

Year 8 Term 2

Area

What do I need to be able to do?

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

- Recall area of basic 2D shapes
- Find the area of a trapezium
- Find the area of a circle
- Find the area of compound shapes
- Find the perimeter of compound shapes

Keywords

Congruent: The same

Area: Space inside a 2D object

Perimeter: Length around the outside of a 2D object

π (π): The ratio of a circle's circumference to its diameter.

Perpendicular: At an angle of 90° to a given surface

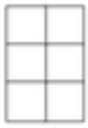
Formula: A mathematical relationship/ rule given in symbols. Eg $b \times h$ = area of rectangle/ square

Infinity (∞): A number without a given ending (too great to count to the end of the number) – never ends

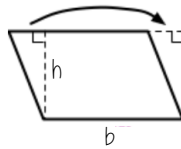
Sector: A part of the circle enclosed by two radii and an arc.

Area – rectangles, triangles, parallelograms

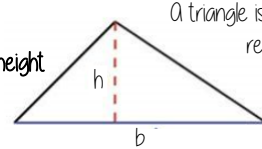
Rectangle
Base $\times$ Height



Parallelogram/ Rhombus
Base $\times$ Perpendicular height

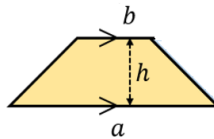


Triangle
 $\frac{1}{2} \times$ Base $\times$ Perpendicular height

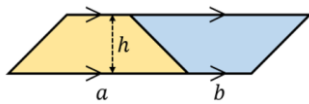


Area of a trapezium

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



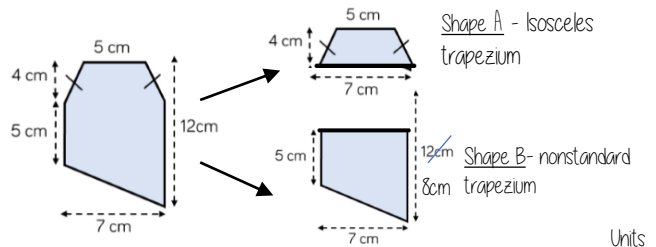
Why?



- Two congruent trapeziums make a parallelogram
- New length $(a+b) \times$ height
- Divide by 2 to find area of one

Compound shapes

To find the area compound shapes often need splitting into more manageable shapes first. Identify the shapes and missing sides etc. first.



Shape A + Shape B = total area

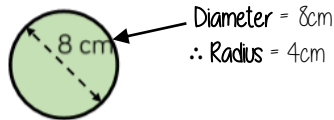
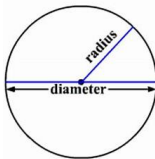
$$\frac{(5+7) \times 4}{2} + \frac{(5+8) \times 7}{2} = 24 + 45.5 = 69.5 \text{ cm}^2$$

Units

Area of a circle (Non-Calculator)

Read the question – leave in terms of π or if $\pi \approx 3$ (provides an estimate for answers)

Area of a circle
 $\pi \times \text{radius}^2$



Diameter = 8 cm
 $\therefore$ Radius = 4 cm

$$\begin{aligned} \pi \times \text{radius}^2 \\ &= \pi \times 4^2 \\ &= \pi \times 16 \\ &= 16\pi \text{ cm}^2 \end{aligned}$$

Find the area of one quarter of the circle



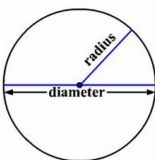
Circle Area = $16\pi \text{ cm}^2$
Quarter = $4\pi \text{ cm}^2$

Area of a circle (Calculator)



SHIFT $\times 10^x$

Area of a circle
 $\pi \times \text{radius}^2$



How to get π symbol on the calculator

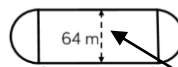
It is important to round your answer suitably – to significant figures or decimal places. This will give you a decimal solution that will go on forever!

Compound shapes including circles

Circumference
 $\pi \times \text{diameter}$

Compound shapes are not always area questions
For Perimeter you will need to use the circumference

Spotting diameters and radii



This dimension is also the diameter of the semi circles

$$\begin{aligned} \text{Arc lengths} &= \pi \times 64 \\ &= 64\pi \end{aligned}$$

Don't need to halve this because there are 2 ends which make the whole circle

Arc lengths + Straight lengths = total perimeter

$$\begin{aligned} &= 64\pi + 150 + 150 \\ &= (300 + 64\pi) \text{ m} \\ \text{OR } &= 501.1 \text{ m} \end{aligned}$$

Still remember to split up the compound shape into smaller more manageable individual shapes first

Year 8 Term 2

Standard Form

What do I need to be able to do?

