Working in 2 & 3 dimensions

Tips for Revising

- Make sure you ***know what you will be tested on***.
  The main topics are listed below. The examples show you what to do.
- List the topics and ***plan a revision timetable***.
- ***Always revise actively*** by working through questions. Look at the examples when you need to.
  Tick each topic when you have revised it – this will help you feel more positive!
- Write a list of the formulae you need to know.
  Learn these formulae and ***test yourself*** (eg by writing out the formulae from memory).
- Try lots of ***past papers*** – you can download them from the AQA website at www.aqa.org.uk
- When you get the Data Sheet, think about ***what questions might be asked***. Practise them.

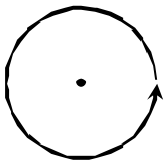
Tips for the exam

- ***Don't panic!***
  Easier said than done! – but try to stay calm. It will help you think more clearly.
- ***Read each question carefully.*** Underline important information if it helps.
- If you have time left at the end, ***check your answers***.
  If you decide to change an answer, cross out the old answer.

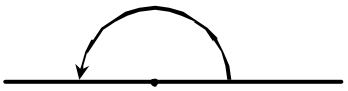
The methods that you need are listed below. You will have a calculator in the exam, so the examples show how to use a calculator to solve the problems, rather than other methods.

Angles

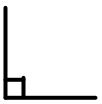
360° at a point

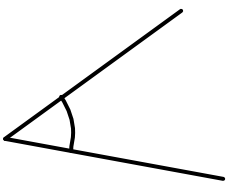


180° on a straight line

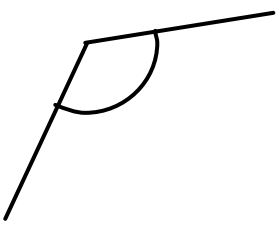


90° in a right angle

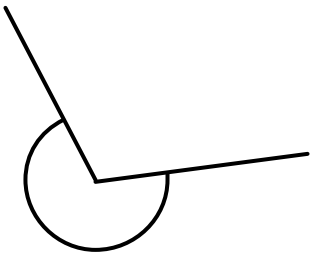




An **acute** angle is **less than 90°**



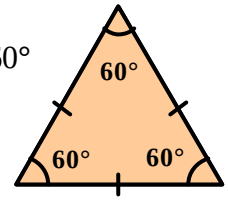
An **obtuse** angle is **more than 90° but less than 180°**



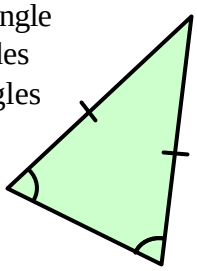
A **reflex** angle is **more than 180°**

Triangles

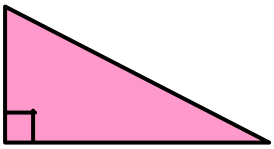
An **equilateral** triangle has 3 equal sides and 3 equal angles of 60°

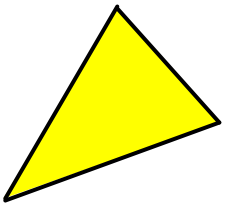


An **isosceles** triangle has 2 equal sides and 2 equal angles



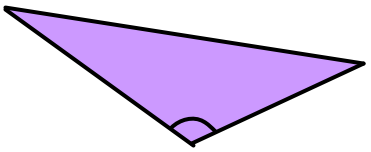
A **right-angled** triangle has **one angle of 90°**





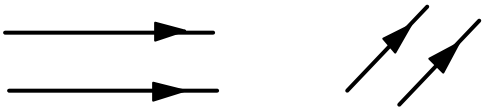
All the angles of an **acute angled** triangle are **less than 90°**

An **obtuse angled** triangle has **one angle more than 90°**

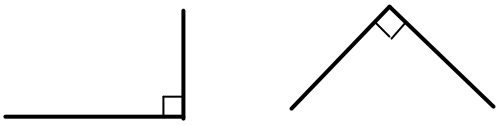


Lines

Parallel lines
are always the same distance apart.

