YEAR 8
Angles in parallel lines and polygons

@What do I need to be able to do?

By the end of this unit you should be able to:
- Identify alternate angles
- Identify corresponding angles
- Identify co-interior angles
- Find the sum of interior angles in polygons
- Find the sum of exterior angles in polygons
- Find interior angles in regular polygons

Keywords

Parallel: Straight lines that never meet
Angle: The figure formed by two straight lines meeting (measured in degrees)
Transversal: A line that cuts across two or more other (normally parallel) lines
Isosceles: Two equal size lines and equal size angles (in a triangle or trapezium)
Polygon: A 2D shape made with straight lines
Sum: Addition (total of all the interior angles added together)
Regular polygon: All the sides have equal length; all the interior angles have equal size.

Basic angle rules and notation 🔴

Acute Angles
0°< angle <90°

Right Angles
90°

Obtuse
90°< angle <180°

Right angle notation

Reflex
180°< angle <360°

Straight Line
180°

The letter in the middle is the angle
The arc represents the part of the angle

Angle Notation: three letters ABC
This is the angle at B = 113°
Line Notation: two letters EC
The line that joins E to C.

Vertically opposite angles
Equal
Angles around a point
360°

Parallel lines

Still remember to look for angles on straight lines, around a point and vertically opposite!!

Corresponding angles often identified by their "F shape" in position

Lines OF and BE are **transversals** (lines that bisect the parallel lines)

Alternate angles often identified by their "Z shape" in position

This notation identifies parallel lines

Alternate/ Corresponding angles

Because alternate angles are equal the highlighted angles are the same size

Because corresponding angles are equal the highlighted angles are the same size

Co-interior angles

Because co-interior angles have a sum of 180° the highlighted angle is 110°

As angles on a line add up to 180° co-interior angles can also be calculated from applying alternate/ corresponding rules first

Triangles & Quadrilaterals

Link to steps 🔴

Side, Angle, Angle

Side, Angle, Side

Side, Side, Side

Properties of Quadrilaterals

Square
All sides equal size
All angles 90°
Opposite sides are parallel

Rectangle
All angles 90°
Opposite sides are parallel

Rhombus
All sides equal size
Opposite angles are equal

Parallelogram
Opposite sides are parallel
Opposite angles are equal
Co-interior angles

Trapezium
One pair of parallel lines

Kite
No parallel lines
Equal lengths on top sides
Equal lengths on bottom sides
One pair of equal angles

Sum of exterior angles

Exterior angles all add up to 360°

Using exterior angles

Exterior Angle

Exterior Angles
Are the angle formed from the straight-line extension at the side of the shape

Interior Angle

Interior angle + Exterior angle = straight line = 180°
Exterior angle = 180 − 165 = 15°

Number of sides = 360° ÷ exterior angle
Number of sides = 360 ÷ 15 = 24 sides

Sum of interior angles

(number of sides − 2) x 180

Interior Angles
The angles enclosed by the polygon

This is an **irregular** polygon – the sides and angles are different sizes

Sum of the interior angles = (5 − 2) x 180

This shape can be made from three triangles
Each triangle has 180°

Sum of the interior angles = 3 x 180
= 540°

Remember this is **all** of the interior angles added together

Missing angles in regular polygons

Exterior angle = 360 ÷ 8 = 45°

Interior angle = $\frac{(8-2) \times 180}{8}$ = $\frac{6 \times 180}{8}$ = 135°

Exterior angles in regular polygons = 360° ÷ number of sides

Interior angles in regular polygons = $\frac{(number\ of\ sides - 2) \times 180}{number\ of\ sides}$

Area of trapezia and Circles

@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
Pi (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. E.g. b x h = area of rectangle/ square
Infinity (∞): A number without a given ending (too great to count to the end of the number) – never ends
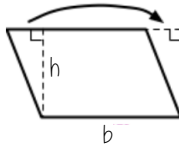**Sector**: A part of the circle enclosed by two radii and an arc.

