

# 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

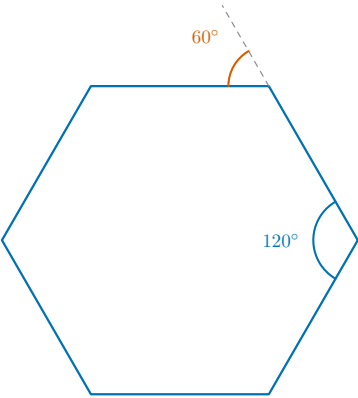
Build the skills to answer Extended exam questions on **similarity** 相似 — **similar shapes** 相似形, the **scale factor** 比例因子, and the **area and volume** 面积和体积 ratios  $k^2$  and  $k^3$ .

**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

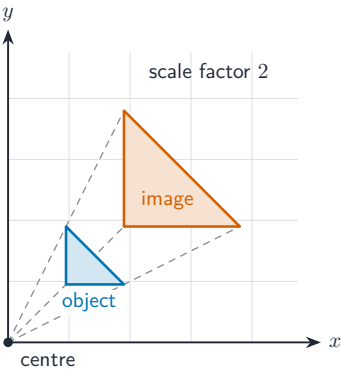
## 1 Worked examples

- Similar shapes and solids



interior + exterior = 180°

*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 cm<sup>3</sup>  $\rightarrow$  ratio 8 : 27  $\rightarrow$  larger =  $40 \times \frac{27}{8} = 135$  cm<sup>3</sup>.

**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  $18 \text{ cm}^2$ . 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  $AB = 6 \text{ cm}$ ,  $BC = 9 \text{ cm}$  and area  $20 \text{ cm}^2$ . Triangle  $PQR$  is similar to  $ABC$ , with  $PQ$  corresponding to  $AB$  and  $PQ = 15 \text{ cm}$ .

(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  $54 \text{ cm}^3$ . A mathematically similar cone has a volume of  $128 \text{ cm}^3$ . 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]