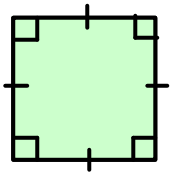


Perpendicular lines
contain a **right angle** of 90°

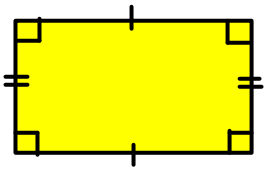


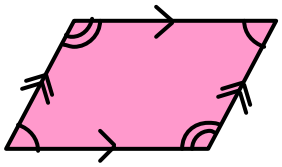
Special Quadrilaterals

square
4 equal sides, 4 right-angles, opposite sides parallel

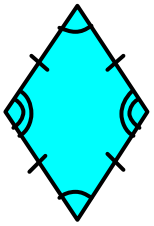


rectangle
4 right-angles, opposite sides equal and parallel



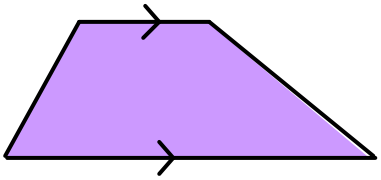


parallelogram
opposite sides equal and parallel
opposite angles equal

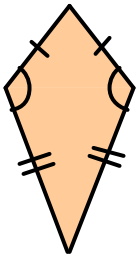


rhombus
4 equal sides,
opposite sides parallel
opposite angles equal

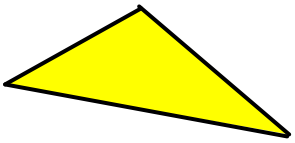
trapezium
one pair of parallel sides



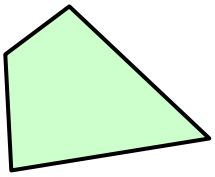
kite
2 pairs of equal sides
1 pair of equal angles



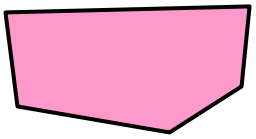
Polygons



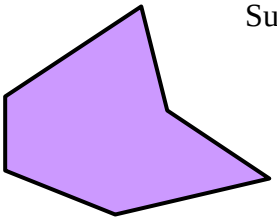
A **triangle** has **3 sides**
Sum of angles = **180°**



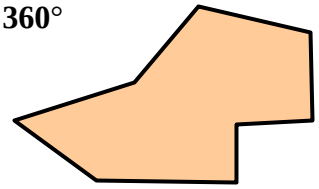
A **quadrilateral** has **4 sides**
Sum of angles = **360°**



A **pentagon** has **5 sides**

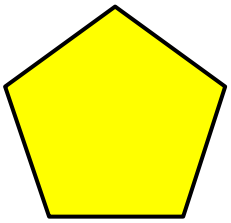


A **hexagon** has **6 sides**

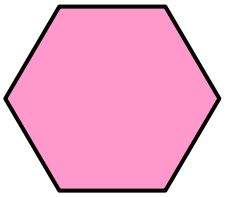


An **octagon** has **8 sides**

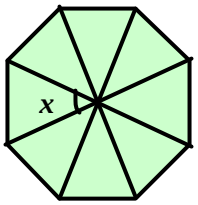
Regular Polygons



Regular pentagon



Regular hexagon



Regular octagon

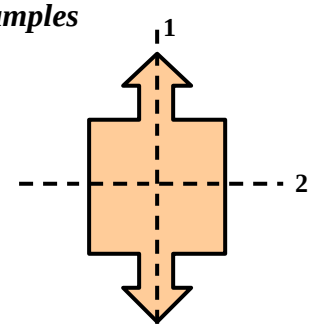
Note the angle at the centre,

$$x = \frac{360°}{8} = 45°$$

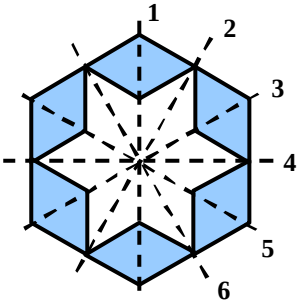
Regular polygons have **equal sides** and **equal angles**.

