STUDY PLUS
A BRIGHTER FUTURE

GCSE Prep Year
FOUNDATION TIER

GEOMETRY
WORKBOOK 33

Name:

_____

Year Group:

_____

Start Date:

_____

KNOWLEDGE ORGANISER - VOLUME & SURFACE AREA

tthat do I need to be able to do?

By the end of this unit you should be able to:

- Name 2D G 3D shapes
- Recognise Prisms
- Sketch and recognise nets
- Draw plans and elevations
- find areas of 2D shapes
- find Surface area for cubes, cuboids, triangular prisms and cylinders
- find the volume of 3D shapes

Keywords

2D: two dimensions to the shape e.g. length and width

3D: three dimensions to the shape e.g. length, width and height

Vertex: a point where two or more line segments meet
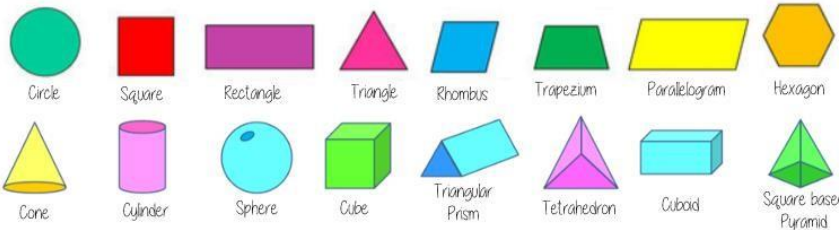
Edge a line on the boundary joining two vertex

face: a flat surface on a solid object

Cross-section: a view inside a solid shape made by cutting through it

Plan: a drawing of something when drawn from above (sometimes birds eye view)
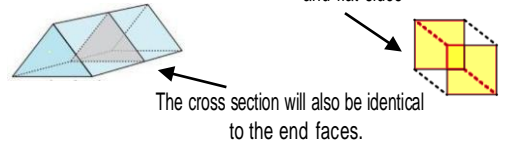
Perspective: a way to give illustration of a 3D shape when drawn on a flat surface.

Name 2D G 3D shapes

Circle, Square, Rectangle, Triangle, Rhombus, Trapezium, Parallelogram, Hexagon

Cone, Cylinder, Sphere, Cube, Triangular Prism, Tetrahedron, Cuboid, Square based Pyramid

Recognise prisms

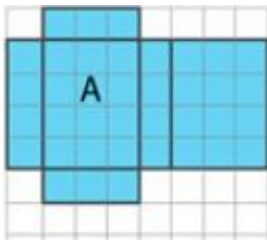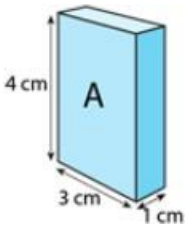A solid object with two identical ends and flat sides

The cross section will also be identical to the end faces.

A cylinder although with very similar properties does not have flat faces so is not categorised as a prism
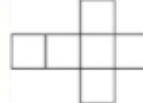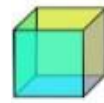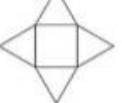
Nets of cuboids

4 cm, 3 cm, 1 cm

A

Visualise the folding of the net.
ttill it make the cuboid with all sides touching

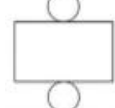1cm grids help to draw accurately

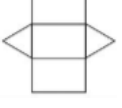## Sketch and recognise nets

Do they have the same number of faces?

tthere do the edges join?

Are the shapes of the faces correct?

Plans and elevations

front, side, plan → 3D Shape
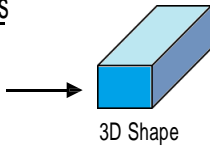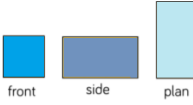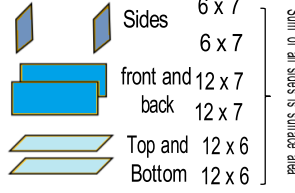
The direction you are considering the shape from determines the front and side views

Area of 2D shapes

Rectangle
Base x Height

Triangle
½ x Base x Perpendicular height

Parallelogram/ Rhombus
Base x Perpendicular height

Area of a trapezium
$$\frac{(a+b) \times h}{2}$$

Area of a circle
π x radius^2

Surface area

Sketching nets first helps you visualise all the sides that will form the overall surface area

6 m, 7 m, 12 m

Sides	6 x 7
	6 x 7
front and back	12 x 7
	12 x 7
Top and Bottom	12 x 6
	12 x 6

Sum of all sides is surface area

for cubes and cuboids you can also find one of each face and double it

for other shapes = not all the sides are the same, so calculate them individually

Surface area - cylinders

The area of the circle
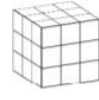π x radius^2

Circumference

The width of this face is the same as the circumference
π x diameter x height

$2 \times \pi \times$ radius$^2 + \pi \times$ diameter x height

Volumes

Volume is the 3D space it takes up – also known as capacity if using liquids to fill the space

Counting cubes
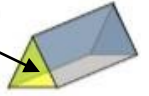Some 3D shape volumes can be calculated by counting the number of cubes that fit inside the shape.

