

Mensuration

IGCSE Mathematics • Topic 5

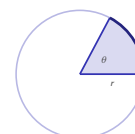
IGCSE Mathematics



Mensuration

What we will cover

- 1 Units of measure
- 2 Area of basic shapes
- 3 Circles
- 4 Arcs & sectors
- 5 Solids: volume & surface
- 6 Compound shapes



arcs and sectors

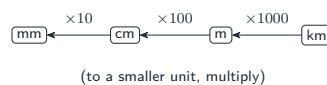
1

Area

Mensuration

Area

Units of measure

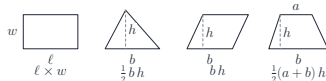


- Length: $1 \text{ m} = 100 \text{ cm}$.
- Area:
 $1 \text{ m}^2 = 100^2 = 10\,000 \text{ cm}^2$.
- Volume:
 $1 \text{ m}^3 = 100^3 = 1\,000\,000 \text{ cm}^3$.
- Capacity: $1 \text{ litre} = 1000 \text{ cm}^3$, so
 $1 \text{ m}^3 = 1000 \text{ litres}$.

Mensuration

Area

Area of basic shapes



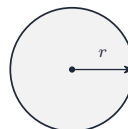
The **perimeter** 周长 is the distance all the way round a shape.

The **area** is the amount of flat space inside it.

Mensuration

Area

Circles



circumference $= \pi d$
area $= \pi r^2$
(diameter $d = 2r$)

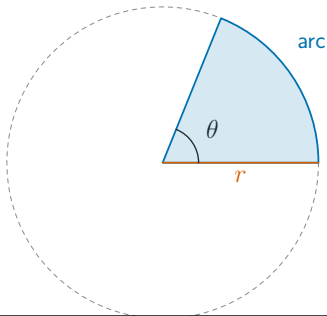
For a **circle** 圓 with **radius** 半径 r (and **diameter** 直径 $d = 2r$):

circumference $= 2\pi r = \pi d$, area $= \pi r^2$.

The **circumference** 圓周 is the distance round...

circumference $= 2\pi \times 7 = 14\pi \text{ cm}$, ar

Arcs and sectors



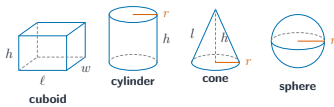
A **sector** 扇形 is the fraction $\frac{\theta}{360}$ of the circle.

$$\text{arc} = \frac{\theta}{360} \times 2\pi r$$

$$\text{sector area} = \frac{\theta}{360} \times \pi r^2$$

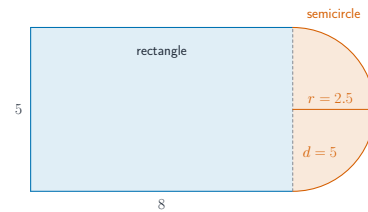
2 Solids

Solids: volume and surface area



- **prism** 棱柱: cross-section $\times$ length
- **cylinder** 圆柱: $\pi r^2 h$
- **cone** 圆锥: $\frac{1}{3} \pi r^2 h$
- **sphere** 球: $\frac{4}{3} \pi r^3$

Compound shapes



Split a **compound shape** 复合图形 into parts you know, find each area (or volume), then **add** them up.

3 Recap

Worked example – converting areas

Convert 3 m^2 to cm^2 .

- $1 \text{ m} = 100 \text{ cm}$, so **square** the conversion factor:
- $1 \text{ m}^2 = 100^2 = 10\,000 \text{ cm}^2$
- $3 \text{ m}^2 = 3 \times 10\,000 = 30\,000 \text{ cm}^2$
- For volume, **cube** it:
 $1 \text{ m}^3 = 100^3 = 1\,000\,000 \text{ cm}^3$.

The classic error is $\times 100$.
Area needs the factor **squared**, **volume** needs it **cubed** – because area is length^2 and volume length^3 .

Topic 5 – key takeaways

1 Units

area $\times 100^2$, volume $\times 100^3$ per metre

3 Sector

the fraction $\theta/360$ of the circle

2 Circle

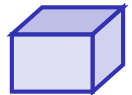
$$C = 2\pi r, \text{ area} = \pi r^2$$

4 Solids

cylinder $\pi r^2 h$, sphere $\frac{4}{3}\pi r^3$

Check yourself

- 1 How many cm^2 are in 1 m^2 ?
- 2 What is the area of a circle of radius r ?
- 3 What fraction of a circle is a 90° sector?
- 4 What is the volume of a sphere of radius r ?



Answers 1. 10 000 2. πr^2 3. one quarter 4. $\frac{4}{3}\pi r^3$