

# YEAR 9 — REASONING WITH GEOMETRY... Deduction

@whisto\_maths

## What do I need to be able to do?

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

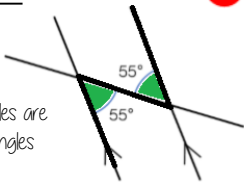
- Identify angles in parallel lines
- Solve angle problems
- Make conjectures with angles
- Make conjectures with shapes

## Keywords

- Parallel:** two straight lines that never meet with the same gradient  
**Perpendicular:** two straight lines that meet at  $90^\circ$   
**Transversal:** a line that crosses at least two other lines  
**Sum:** the result of adding two or more numbers  
**Conjecture:** a statement that might be true but is not proven  
**Equation:** a statement that says two things are equal  
**Polygon:** a 2D shape made from straight edges  
**Counterexample:** an example that disproves a statement

## Alternate angles

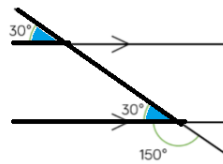
Because alternate angles are equal the highlighted angles are the same size



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## Corresponding angles

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

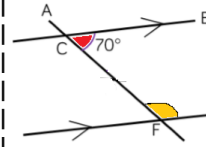


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## Co-interior angles

Because co-interior angles have a sum of  $180^\circ$  the highlighted angle is  $110^\circ$

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



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## Solving angle problems

### Angles on a straight line

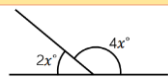


**Vertically opposite angles**  
Equal

**Angles around a point**  
 $360^\circ$



Link angle facts to algebra



$$2x + 4x = 180^\circ$$

Form an equation

State the reason

The sum of angles on a straight line is  $180^\circ$

Solve

$$2x + 4x = 180^\circ$$

$$6x = 180^\circ$$

$$x = 30^\circ$$

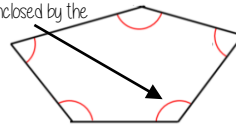


**Triangles**  
Sum of angles is  $180^\circ$

Isosceles have the same base angles

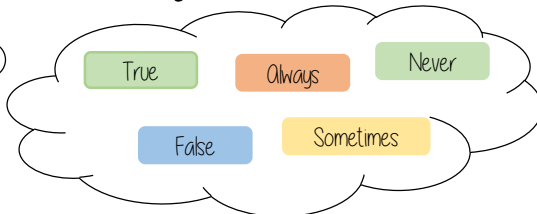
### Interior Angles

The angles enclosed by the polygon



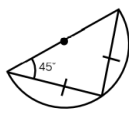
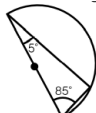
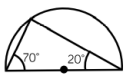
$$(\text{number of sides} - 2) \times 180$$

## Making conjectures with angles



### Proving a conjecture

A pattern is noticed for many cases



Apply the angle rules

The sum of angles in a triangle is  $180^\circ$

Test the theory

$$180 - 70 - 20 = 90$$

$$180 - 85 - 5 = 90$$

$$180 - 45 - 45 = 90$$

Make conjecture

The angle that meets the circumference in a semi circle is  $90^\circ$

### Disproving a conjecture

Only one counterexample is needed to disprove a conjecture

## Making conjectures with shapes

Keywords and facts to recall with shape

**Area:** the amount of space inside a shape  
**Perimeter:** the length around a shape  
**Regular Polygons:** All sides and angles are equal

### Quadrilateral Facts

**Square**  
All sides equal size  
All angles  $90^\circ$   
Opposite sides are parallel

**Rectangle**  
All angles  $90^\circ$   
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



### Kite

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