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

- Write numbers in standard form and as ordinary numbers
- Order numbers in standard form
- Add/ Subtract with standard form
- Multiply/ Divide with standard form
- Use a calculator with standard form

Keywords

Standard (index) Form: A system of writing very big or very small numbers

Commutative: an operation is commutative if changing the order does not change the result

Base: The number that gets multiplied by a power

Power: The exponent — or the number that tells you how many times to use the number in multiplication

Exponent: The power — or the number that tells you how many times to use the number in multiplication

Indices: The power or the exponent

Negative: A value below zero.

Positive powers of 10

1 billion = 1 000 000 000

$$10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 = 10^9$$

Addition rule for indices $10^a \times 10^b = 10^{a+b}$

Subtraction rule for indices $10^a \div 10^b = 10^{a-b}$

Standard form with numbers > 1

Any number between 1 and less than 10 $\rightarrow A \times 10^n$ $\leftarrow$ Any integer

Example

$$\begin{aligned} 3.2 \times 10^4 \\ = 3.2 \times 10 \times 10 \times 10 \times 10 \\ = 32000 \end{aligned}$$

Non-example

$$\begin{aligned} (0.8) \times 10^4 \\ 5.3 \times 10^{07} \end{aligned}$$

Negative powers of 10

0.001	10	1	$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$
$1 \times \frac{1}{1000}$	10^1	10^0	10^{-1}	10^{-2}	10^{-3}
1×10^{-3}	0	0	0	0	1

Any value to the power 0 always = 1

Negative powers do not indicate negative solutions

Numbers between 0 and 1

0.054	1	$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$
$= 5.4 \times 10^{-2}$	10^0	10^{-1}	10^{-2}	10^{-3}
	0	0	5	4

A negative power does not mean a negative answer — it means a number closer to 0

Order numbers in standard form

6.4×10^{-2}	2.4×10^2	3.3×10^0	1.3×10^{-1}
0.064	240	1	0.13

Look at the power first will the number be = > or < than 1

Use a place value grid to compare the numbers for ordering

Mental calculations

$$\begin{aligned} 6.4 \times 10^2 \times 1000 & \text{ Not in Standard Form} \\ = 6.4 \times 10^2 \times 10^3 & \text{ Use addition for indices rule} \\ = 6.4 \times 10^5 \end{aligned}$$

$$\begin{aligned} (2 \times 10^3) \div 4 & \text{ Divide the values} \\ = (2 \div 4) \times 10^3 \\ = 0.5 \times 10^3 \end{aligned}$$

$$\begin{aligned} (8 \times 10^5) \times (3) & \text{ Not in Standard Form} \\ = 24 \times 10^5 & \text{ Use addition for indices rule} \\ = 2.4 \times 10^1 \times 10^5 & \text{ Use addition for indices rule} \\ = 2.4 \times 10^6 \end{aligned}$$

Remember the layout for standard form

Any number between 1 and less than 10 $\rightarrow A \times 10^n$ $\leftarrow$ Any integer

Addition and Subtraction

Tip: Convert into ordinary numbers first and back to standard form at the end

$$6 \times 10^5 + 8 \times 10^5$$

Method 1

$$\begin{aligned} &= 600000 + 800000 \\ &= 1400000 \\ &= 1.4 \times 10^6 \end{aligned}$$

Method 2

$$\begin{aligned} &= (6 + 8) \times 10^5 \\ &= 14 \times 10^5 \\ &= 1.4 \times 10^1 \times 10^5 \\ &= 1.4 \times 10^6 \end{aligned}$$

This is not the final answer

Only works if the powers are the same

More robust method
Less room for misconceptions
Easier to do calculations with negative indices
Can use for different powers

Multiplication and division

$$\frac{1.5 \times 10^5}{0.3 \times 10^3}$$

Division questions can look like this

For multiplication and division you can look at the values for A and the powers of 10 as two separate calculations

$$(1.5 \times 10^5) \div (0.3 \times 10^3)$$

Revisit addition and subtraction laws for indices — they are needed for the calculations

$$15 \div 0.3 \times 10^5 \div 10^3$$

$$= 5 \times 10^2$$

Addition law for indices

$$a^m \times a^n = a^{m+n}$$

Subtraction law for indices

$$a^m \div a^n = a^{m-n}$$

Using a calculator

$$14 \times 10^5 \times 3.9 \times 10^3$$

Use a calculator to work out this question to a suitable degree of accuracy

Input 14 and press $\times 10^1$ Then press 5 (for the power)
Press $\times$
Input 3.9 and press $\times 10^3$ Then press 3 (for the power)
Press $=$

This gives you the solution



Click calculator for video tutorial

To put into standard form and a suitable degree of accuracy

Press **SHIFT** **SETUP** and then press 7 for sci mode

Choose a degree of accuracy so in most cases press 2

$$\text{Answer: } 5.5 \times 10^6$$

Year 8 Term 2

3D Shapes

What do I need to be able to do?