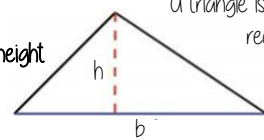## Area – rectangles, triangles, parallelograms

Rectangle
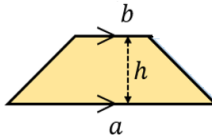Base x Height
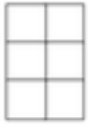
Parallelogram/ Rhombus
Base x Perpendicular height

Triangle
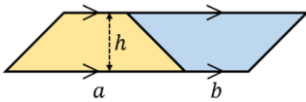½ x Base x Perpendicular height

A triangle is half the size of the rectangle it would fit in

Area of a trapezium

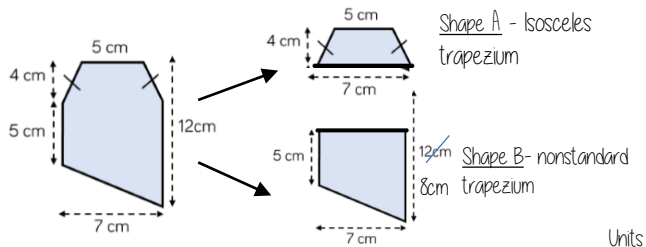Area of a trapezium
$$\frac{(a+b) \times h}{2}$$

Why?

- Two congruent trapeziums make a parallelogram
- New length (a + b) x 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.

5 cm
4 cm
5 cm
12cm
7 cm

Shape A - Isosceles trapezium
4 cm
5 cm
7 cm

Shape B- nonstandard trapezium
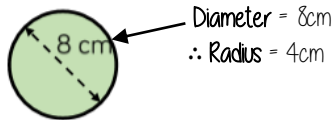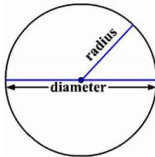5 cm
12cm
8cm
7 cm

Units

Shape A + Shape B = total area
$$\frac{(5+7) \times 4}{2} + \frac{(5+8) \times 7}{2} = 24 + 45.5 = 69.5 cm^2$$

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
π x radius^2

Diameter = 8cm
∴ Radius = 4cm

Radius = 4cm
4 cm

π x radius^2
= π x 4^2
= π x 16
= 16π cm^2

Find the area of one quarter of the circle

Circle Area = 16π cm^2
Quarter= 4π cm^2

Compound shapes including circles

Circumference
π x diameter

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

Spotting diameters and radii

64 m
150 m
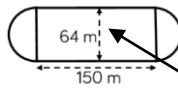
This dimension is also the diameter of the semi circles.

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

Arc lengths = π x 64
= 64 π

Arc lengths + Straight lengths = total perimeter

= 64 π + 150 + 150
= (300 + 64 π) m
OR = 501.1 m

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

Area of a circle (Calculator)

SHIFT ×10^x

Area of a circle
π x 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!

The data handling cycle

@What do I need to be able to do?

By the end of this unit you should be able to:
- Set up a statistical enquiry
- Design and criticise questionnaires
- Draw and interpret multiple bar charts
- Draw and interpret line graphs
- Represent and interpret grouped quantitative data
- Find and interpret the range
- Compare distributions

Keywords

Hypothesis: an idea or question you want to test
Sampling: the group of things you want to use to check your hypothesis
Primary Data: data you collect yourself
Secondary Data: data you source from elsewhere e.g. the internet/ newspapers/ local statistics
Discrete Data: numerical data that can only take set values
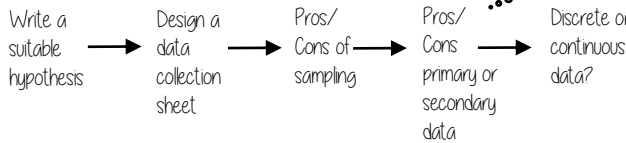**Continuous Data:** numerical data that has an infinite number of values (often seen with height, distance, time)
Spread: the distance/ how spread out/ variation of data
Average: a measure of central tendency — or the typical value of all the data together
Proportion: numerical relationship that compares two things

Set up a statistical enquiry

Write a suitable hypothesis → Design a data collection sheet → Pros/Cons of sampling → Pros/Cons primary or secondary data → Discrete or continuous data?

