Year 8
Knowledge Organisers

Block: Summer 1
Developing geometry

- Angles in parallel lines and polygons
- Area of trapezia and circles
- Line symmetry and reflection

YEAR 8 - DEVELOPING GEOMETRY...

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 (R)

Acute Angles
0° < angle < 90°

Right Angles
90°

Obtuse
90° < angle < 180°

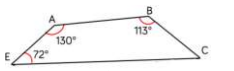
Right angle notation

Reflex
180° < angle < 360°

Straight Line
180°

Vertically opposite angles
Equal
Angles around a point
360°

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



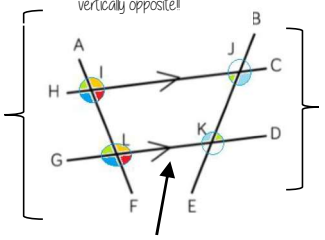
Angle Notation: three letters ABC
This is the angle at B = 113°
Line Notation: two letters EC
The line that joins E to C

Parallel lines

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

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

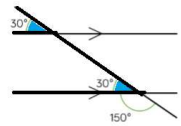
Corresponding angles often identified by their **"F shape"** in position



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

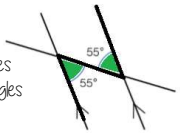
This notation identifies parallel lines

Alternate/ Corresponding angles

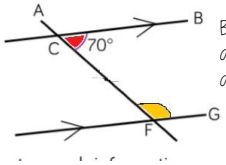


Because alternate angles are equal the highlighted angles are the same size

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

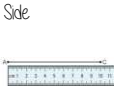
Triangles & Quadrilaterals

Link to steps (R)

Side, Angle, Side

Side, Angle, Side

Side, Side, Side

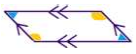


Properties of Quadrilaterals

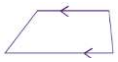
Square
All sides equal size
All angles 90°
Opposite sides are parallel

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

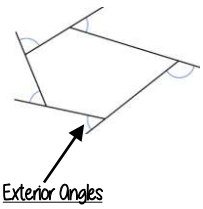


Trapezium
One pair of parallel lines

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

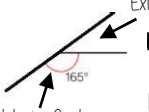
Sum of exterior angles

Exterior angles all add up to 360°



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

Using exterior angles



Exterior Angle

Interior Angle

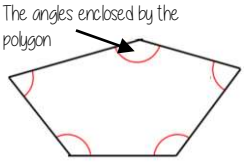
Interior angle + Exterior angle = straight line = 180°
Exterior angle = 180 − 165 = **15°**

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

Sum of interior angles

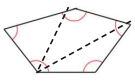
(number of sides − 2) x 180

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 = $\frac{(\text{number of sides} - 2) \times 180}{\text{number of sides}}$

YEAR 8 - DEVELOPING GEOMETRY...

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

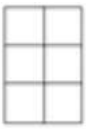
Keywords

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.

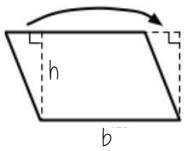
Area – rectangles, triangles, parallelograms

R

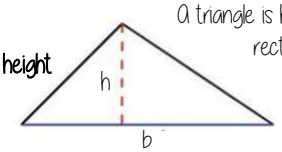
Rectangle
Base x Height



Parallelogram/ Rhombus
Base x Perpendicular height



Triangle
½ x Base x Perpendicular height

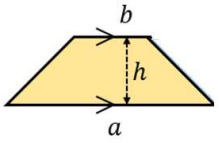


A triangle is half the size of the rectangle it would fit in

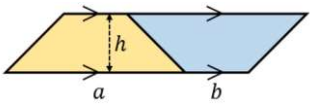
Area of a trapezium

Area of a trapezium

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



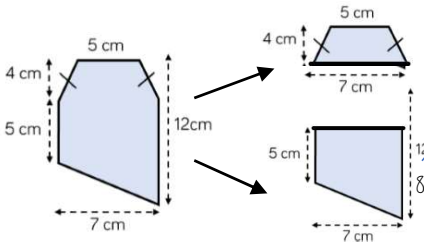
Why?



- 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.



Shape A - Isosceles trapezium

Shape B- nonstandard trapezium

Units

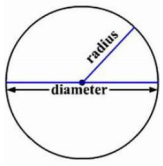
Shape A + Shape B = total area

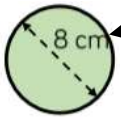
$\frac{(5+7)\times 4}{2} + \frac{(5+8)\times 7}{2} = 24 + 45.5 = 69.5\text{cm}^2$

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

π x radius^2
$= \pi \times 4^2$
$= \pi \times 16$
$= 16\pi$ cm^2

Find the area of one quarter of the circle

Radius = 4cm

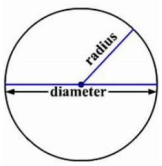
4 cm

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

Area of a circle (Calculator)

SHIFT ×10^x

Area of a circle
π x radius^2



How to get π symbol on the calculator

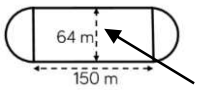
It is important to round your answer suitably – to significant figures or decimal places. This will give you a decimal solution that will go on forever!

