

Exercise walk-through

4.7

Mensuration: perimeter, area, surface and volume

Pearson Edexcel · International GCSE · Mathematics A

1. Topic 4 at a glance

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The largest topic: Foundation 4.1-4.11 (angle facts, polygons, measures, constructions, circle language, Pythagoras and 2D trigonometry, mensuration, similarity); Higher adds the circle-theorem programme, obtuse and non-right trigonometry, 3D problems, sectors, cones, spheres and the k -squared/ k -cubed ratios.

Must-know: $a^2 = b^2 + c^2 - 2bc \cos A$; $a/\sin A = b/\sin B$; area $\frac{1}{2}ab \sin C$; arc and sector from $\theta/360$; cone $\frac{1}{3}\pi r^2 h$; sphere $\frac{4}{3}\pi r^3$ and $4\pi r^2$; lengths k , areas k^2 , volumes k^3 .

3. Bearings and compound measures

Bearings and compound measures

Bearings: three figures, clockwise from north; the return bearing adds 180. Sketch the north line at every point.

Speed, density, pressure: one triangle family - distance over time, mass over volume, force over area. Convert first (2 h 36 min is 2.6 h; 234 km in 2.6 h is 90 km/h).

8. Mensuration

Mensuration

Areas: triangle half-bh, parallelogram bh, trapezium half(a+b)h, circle πr^2 . Sectors: $\theta/360$ of the circle - $r = 9$ at 40 degrees gives arc 2π and area 9π .

Solids: prism cross-section times length; cylinder $\pi r^2 h$ with surface $2\pi r^2 + 2\pi rh$; cone $\frac{1}{3}\pi r^2 h$ with curved surface πrl ; sphere $\frac{4}{3}\pi r^3$ and $4\pi r^2$. June 2024 2HR Q10: hexagon = rectangle 23×4.7 plus trapezium with height $5 \sin 30 = 2.5$: total 150.6.

Exercises 2.1·2.3

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

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

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

Exercises 2.1·2.3

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

$$\mathbf{2.1} \quad \frac{1}{2}(7 + 11) \times 4 = 36 \text{ cm}^2.$$

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

$$\mathbf{2.2} \quad 10\pi \text{ cm}; 25\pi \text{ cm}^2.$$

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

$$\mathbf{2.3} \quad \frac{40}{360} \times 2\pi \times 9 = 2\pi \approx 6.28 \text{ cm}.$$

Exercises 2.4·3.1

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

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

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° angle with FC . Find the area of the hexagon. [5]

Exercises 2.4·3.1

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

2.4 $\pi \times 25 \times 10 = 250\pi \text{ cm}^3$.

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

2.5 Slant $l = \sqrt{9 + 16} = 5$ cm; $V = \frac{1}{3}\pi \times 9 \times 4 = 12\pi \text{ cm}^3$; curved surface $\pi \times 3 \times 5 = 15\pi \text{ cm}^2$.

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° angle with FC . Find the area of the hexagon. [5]

3.1 The strip between the parallels FC and ED is a rectangle 23×4.7 ; above it, the height of the trapezium $ABCF$ is $5 \sin 30^\circ = 2.5$ cm. Split: rectangle $23 \times 4.7 = 108.1$ plus trapezium $\frac{1}{2}(11 + 23) \times 2.5 = 42.5$; total 150.6 cm^2 (exact $\frac{753}{5}$).

Exercises 3.2·3.3

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

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 π . (b) Find the total surface area in terms of π . [6]

Exercises 3.2·3.3

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3.2 (a) $\frac{4}{3}\pi \times 216 = 288\pi \text{ cm}^3$. (b) $4\pi \times 36 = 144\pi \text{ cm}^2$. (c) $\pi \times 36 \times h = 288\pi$ gives $h = 8 \text{ cm}$.

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

3.3 (a) Cylinder $\pi \times 4 \times 5 = 20\pi$; hemisphere $\frac{2}{3}\pi \times 8 = \frac{16}{3}\pi$; total $\frac{76}{3}\pi \text{ m}^3$. (b) Cylinder wall $2\pi \times 2 \times 5 = 20\pi$; hemisphere curved $2\pi \times 4 = 8\pi$; total $28\pi \text{ m}^2$.

Local review guidance: the split drawn or named before formulas; exact π forms kept until the final line; units squared or cubed to match. This is authored classroom guidance.