M1 Maths

# G1-1 Drawings

- plans and elevations, perspective drawings, cross sections and nets

Summary Learn Solve Revise Answers

## Summary

Plans and elevations are 2D drawings of 3D objects viewed from above (plan) and from the front and side (elevations).

Perspective drawings are drawings of 3D objects from viewpoints where the top and some sides can be seen. They give a good 3D impression.

A cross section is a drawing of a thin slice of a 3D object, usually cut perpendicular to its length.

A net is a drawing showing the faces of a 3D object, which can be folded to make the shape of the object.

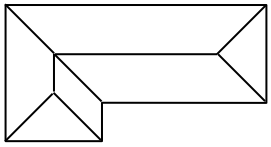
## Learn

Plans and elevations, perspective drawings, cross sections and nets are ways of drawing 3D objects in 2 dimensions.

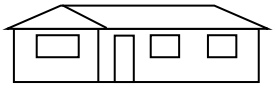
### Plans and elevations

Plans and elevations are used a lot in designing buildings. A plan is a view of something from directly above, looking vertically downwards. An elevation is a view from beside, looking horizontally, usually perpendicular to some of the walls (or faces) and parallel to others. Two elevations are usually drawn, one from the front, called the front elevation, and one from the side, called the side elevation. For objects that look different from all four sides, four elevations may be drawn – front, back, left and right.

A plan and front and right-side elevations of a house are shown below.



Plan



Front Elevation

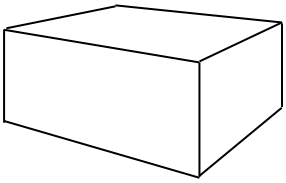
Right-side Elevation

## Perspective drawings

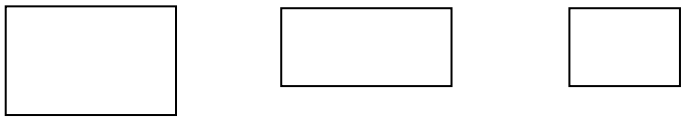
Plans and elevations have the advantage that all parts of the picture are at the same scale and the shape of objects on the picture are exactly the same as the shapes of the objects in real life.

This is not the case with a perspective drawing. A perspective drawing is designed more to give a 3D effect. Unlike plans and elevations, the line of sight for a perspective drawing is deliberately not horizontal or perpendicular to the faces. Also, unlike plans and elevations, parts of the object are drawn bigger if they are close to the viewer and smaller if they are further away, so the scale is not the same for all parts of the drawing.

Below is a perspective drawing of a rectangular prism along with a plan and elevations.



Perspective drawing



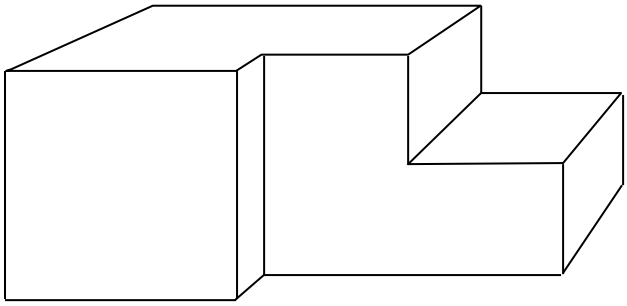
Plan Front elevation Side elevation

Note that the perspective drawing gives a better impression of the shape because it shows more than one face and gives an impression of 3D. It cannot be used for accurate measurement, though: although the height of the prism is the same at the front and the back, they are shown as different on the drawing.

A perspective drawing is basically the picture you would get if you took a photograph of the object from a point fairly close to the object and not in line with any of the faces; plans and elevations are basically the pictures you would get if you took photographs of the object from points very large distances (theoretically infinite) away in line with the faces.

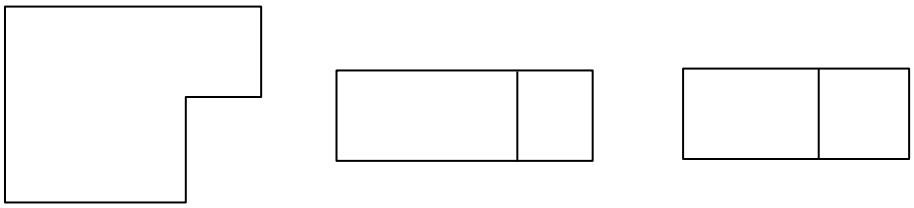
## Practice

Q1 Sketch a plan and front and right elevations of the office block shown below.



Q2 Sketch a perspective drawing of a rectangular prism 20 m wide, 12 m front to back and 6 m high.

