

- Draw a **5 cm base** accurately.
- Draw arcs of **3 cm and 4 cm** centred at its endpoints.
- Join their intersection to the endpoints and retain the construction arcs.

(b)

- Use two 3–4–5 triangles and rectangles **3×7 , 4×7 , 5×7 cm**.
- Area $S = 2(3 \times 4/2) + 7(3 + 4 + 5)$, so $S = \mathbf{96}$ cm².