Symmetry

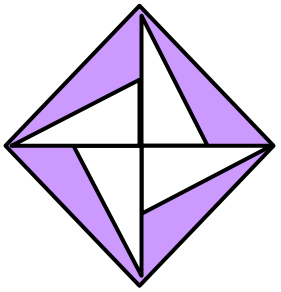
Examples



2 lines of symmetry
rotational symmetry order 2



6 lines of symmetry
rotational symmetry order 6



no lines of symmetry
rotational symmetry order 4

Units of Length

Metric metres (m) centimetres (cm) millimetres (mm) kilometres (km)

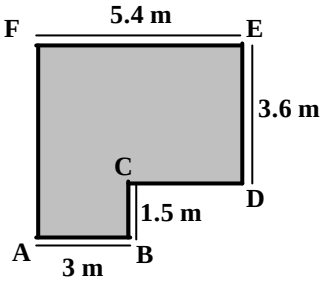
Learn **1 m = 100 cm** **1 m = 1000 mm** **1 cm = 10 mm** **1 km = 1000 m**
(To convert from one unit to another multiply or divide by the conversion factor.)

Imperial inches feet yards miles

Perimeters

Perimeter = total length of outside edges.
(You may need to find unknown edges)

Example
Find the total length of coving needed to go around this ceiling.

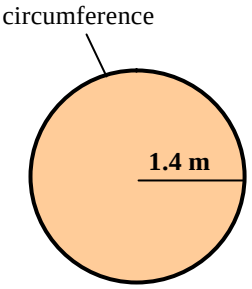


Unknown sides:
AF = 3.6 + 1.5 = 5.1 m
CD = 5.4 – 3 = 2.4 m

Total length = 3 + 1.5 + 2.4 + 3.6 + 5.4 + 5.1
= **21 m**

Circumference of a circle = p ´ diameter
(You may need to double the radius.)

Example
The radius of a circular flowerbed is 1.4 metres. What is its circumference?



Diameter = 2 × 1.4 = 2.8

Circumference = π × 2.8
= 8.796…
= **8.8 m** (to 1 decimal place)

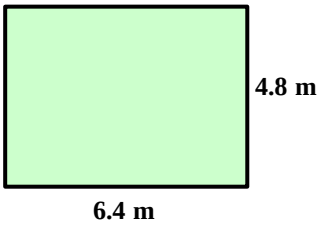
Units of Area

m^2 cm^2 mm^2 km^2

Areas

Area of rectangle = length ´ width

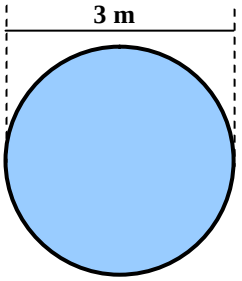
Example
Find the area of this rectangular lawn.



Area = 6.4 × 4.8
= **30.72 m^2**

Area of circle = p ´ radius^2
(You may need to halve the diameter.)

Example
The diameter of a circular pond is 3 metres. What is its area?

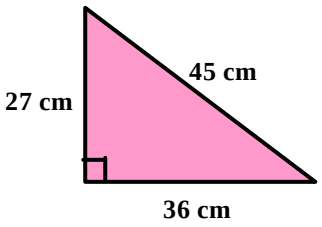


Radius = 3 ÷ 2 = 1.5 m

Area = π × 1.5^2 = 7.068…
= **7.1 m^2** (to 1 decimal place)

Area of triangle = ½ ´ base ´ height

Example
Find the area of this triangular sign.