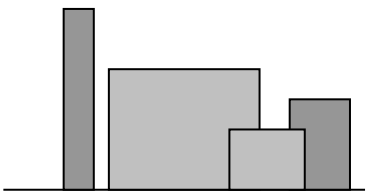
Q3 Sketch a perspective drawing of the shed whose plan and elevations are shown below.



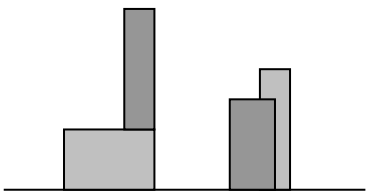
Plan Front elevation Right elevation

Q4 Four office blocks are built on a patch of flat ground. Each is a rectangular prism with its vertical faces facing north, south, east and west. The following are views of the four buildings from the west and from the south. The scale is 1 cm : 20 m.

View from the west



View from the south

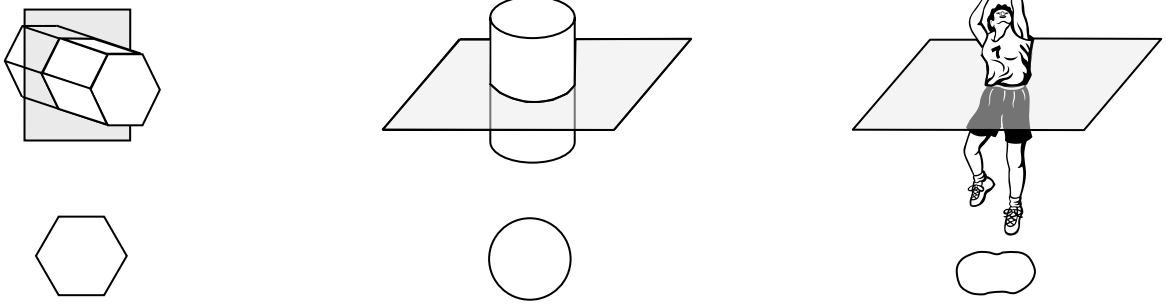


Draw a plan view of the arrangement at the same scale. Have north to the top of the page.

## Cross sections

A cross section of a 3D object is a drawing of a thin slice of the object, usually cut perpendicular to its length. A cross section of a prism (a shape which is the same shape and size right along its length) is the same shape and size as the end of the prism. For other shapes that get thinner or thicker or change shape along their length, the cross sections will be different in different places.

The cross section of a hexagonal prism is a hexagon; the cross section of a cylinder is a circle; the cross section of a person at waist level is sort of oval



## Practice

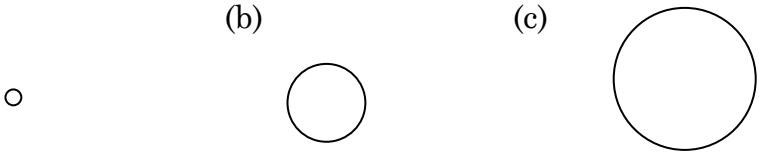
Q5 (a) Draw a cross section of a concrete pipe. Shade the concrete.

(b) Draw a cross section of a hexagonal pencil showing the wood and the lead.

(c) Draw a cross section of a bus passing through two seats.

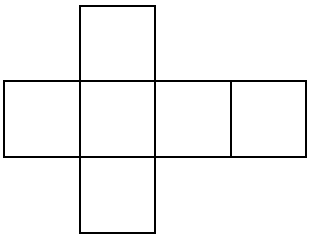
Q6 These are three horizontal cross sections of a shape. (a) is 10 cm above the ground, (b) 50 cm above and (c) 90 cm above. The shape is 1 m tall. What is the shape likely to be? Draw it.

(a) (b) (c)



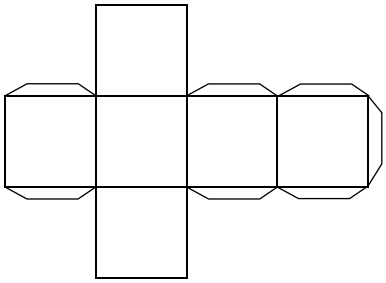
## Nets

A net of a 3D shape is a flat paper shape which can be folded along lines to make the 3D shape. For example the shape below can be folded along the lines to make a cube. Can you see how?