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



This dimension is also the diameter of the semi circles

Arc lengths = π x 64
$= 64\pi$

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

Arc lengths + Straight lengths = total perimeter

$= 64\pi + 150 + 150$
$= (300 + 64\pi)$ m
OR = 501.1 m

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

YEAR 8 - DEVELOPING GEOMETRY...

Line symmetry and reflection

What do I need to be able to do?

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

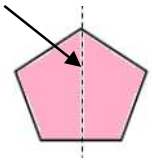
- Recognise line symmetry
- Reflect in a horizontal line
- Reflect in a vertical line
- Reflect in a diagonal line

Keywords

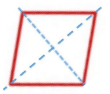
Mirror line: a line that passes through the center of a shape with a mirror image on either side of the line
Line of symmetry: same definition as the mirror line
Reflect: mapping of one object from one position to another of equal distance from a given line.
Vertex: a point where two or more-line segments meet.
Perpendicular: lines that cross at 90°
Horizontal: a straight line from left to right (parallel to the x axis)
Vertical: a straight line from top to bottom (parallel to the y axis)

Lines of symmetry

Mirror line (line of reflection)



Shapes can have more than one line of symmetry....
This regular polygon (a regular pentagon has 5 lines of symmetry)

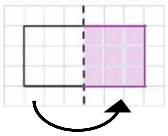


Rhombus
two lines of symmetry

Parallelogram
No lines of symmetry

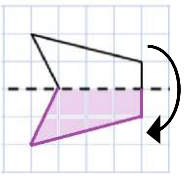
A circle has an infinite amount of lines of symmetry

Reflect horizontally/ vertically (1)



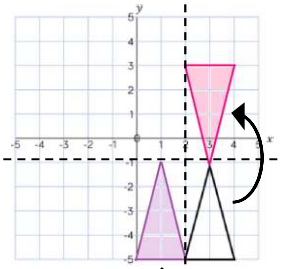
Note. a reflection doubles the area of the original shape

Reflection in a vertical line



Reflection in a horizontal line

Reflection on an axis grid

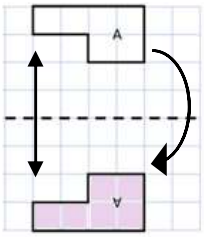


Reflection in the line y=-2

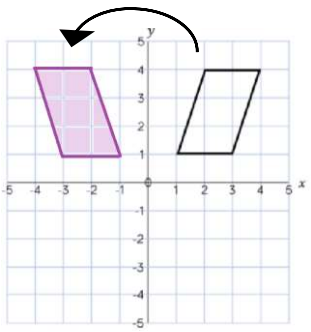
Reflection in the line x=2

Reflect horizontally/ vertically (2)

All points need to be the same distance away from the line of reflection



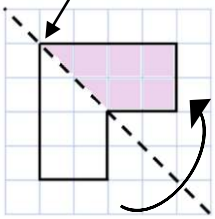
Reflection in the line y axis – this is also a reflection in the line x=0



Lines parallel to the x and y axis
REMEMBER
Lines parallel to the x-axis are y = _____
Lines parallel to the y-axis are x = _____

Reflect Diagonally (1)

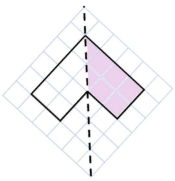
Points on the mirror line don't change position

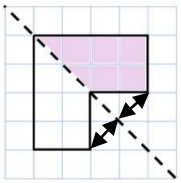


Fold along the line of symmetry to check the direction of the reflection

Turn your image

If you turn your image it becomes a vertical/ horizontal reflection (also good to check your answer this way)



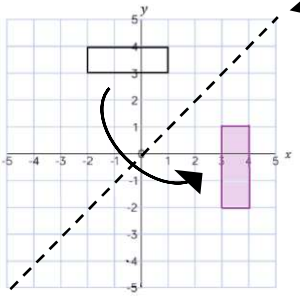


Drawing perpendicular lines

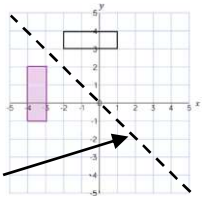
Perpendicular lines to and from the mirror line can help you to plot diagonal reflections

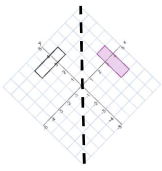
Reflect Diagonally (2)

This is the line **y = x** (every y coordinate is the same as the x coordinate along this line)



This is the line **y = - x**
The x and y coordinate have the same value but opposite sign





Turn your image

If you turn your image it becomes a vertical/ horizontal reflection (also good to check your answer this way)