

1.4 Use similarity, right triangles, area and volume

Name: _____ Class: _____ Date: _____ Total: 24 marks

KEY WORDS similar 相似 • hypotenuse 斜边 • volume 体积

Objective

Use similarity, right triangles, area and volume. Original GAC004-aligned practice, not an official assessment. Show the method as well as the result. All applied scenarios are invented classroom problems.

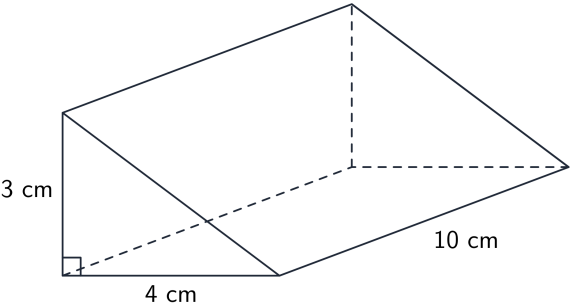
1 Key knowledge and worked examples

■ Key knowledge: choose the correct dimension and distinguish surface from volume

Similar 相似 shapes have equal corresponding angles and proportional corresponding lengths. A length scale factor k produces area factor k^2 and volume factor k^3 for similar solids. Congruent shapes have the same size as well as shape.

In a right triangle, the **hypotenuse** 斜边 is opposite the right angle and $c^2 = a^2 + b^2$. A triangle's area uses perpendicular height, not a sloping side. **Volume** 体积 measures three-dimensional space in cubic units; surface area measures the boundary in square units. For a prism, volume is cross-sectional area times length. Keep all lengths in compatible units before calculating.

■ Worked example: a triangular prism has a constant cross-section



not to scale

Known: perpendicular triangle sides are 3 and 4 cm; prism length is 10 cm. Find the cross-sectional area, then multiply by the prism length.

$$A = \frac{1}{2}bh = \frac{1}{2}(3)(4) = 6 \text{ cm}^2$$

$$V = AL = 6(10) = 60 \text{ cm}^3$$

The sloping triangle side is not its perpendicular height. Volume is not the area of the triangular end.

2 Practice

2.1 A right triangle has perpendicular sides 5 and 12 cm. Find its hypotenuse. [2]

2.2 A triangle has base 8 cm and perpendicular height 6 cm. Find its area. [2]

2.3 Two similar triangles have corresponding lengths 4 and 10 cm. The smaller has area 12 cm². Find the length scale factor and the larger area. [3]

2.4 A closed cylinder has radius 3 cm and height 8 cm. Find its volume, giving an exact answer in terms of pi and a decimal to 3 significant figures. [3]

3 Exam-style questions

3.1 A rectangular block measures 8 by 5 by 3 cm. (a) Find its volume and total surface area. (b) A geometrically similar block has all lengths doubled. Find its volume and explain why the volume is not merely doubled. [6]

3.2 An open rectangular tank has internal length 80 cm, width 50 cm and depth 40 cm. (a) Find its capacity in litres, using $1000 \text{ cm}^3 = 1 \text{ litre}$. (b) It initially contains water to depth 25 cm. Find the water volume. (c) A rectangular solid block measuring 20 by 10 by 10 cm is fully submerged without spilling; it does not absorb water. Find the new water depth and state the remaining depth below the rim. [8]