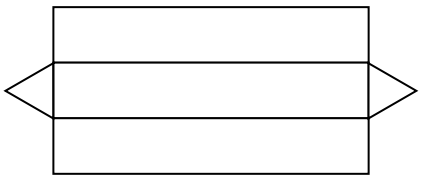


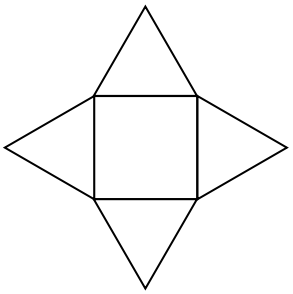
The best way to get a feel for nets is to cut some out, fold them and make some solid shapes.

If you want to glue them, you will need to put tabs on them like this:

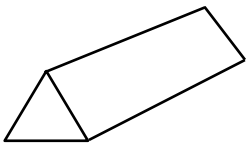


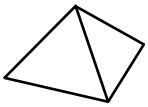
You need to be able to predict what solid shape a net will make without actually making it. For example, you should be able to tell what shapes the nets below will make.





The left one will make a triangular prism and the right one will make a square-based pyramid.



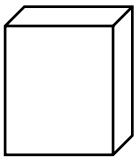


To make a net from a given shape, the easiest way to do it is to lay one face of the shape onto paper and draw around it. Then roll the shape over, draw round another side, roll it over a different way, draw around that side, and so on until you've traced all the sides. You should get some solid shapes and some paper and practice this.

After a bit of practice, you will be able to draw nets without tracing around the shape – you will get a feel for how the different faces are best arranged in the net.

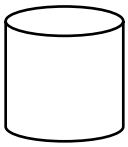
## Practice

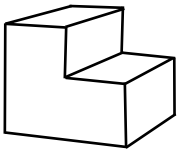
Q7 Draw a net for each of the following shapes:

(a) a rectangular prism like a breakfast cereal packet 

(b)  a pyramid with a hexagonal base

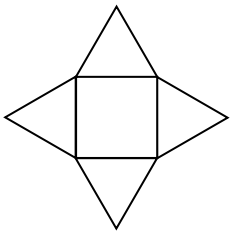
(c) a cylinder (a shape like a tin of pineapple, left below)

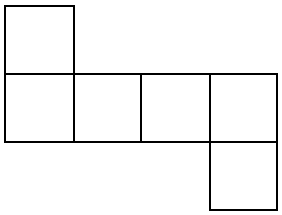


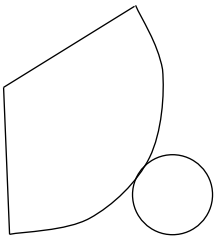


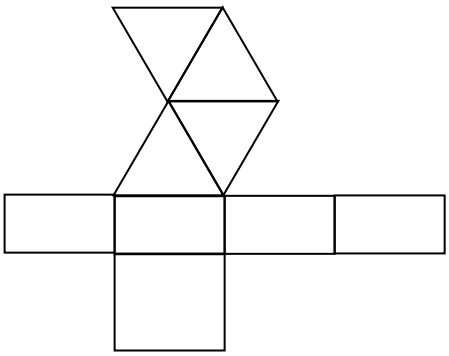
(d) an L-shaped block (the shape to the right)

Q8 What shape would be made by each of the following nets?

(a) 

(b) 

(c) 

(d) 

## Solve

Q51 Draw a plan and the four elevations of your house.

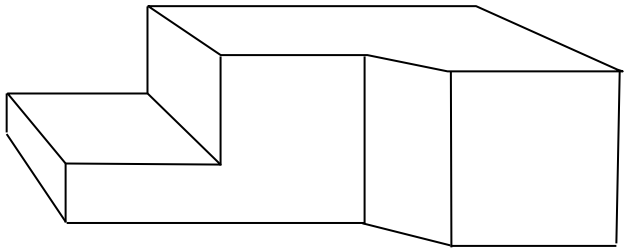
Q52 Draw a perspective drawing of your house.

Q53 Draw a cross section of your neck, showing your spine, windpipe, oesophagus, muscles and skin. You might like to compare it to neck cross section pictures from the Internet.

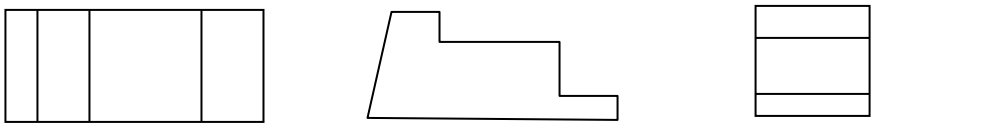
Q54 Make a net of a regular icosahedron (a 3D shape with 20 equal equilateral triangle faces). Include gluing tabs so you can cut it out, fold it and make the icosahedron.

## Revision Set 1

Q61 Sketch a plan and front and left elevations of the office block shown below.



