

E4.4 Similarity

Name: _____ Class: _____ Date: _____

Total: 21 marks

KEY WORDS similar 相似 • similar shapes 相似形 • scale factor 比例因子
• area and volume 面积和体积 • triangle 三角形

Objective

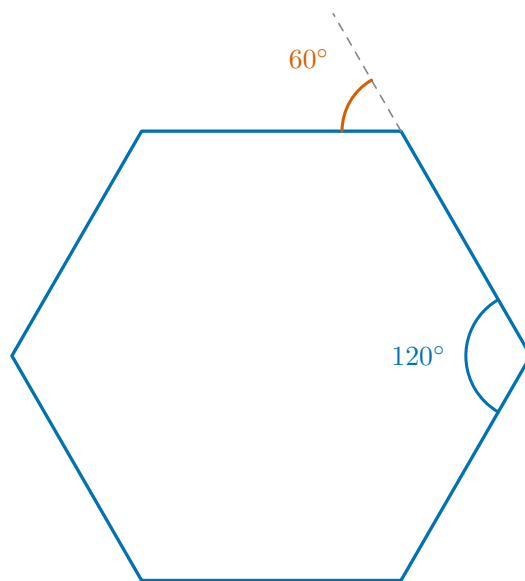
Build the skills to answer Extended exam questions on **similarity** 相似 — **similar shapes** 相似形, the **scale factor** 比例因子, and the **area and volume** 面积和体积 ratios k^2 and k^3 .

You must be able to:

- find a missing length in similar shapes
- use the area ratio k^2 for similar shapes
- use the volume ratio k^3 for similar solids

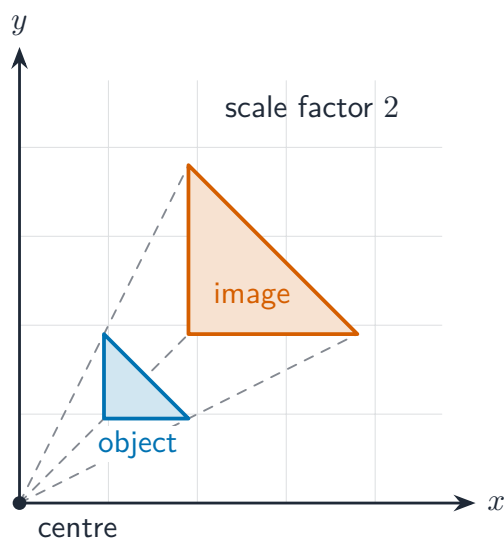
1 Worked examples

- Similar shapes and solids



$$\text{interior} + \text{exterior} = 180^\circ$$

Similar shapes have equal angles and sides in the same ratio



Similar shapes are linked by an enlargement

- **Similar** 相似: same angles, all sides $\times$ the **scale factor** 比例因子 k .
- $\frac{\text{area } A}{\text{area } B} = k^2$; $\frac{\text{volume } A}{\text{volume } B} = k^3$.
- **Worked:** lengths 2 : 3, smaller volume 40 cm³ $\rightarrow$ ratio 8 : 27 $\rightarrow$ larger = $40 \times \frac{27}{8} = 135$ cm³.

Answer shapes: M1 a correct method, A1 the correct answer.

2 Practice

2.1 Two similar triangles have a scale factor of 3. A side of the small triangle is 4 cm. Find the matching side of the large triangle. [1]

2.2 Two similar shapes have lengths in the ratio 2 : 5. Write down the ratio of their areas. [1]

2.3 Two similar solids have lengths in the ratio 1 : 2. Write down the ratio of their volumes. [1]

3 Exam-style questions

3.1 Two similar shapes have lengths in the ratio 3 : 4. The area of the smaller is 18 cm². Find the area of the larger. [3]

3.2 Two similar bottles have heights 10 cm and 15 cm. The smaller holds 400 ml. Find the volume of the larger. [3]

3.3 Triangle ABC has $AB = 6$ cm, $BC = 9$ cm and area 20 cm^2 . Triangle PQR is similar to ABC , with PQ corresponding to AB and $PQ = 15$ cm.

(a) Write down the scale factor from ABC to PQR , and find QR . [3]

(b) Find the area of triangle PQR . [3]

(c) A solid cone has a volume of 54 cm^3 . A mathematically similar cone has a volume of 128 cm^3 . Find the ratio of their heights. [3]

(d) Explain why two shapes with equal angles must be similar, but two shapes with equal areas need not be. [3]