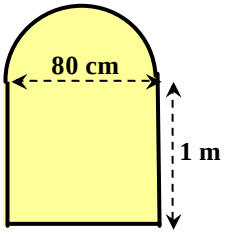


Area = ½ × 36 × 27
or 36 × 27 ÷ 2
= **486 cm^2**

Make sure you use the right measurements.
The **height** must be **perpendicular** to the **base**.

You may need to add or subtract areas and/or convert units.

Example
Find the area of this window. Give the answer in m^2.



80 cm = 0.8 m
Area of rectangle = 0.8 × 1
= 0.8 m^2
Radius = 0.8 ÷ 2 = 0.4 m
Area of full circle = π × 0.4^2 = 0.5026…
Area of semi-circle = 0.5026… ÷ 2 = 0.2513…

Total area = 0.2513… + 0.8 = 1.051…
= **1.05 m^2** (to 2 decimal places)

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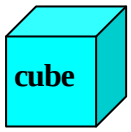
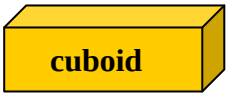
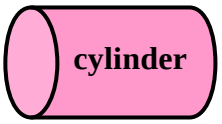
Units of Volume

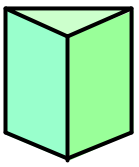
m^3 cm^3 mm^3 litres (for liquids)

Volumes









triangular prism

For all of these shapes:

Volume = Area of cross-section ´ length

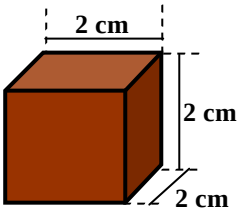
Prisms have a constant cross section.

If you need to find the **total surface area, add the area of each face.**

Volume of cube = length ´ width ´ height

Example

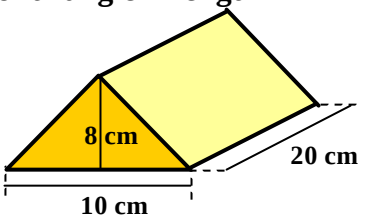
Find the volume of this stock cube.



Volume $= 2 \times 2 \times 2$
$= \mathbf{8\ cm^3}$

Volume of triangular prism
= area of triangle ´ length

Example
Find the volume of this fudge bar.

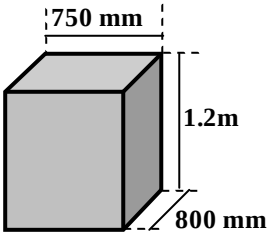


Area of triangle $= \frac{1}{2} \times 10 \times 8$
or $10 \times 8 \div 2 = 40\ cm^2$

Volume of bar $= 40 \times 20 = \mathbf{800\ cm^3}$

Volume of cuboid = length ´ width ´ height

Example
Find the volume of this water tank.
Give the answer in m^3.

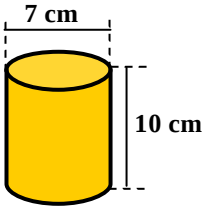


750 mm = 0.75 m
800 mm = 0.8 m

Volume $= 0.8 \times 1.2 \times 0.75$
$= \mathbf{0.72\ m^3}$

Volume of cylinder = area of circle ´ length

Example
Find the volume of this can.



Radius $= 7 \div 2 = 3.5$ cm

Area of circle $= \pi \times 3.5^2 = 38.4845\ldots\ cm^2$

Volume of can $= 38.4845\ldots \times 10 = 384.845\ldots$
$= \mathbf{385\ cm^3}$ (to nearest cm^3)

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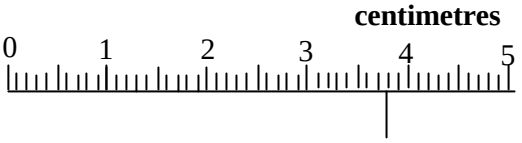
Measurements

Lengths - you may need to measure to the nearest mm or cm.

The arrow shows **3.8 cm** or **38 mm to the nearest mm**.
This measurement is **4 cm to the nearest cm**.



Angles - make sure you use the right scale on your protractor. Follow the scale round from zero.