Cubes/ Cuboids = base x width x height

Remember multiplication is commutative

Cross section

Cross section

Prisms and cylinders = area cross section x height

Height can also be described as depth
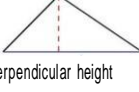
Areas – square units
Volumes – cube units
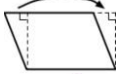
Areas and volumes can be left in terms of pi π

Knowledge Organiser: Area and Volume

What you need to know:

3D solids: They have 3 dimensions – length, width and depth.
Here are the main 3D solids that you need to be familiar with.

Cube		Tetrahedron		Sphere	
	6 square faces 12 edges 8 vertices		4 triangular faces 6 edges 4 vertices		1 curved surface 0 edges 0 vertices
Cuboid		Octahedron		Triangular prism	
	6 faces 12 edges 8 vertices		8 faces 12 edges 6 vertices		5 faces 9 edges 6 vertices
Square-based pyramid		Cone		Cylinder	
	5 faces 8 edges 5 vertices		1 circular face 1 curved surface 1 curved edge 1 apex		2 circular faces 1 curved surface 2 curved edges 0 vertices

You especially need to know the names of these solids.
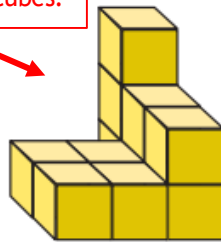
Volume

Volume: This is the amount of space that a 3D object occupies.
Sometimes an object is made up of cubes, we can count them to calculate the volume.
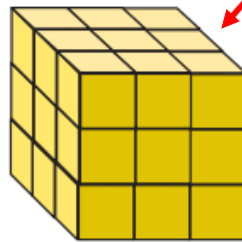
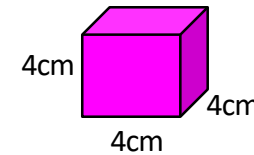This is made up of 11 cubes.

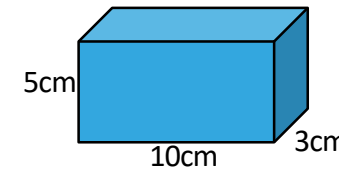This is made up of 27 cubes.

= 1cm³

This is made up of 1 cube.

11cm³

27cm³

Cubes and cuboids: To calculate the volume of a cube and cuboid we use the following formula:

Volume = Length x Width x Height

4cm, 4cm, 4cm

Volume = 4 x 4 x 4 = 64cm³

The units are cubic for volume.

5cm, 10cm, 3cm
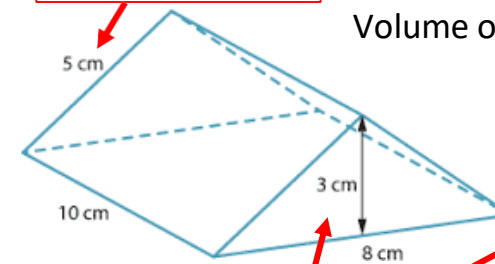
Volume = 10 x 3 x 5 = 150cm³

It doesn't matter which order you multiply in.

Prism: A prism is a solid object with identical ends and flat faces.
The general formula for the volume of a prism is:

Volume = Area of the cross section x Length

We do not need this.

5 cm, 10 cm, 3 cm, 8 cm

Volume of triangular prism = Area of a triangle x length

$$\text{Area of triangle} = \frac{3 \times 8}{2} = 12$$

Area of the cross section.

Volume = 12 x 10 = 120cm³

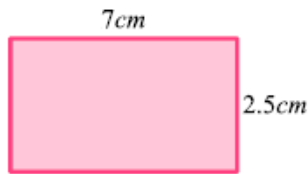Multiply the area of the cross section by 10 which is the length.

Geometry and Measure (Foundation)
QUICK REVISION
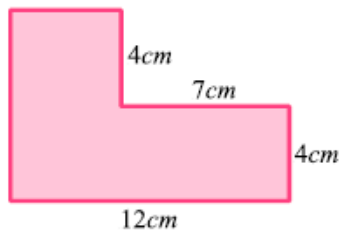
Perimeter and area in rectangles

Given the rectangle below, calculate (stating the units):
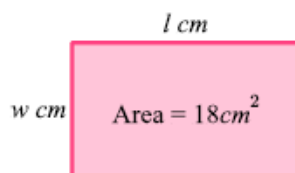
a) The perimeter

b) The area

7cm
2.5cm

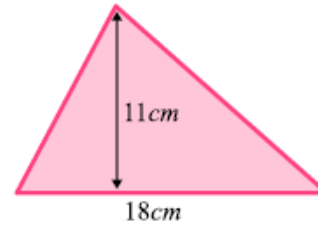For the given shape, find:

a) Its perimeter

b) Its area

4cm
7cm
4cm
12cm

The length (l) and width (w) of this rectangle take integer values. Given that $l > w$, list the possible dimensions of the rectangle.
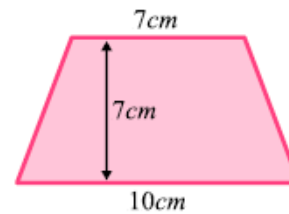
l cm
w cm   Area $= 18cm^2$

Area of simple shapes
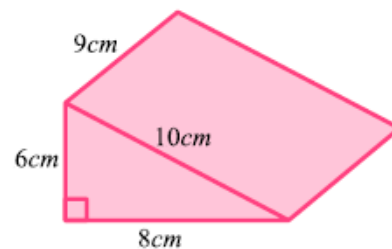
Find the area of this triangle.