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

- Name 2D & 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

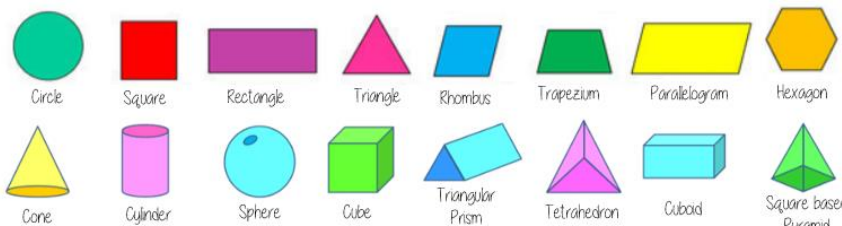
Face: a flat surface on a solid object

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)

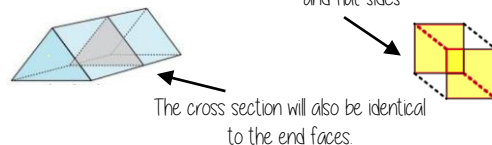
Perspective: a way to give illustration of a 3D shape when drawn on a flat surface.

Name 2D & 3D shapes



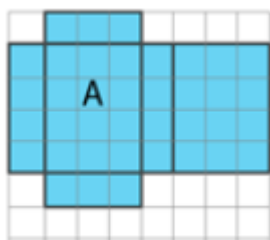
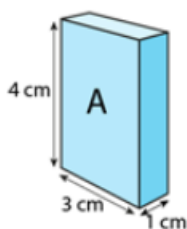
Recognise prisms

A solid object with two identical ends and flat sides



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

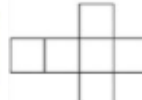
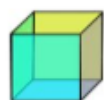
Nets of cuboids



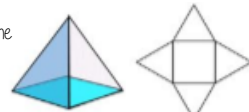
1cm grids help to draw accurately

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

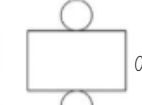
Sketch and recognise nets



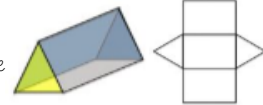
Do they have the same number of faces?



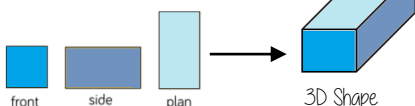
Where do the edges join?



Are the shapes of the faces correct?



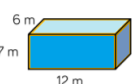
Plans and elevations



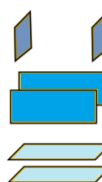
The direction you are considering the shape from determines the front and side views

Surface area

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



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



Sides 6×7
 6×7
 Front and back 12×7
 12×7
 Top and Bottom 12×6
 12×6

Sum of all sides is surface area



For other shapes - not all the sides are the same, so calculate the individually

Surface area - cylinders



The area of the circle $\pi \times \text{radius}^2$

The width of this face is the same as the circumference $\pi \times \text{diameter} \times \text{height}$

$$2 \times \pi \times \text{radius}^2 + \pi \times \text{diameter} \times \text{height}$$

Volumes

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



Counting cubes

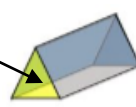
Some 3D shape volumes can be calculated by counting the number of cubes that fit inside the shape

$$\text{Cubes/Cuboids} = \text{base} \times \text{width} \times \text{height}$$

Remember multiplication is commutative



Cross section



$$\text{Prisms and cylinders} = \text{area cross section} \times \text{height}$$

Height can also be described as depth

Areas - square units
 Volumes - cube units

Areas and volumes can be left in terms of π

Area of 2D shapes

Rectangle
 Base $\times$ Height



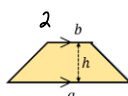
Triangle
 $\frac{1}{2} \times \text{Base} \times \text{Perpendicular height}$



Parallelogram/ Rhombus
 Base $\times$ Perpendicular height



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



Area of a circle
 $\pi \times \text{radius}^2$