Q62 Sketch a perspective drawing of the steps whose plan and elevations are shown below.



Plan Front elevation Right elevation

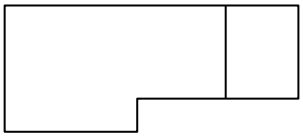
Q63 Draw a cross section of a mandarin, showing the skin, the segments and some seeds.

Q64 Draw a net for each of the following shapes:
a square-based prism
a pentagonal-based pyramid

Q65 What shape would be made by each of the following nets?
(a) (b)

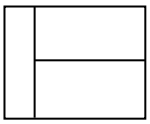
# Answers

Q1



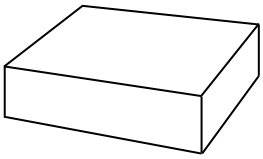
Plan

Front elevation

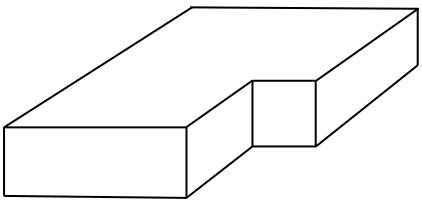


Right elevation

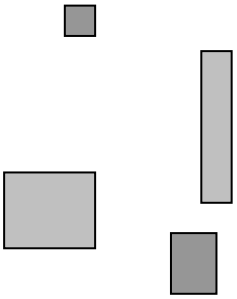
Q2



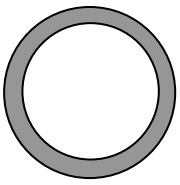
Q3



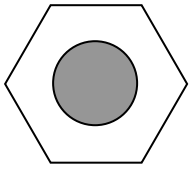
Q4



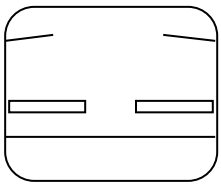
Q5 (a)



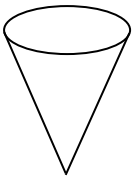
(b)



(c)

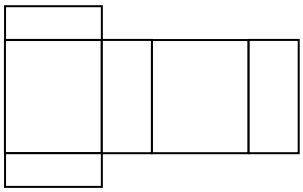


Q6 A cone

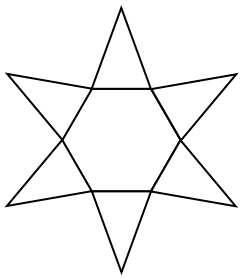


Q7 There are various possibilities for these. One example is given for each.

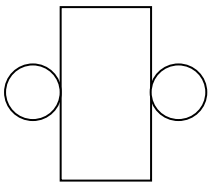
(a)



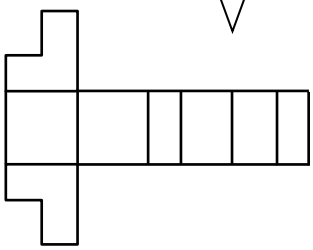
(b)



(c)



(d)



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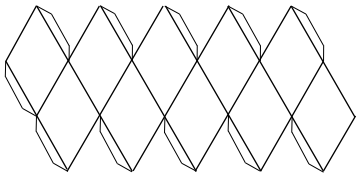
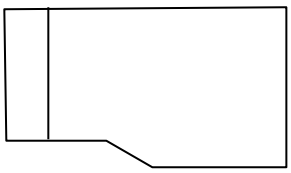
Q8 (a) square-based pyramid (b) cube (c) cone
(d) a square prism with a pyramid on top

Q54 One possibility:

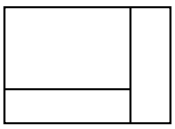


Q61



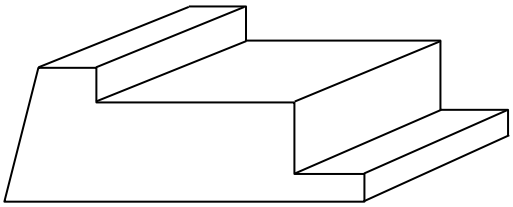
Plan

Front elevation

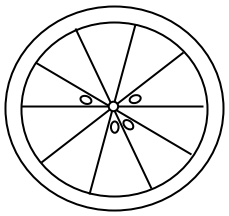


Left elevation

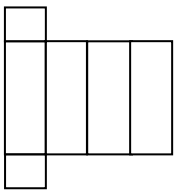
Q62



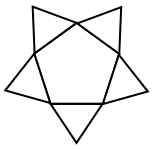
Q63



Q64 (a)



(b)



Q65 (a) triangular pyramid (tetrahedron) (b) cylinder