11cm
18cm

Determine the area of this trapezium.

7cm
7cm
10cm

Volume and surface area

For this triangular prism, find:
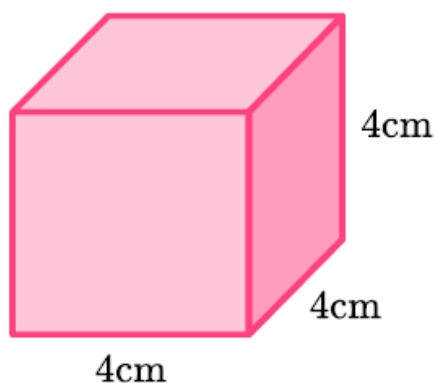
a) The volume

b) The surface area

9cm
10cm
6cm
8cm

GCSE DIAGNOSTIC QUESTIONS
VOLUME & THE SURFACE AREA

1. Find the volume of this cube, stating the appropriate units:

4cm

4cm

4cm

A) $16\ cm^3$	B) $12\ cm^3$
C) $64\ cm^3$	D) $48\ cm^3$

2. Find the volume of this cuboid, stating the appropriate units:

5cm

4cm

13cm
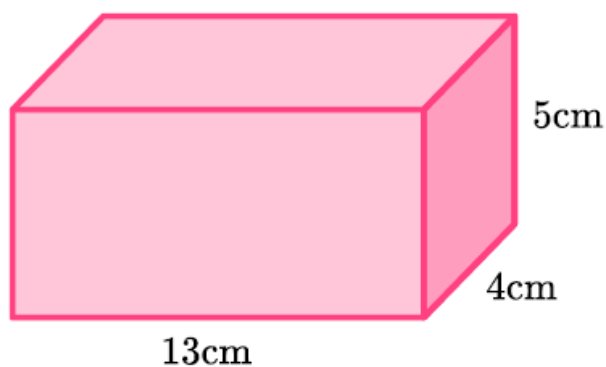
A) $52\ cm^3$	B) $130\ cm^3$
C) $274\ cm^3$	D) $260\ cm^3$

3. Find the volume of this triangular prism, stating the appropriate units:
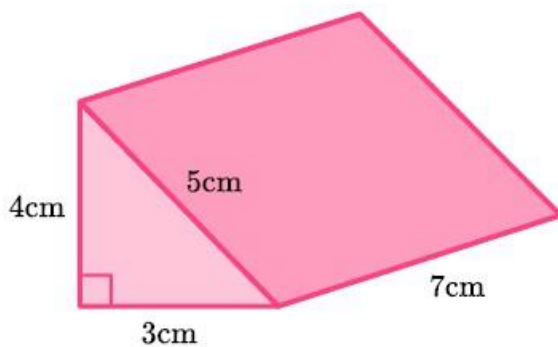
A) $42\ cm^3$	B) $84\ cm^3$
C) $420\ cm^3$	D) $210\ cm^3$

4. The volume of this cuboid is $552\ cm^3$. Find the length of the base.
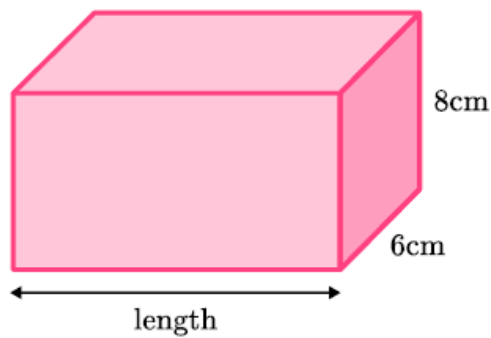
A) $404\ cm$	B) $39.4\ cm$
C) $23\ cm$	D) $11.5\ cm$

EXAM STYLE QUESTIONS

1) **(a)** Work out the surface area of a cube with side length $11cm$.

....

(b) Convert the surface area in (a) to m^2.

....

2) Work out the surface area of the cuboid.

....
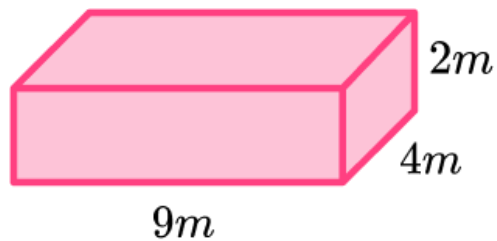
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