Features of a data collection sheet

Grouped or ungrouped categories

Data Title	Tally	Frequency
	IIII	

Total number of that group observed

Design and criticise a questionnaire

The Question - be clear with the question - don't be too leading/ judgemental

e.g. How much pocket money do you get a week?

Responses – do you want closed or open responses? – do any options overlap? – Have you an option for all responses?

Zero option → ☐ £0 ☐ £0.01 - £2 ☐ £2.01 - £4 ☐ more than £4 ← More option

NOTE: For responses about continuous data include inequalities $< x \leq$
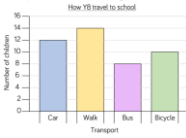
Pictograms, bar and line charts (R)

Represents quantitative data

Pictogram

Language	
French	●●●●
Spanish	●●●
German	●

● = 4 people

- Need to remember a key
- Visually able to identify mode

Bar Chart

How Y8 travel to school

- Gaps between the bars
- Clearly labelled axes
- Scale for the axes
- Title for the bar chart
- Discrete Data

Line Chart

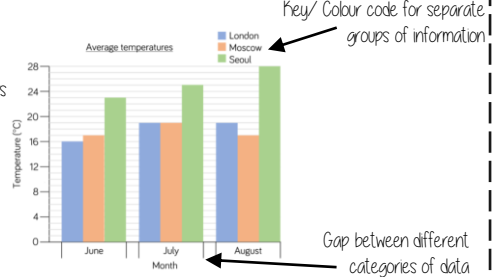Number of books read in a month
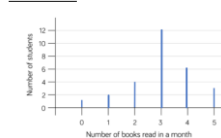
- Gaps between the lines
- Clearly labelled axes
- Scale for the axes
- Discrete Data

Multiple Bar chart

Compares multiple groups of data

- Clearly labelled axes
- Scale for axes
- Comparable data bars drawn next to each other

Average temperatures

Key/ Colour code for separate groups of information (London, Moscow, Seoul)

Gap between different categories of data

Draw and interpret Pie Charts (R)

Remember a circle has 360°

Type of pet	Dog	Cat	Hamster
Frequency	32	25	3

There were 60 people asked in this survey (Total frequency)

$\frac{32}{60}$ "32 out of 60 people had a dog"

This fraction of the 360 degrees represents dogs

$\frac{32}{60} \times 360 = 192°$

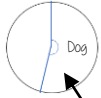**Multiple method**
As 60 goes into 360 — 6 times.
Each frequency can be multiplied by 6 to find the degrees (proportion of 360)
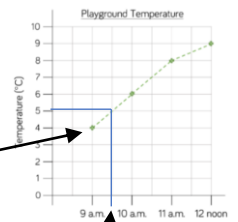
Use a protractor to draw. This is 192°

Represents quantitative, discrete data

Draw and interpret line graphs

- Commonly used to show changing over time
- The points are the recorded information and the lines join the points.
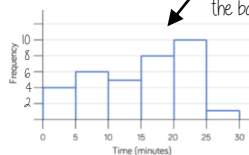
Line graphs do not need to start from 0

More than one piece of data can be plotted on the same graph to compare data

Playground Temperature

It is possible to make estimates from the line e.g temperature at 9.30am is 5°C

Grouped quantitative data

Time (minutes)	Frequency
$0 \leq t < 5$	4
$5 \leq t < 10$	6
$10 \leq t < 15$	5
$15 \leq t < 20$	8
$20 \leq t < 25$	10
$25 \leq t < 30$	1