Scale drawings

A scale of **1 : *n*** means the **real distances** are ***n* times more than those on the plan or map**.
Angles stay the same.

To find an actual distance, multiply by *n*

Example
The plan of a room has a scale of 1 : 50.
The length of the room on the plan is 9.6 cm.
What is the actual length of the room in metres?

Actual length = 9.6 × 50 = 480 cm

Actual length = 480 ÷ 100 = **4.8 m**

To find a distance for a plan or model, divide by *n*

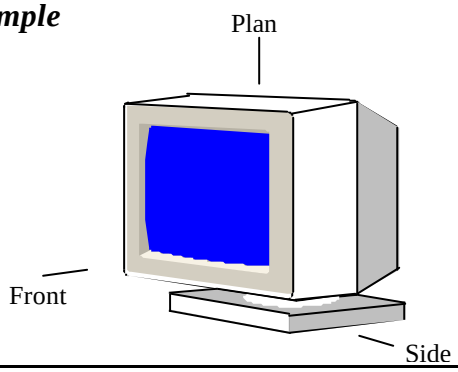
Example
A model of a boat has a scale of 1 : 20.
The length of the boat is 8.6 m.
What is the length of the model in millimetres?

Actual length = 8.6 m = 8.6 × 1000 = 8600 mm

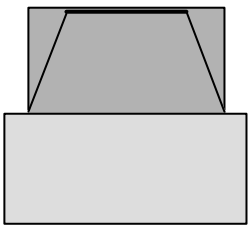
Length of model = 8600 ÷ 20 = **430 mm**

Plans and Elevations

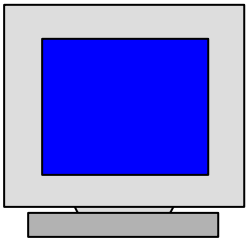
Example



Plan – the view from above

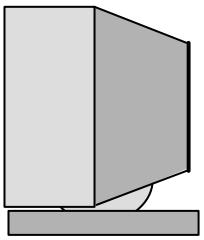


Front elevation – the view from the front



Side elevation – the view from the side

Exam questions often ask you to draw an **accurate** elevation **to scale**.

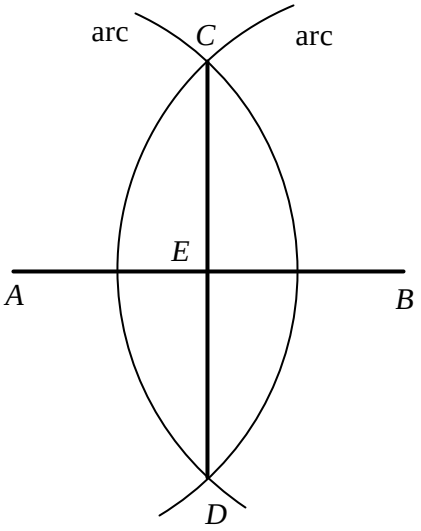


Constructions

To draw the perpendicular bisector of a line AB

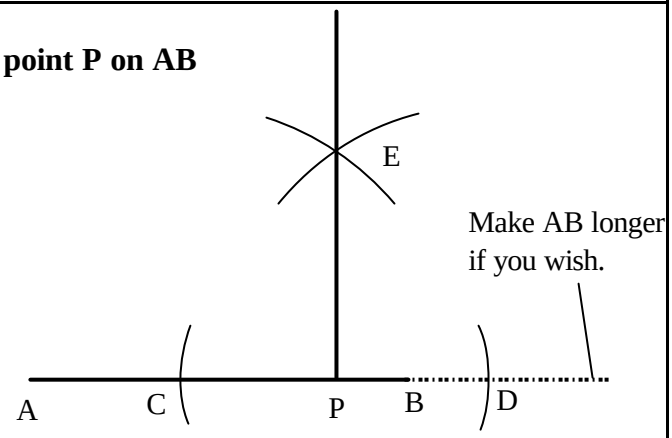
- With compass point on A draw an arc.
- With compass point on B draw an arc.
- Join the points C and D (where the arcs meet).

