

## Geometry

### IGCSE Mathematics ■ Topic 4

IGCSE Mathematics



Geometry

## What we will cover

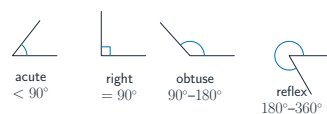
- 1 Angles & angle facts
- 2 Parallel-line angles
- 3 Triangles & polygons
- 4 Circle parts
- 5 Circle theorems
- 6 Bearings & similar shapes

# 1 Angles

Geometry

Angles

## Angle types

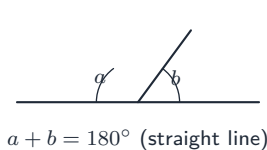


- Angles at a point add up to  $360^\circ$ .
- Angles on a straight line add up to  $180^\circ$ .
- **Vertically opposite angles** 对顶角 (made by two crossing lines) are equal.

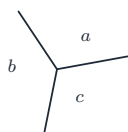
Geometry

Angles

## Angle facts



$$a + b = 180^\circ \text{ (straight line)}$$



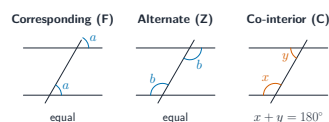
$$a + b + c = 360^\circ \text{ (round a point)}$$

Angles on a line add to  $180^\circ$ ; around a point to  $360^\circ$ ; **vertically opposite** 对顶角 angles are equal. Always **give the reason**.

Geometry

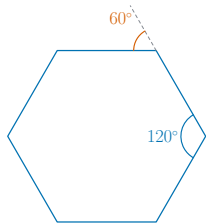
Angles

## Parallel-line angles



- **Corresponding angles** 同位角 (in matching positions, an "F" shape) are equal.
- **Alternate angles** 内错角 (opposite sides of the crossing line, a "Z" shape) are equal.
- **Co-interior angles** 同旁内角 (a "C" shape) add up to  $180^\circ$ ; we say they are **supplementary** 互补.

## Triangles and polygons



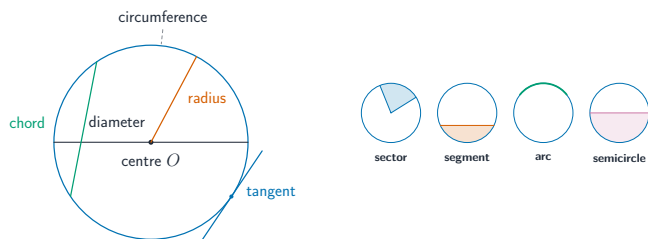
$$\text{interior} + \text{exterior} = 180^\circ$$

- A shape has **line symmetry** 轴对称 if a mirror line splits it into two matching halves.
- A shape has **rotational symmetry** 旋转对称 if it fits onto itself as you turn it. The order is how many times it fits in one full turn.

# 2

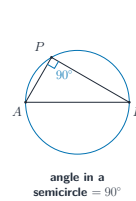
## Circles

## Circle parts

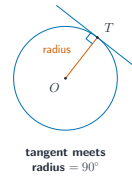


radius 半径, diameter 直径, chord 弦, tangent 切线; a sector 扇形 is a slice, a segment 弓形 is cut off by a chord.

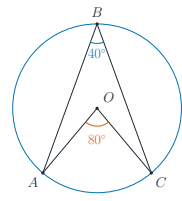
## Circle theorems



angle in a semicircle =  $90^\circ$



tangent meets radius =  $90^\circ$



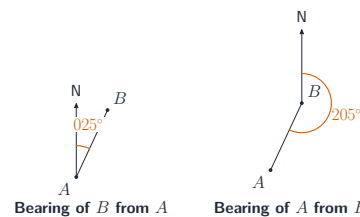
angle at centre =  $2 \times$  angle at circumference

Angle in a semicircle 半圆 =  $90^\circ$ ; tangent  $\perp$  radius. The angle at the centre is **twice** the angle at the circumference.

# 3

## Bearings and similarity

## Bearings



Bearing of  $B$  from  $A$

Bearing of  $A$  from  $B$

A **bearing** 方位角 is measured **clockwise from north**, written with **three** digits. So due east is  $090^\circ$  and south-west is  $225^\circ$ .

## Similar shapes

length  
 $\times k$

area  
 $\times k^2$

volume  
 $\times k^3$

**Similar** 相似 shapes have the same angles & sides  $\times$  a **scale factor** 比例因子  $k$ .  
(**Congruent** 全等 = identical.)

## Quadrilaterals, symmetry and solids

**quadrilaterals** 四边形  
angles sum to  $360^\circ$ :  
square, rectan-  
gle, rhombus, kite

**symmetry** 对称  
lines of reflection;  
order of rota-  
tional symmetry

**nets & solids** 展开图  
a net folds into a  
solid; add the faces  
for surface area

A **net** 展开图 is the key to surface area – unfold the solid, find each face's area, add them.

# 4

## Recap

## Worked example – angles on a straight line

Three angles on a straight line are  $x$ ,  $50^\circ$  and  $70^\circ$ . Find  $x$ .

- Angles on a straight line add to  $180^\circ$ .
- $x + 50 + 70 = 180$
- $x + 120 = 180$
- $x = 60^\circ$

Learn the four: straight line  $180^\circ$ , point  $360^\circ$ , tri-  
angle  $180^\circ$ , quadrilateral  
 $360^\circ$ . In an exam, name  
the rule you used – it car-  
ries a mark.

## Topic 4 – key takeaways

### 1 Parallel

F equal, Z equal, C add to  $180^\circ$

### 2 Polygons

interior sum  $(n - 2) \times 180^\circ$

### 3 Circles

semicircle  $90^\circ$ ; centre =  $2 \times$   
circumference

### 4 Similar

area  $\times k^2$ , volume  $\times k^3$

## Check yourself

- What do co-interior (C) angles add up to?
- What is each exterior angle of a regular hexagon?
- What is the angle in a semicircle?
- If lengths scale by  $k$ , how does volume scale?



**Answers** 1.  $180^\circ$  2.  $60^\circ$  3.  $90^\circ$  4. by  $k^3$