This is a frequency diagram. There are no gaps between the bars

Grouping the data is useful if there is a large spread of data to begin with

"More than or equal to 25 and less than 30 minutes"

The use of inequalities shows that this will be a frequency diagram

Find and interpret the range

Difference between the biggest and smallest values
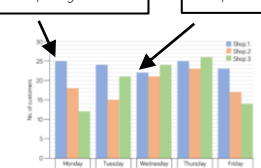
The range is a measure of **spread**

A smaller range means there is less variation in the results – it is more consistent data

A range of 0 means all the data is the same value

Shop 1 highest value

Shop 1 lowest value

Shop 1 has the smallest range – this indicates it has a more consistent flow of customers each week

Range of customers = 25 – 22 = 3 (Shop 1)

Measures of location

@What do I need to be able to do?

By the end of this unit you should be able to:
- Understand and use mean, median and mode
- Choose the most appropriate average
- Identify outliers
- Compare distributions using averages and range

Keywords

Spread: the distance/ how spread out/ variation of data
Average: a measure of central tendency – or the typical value of all the data together
Total: all the data added together
Frequency: the number of times the data values occur
Represent: something that show's the value of another
Outlier: a value that stands apart from the data set
Consistent: a set of data that is similar and doesn't change very much

Mean, Median, Mode

The Mean

A measure of average to find the central tendency... a typical value that represents the data

24, 8, 4, 11, 8,

Find the sum of the data (add the values)   55

Divide the overall total by how many pieces of data you have   55 ÷ 5

Mean = 11

The Median

The value in the center (in the middle) of the data

24, 8, 4, 11, 8,

Put the data in order   4, 8, 8, 11, 24

Find the value in the middle   4, 8, (8), 11, 24

Median = 8

NOTE: If there is no single middle value find the mean of the two numbers left

The Mode (The modal value)

This is the number OR the item that occurs the most (it does not have to be numerical)

24, 8, 4, 11, 8,

This can still be easier if it the data is ordered first

4, 8, 8, 11, 24

Mode = 8

Choosing the appropriate average

The average should be a representative of the data set – so it should be compared to the set as a whole - to check if it is an appropriate average

Here are the weekly wages of a small firm

| £240 | £240 | £240 | £240 | £240 |
| £260 | £260 | £300 | £350 | £700 |

Which average best represents the weekly wage?

The Mean = £307
The Median = £250
The Mode = £240

Put the data back into context
Mean/Median – too high (most of this company earn £240)
Mode is the best average that represents this wage

It is likely that the salaries above £240 are more senior staff members – their salary doesn't represent the average weekly wage of the majority of employers

Identify outliers

Outliers are values that stand well apart from the rest of the data

Outliers can have a big impact on range and mean. They have less impact on the median and the mode

Sometimes it is best to not use an outlier in calculations

Height in cm
152 150 142 158 (182) 151 153 149 156 160 151 144

Where an outlier is identified try to give it some context.
This is likely to be a taller member of the group.
Could the be an older student or a teacher?
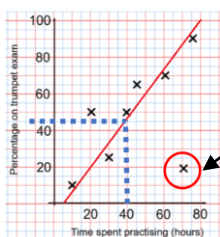
Outliers can also be identified graphically e.g. on scatter graphs

Comparing distributions

Comparisons should include a statement of average and central tendency, as well as a statement about spread and consistency.

Here are the number of runs scored last month by Lucy and James in cricket matches
Lucy: 45, 32, 37, 41, 48, 35
James: 60, 90, 41, 23, 14, 23

Lucy
Mean: 39.6 (1dp), **Median**: 38 **Mode**: no mode, **Range**: 16
James
Mean: 41.8 (1dp), **Median**: 32, **Mode**: 23, **Range**: 76

James has two extreme values that have a big impact on the range

"James is less consistent that Lucy because his scores have a greater range. Lucy performed better on average because her scores have a similar mean and a higher median"