- **CD is the perpendicular bisector.**
- **E is the mid-point of AB**



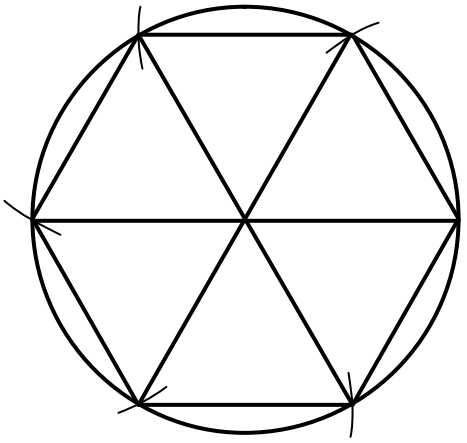
To draw a line perpendicular to AB through a point P on AB

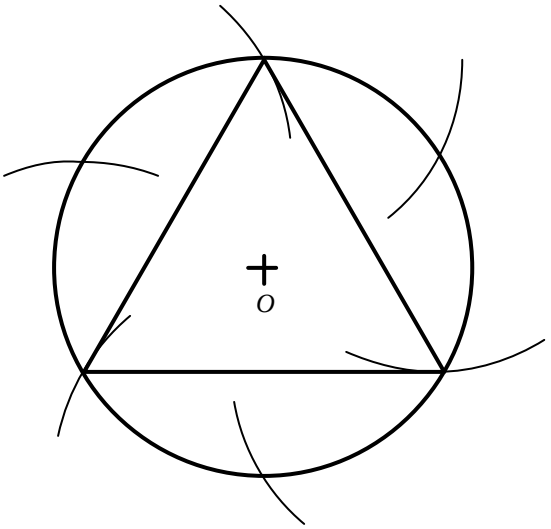
- With compass point on P, draw arcs to cut AB at C and D.
- With compass point on C, then D, draw arcs above P to meet at E.
- **PE is the perpendicular to AB at P.**



To construct a regular hexagon or an equilateral triangle with vertices on a circle

- Draw the circle.
- ***Keeping the radius the same,*** use the compass to 'step round' the circle.
- Join **all the points** for a regular hexagon.





- Join **alternate points** for an **equilateral triangle**.

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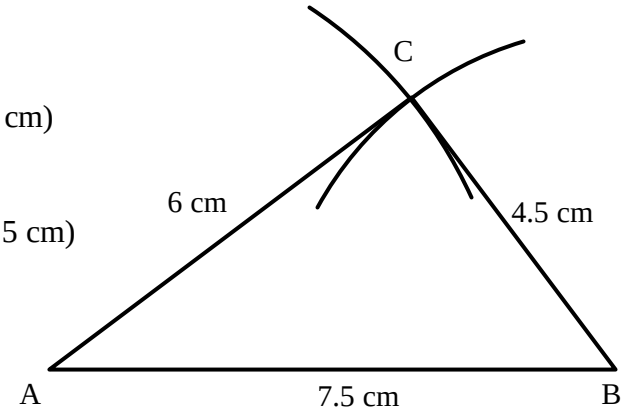
Constructions (continued)

You may also be asked to construct a rectangle or a triangle with given sides or angles.

To construct a triangle when given the length of its sides:
eg with AB = 7.5 cm, AC = 6 cm and BC = 4.5 cm

- Draw one side, AB = 7.5 cm.
- Open the compasses to the length of AC (6 cm) and with the point on A draw an arc.
- Open the compasses to the length of BC (4.5 cm) and with the point on B draw an arc.
- Where the arcs meet is the vertex C.
- Join AC and BC to give the traingle.



If you measure the angles of triangle ABC, you should find:

angle A = 37°
angle B = 53°
angle C = 90°

ABC is a right-angled triangle.