

## 4.7 Mensuration: perimeter, area, surface and volume

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

Total: 28 marks

KEY WORDS sector • volume

### Mensuration: perimeter, area, surface and volume

#### Objective

Find perimeters and areas of composite shapes, circles and sectors; surface areas and volumes of prisms, cylinders, cones and spheres; convert metric units (objectives Foundation 4.9–4.10 and Higher 4.9, 4.10).

#### 1 Key knowledge and worked examples

**Area toolkit.** Triangle  $\frac{1}{2}bh$ , parallelogram  $bh$ , trapezium  $\frac{1}{2}(a+b)h$ , circle  $\pi r^2$  with circumference  $2\pi r$ . Higher sectors: arc  $= \frac{\theta}{360} \times 2\pi r$ , area  $= \frac{\theta}{360} \times \pi r^2$  – for  $r = 9$ ,  $\theta = 40^\circ$ : arc  $2\pi \approx 6.28$ , area  $9\pi \approx 28.3$ . Composite shapes split into parts before any formula is applied.

**Solids.** Prism = cross-section  $\times$  length; cylinder  $V = \pi r^2 h$ , surface  $2\pi r^2 + 2\pi rh$ ; cone  $V = \frac{1}{3}\pi r^2 h$ , curved surface  $\pi rl$  with  $l$  the slant; sphere  $V = \frac{4}{3}\pi r^3$ , surface  $4\pi r^2$ . Unit chains: area  $100^2$ , volume  $100^3$  between cm and m.

#### 2 Practice

**2.1** Find the area of a trapezium with parallel sides 7 cm and 11 cm and height 4 cm. [2]

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**2.2** Find the circumference and area of a circle of radius 5 cm, exact in terms of  $\pi$ . [2]

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**2.3** A sector has  $r = 9$  cm and  $\theta = 40^\circ$ . Find its arc length. [2]

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**2.4** Find the volume of a cylinder with  $r = 5$  cm and  $h = 10$  cm, in terms of  $\pi$ . [2]

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**2.5** A cone has  $r = 3$  cm and  $h = 4$  cm. Find its slant, volume and curved surface area, in terms of  $\pi$  where exact. [4]

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### 3 Exam-style questions

**3.1** (*Edexcel 4MA1 2HR June 2024 Q10, adapted.*) Hexagon  $ABCDEF$  has  $AB \parallel FC \parallel ED$  with  $AB = 11$  cm,  $ED = FC = 23$  cm, the perpendicular distance between  $FC$  and  $ED$  equal to 4.7 cm, and  $BC = 5$  cm making a  $30^\circ$  angle with  $FC$ . Find the area of the hexagon. [5]

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**3.2** (*Original.*) A sphere has radius 6 cm. (a) Find its volume in terms of  $\pi$ . (b) Find its surface area in terms of  $\pi$ . (c) A cylinder has the same radius and the same volume; find its height. [5]

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**3.3** (*Original.*) A barn silo is a cylinder ( $r = 2$  m,  $h = 5$  m) topped by a hemisphere. (a) Find the total volume in terms of  $\pi$ . (b) Find the total surface area in terms of  $\pi$ . [6]

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