

## 4.2 Perimeter, area and volume, including circles

Name: \_\_\_\_\_ Class: \_\_\_\_\_ Date: \_\_\_\_\_

Total: 27 marks

KEY WORDS circumference • frustum • scale factor

### Perimeter, area and volume, including circles

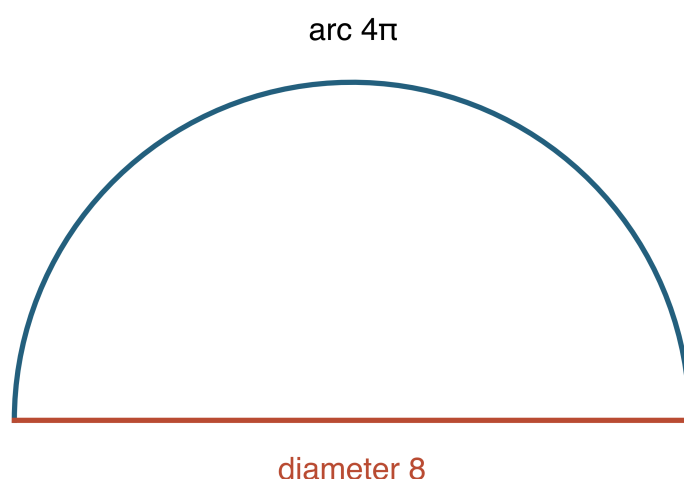
#### Objective

Calculate perimeters, areas and volumes of plane shapes, circles, sectors, prisms, cylinders, cones and spheres, and use the  $k : k^2 : k^3$  similarity ladder for lengths, areas and volumes (rows G14–G17, G19).

#### 1 Key knowledge and worked examples

**Mensuration and similarity.** Triangle  $\frac{1}{2}bh$ , parallelogram  $bh$ , trapezium  $\frac{1}{2}(a+b)h$ ; circle  $C = 2\pi r$ ,  $A = \pi r^2$ ; arc and sector scale by  $\frac{\theta}{360^\circ}$ ; prism volume = cross-section  $\times$  length, cylinder  $\pi r^2 h$ , cone  $\frac{1}{3}\pi r^2 h$ , sphere  $\frac{4}{3}\pi r^3$ . Similar figures: lengths  $k$ , areas  $k^2$ , volumes  $k^3$  – find  $k$  from a linear pair before scaling.

Semicircle perimeter: curved arc + straight diameter



*Original native-lesson illustration; labels belong to its worked example.*

## 2 Practice

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**2.1** A trapezium has parallel sides 6 cm and 10 cm with perpendicular height 4 cm. Find its area. [2]

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**2.2** A triangle has base 8 cm and perpendicular height 5 cm. Find its area. [2]

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**2.3** A circle has radius 4 cm. Write down its circumference and area in terms of  $\pi$ . [3]

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**2.4** A cylinder has radius 3 cm and height 5 cm. Find its volume in terms of  $\pi$ . [3]

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**2.5** Find the perimeter of a semicircle of radius 4 cm, in terms of  $\pi$ . [3]

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**2.6** A cone has radius 3 cm and perpendicular height 4 cm. Find its slant height and its volume in terms of  $\pi$ . [2]

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### 3 Exam-style questions

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**3.1** (*June 2024 1H Q12, adapted.*) A sector of a circle has radius 12 cm and angle  $60^\circ$ . Work out the length of its arc, giving your answer in terms of  $\pi$ . [3]

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**3.2** (*Original, Higher similarity.*) Two spheres have radii 3 cm and 6 cm. (a) Write down the ratio of their surface areas. (b) The smaller sphere has volume  $36\pi \text{ cm}^3$ . Find the volume of the larger sphere. [4]

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**3.3** (*June 2024 2H Q25, adapted.*) A right-angled triangular prism has edges in the ratio  $a : b : c : d = 3 : 4 : 5 : 12$  and volume  $1125 \text{ cm}^3$ . Work out the total length of all of its edges. [5]

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