

Geometry

IGCSE Mathematics ■ Topic 4

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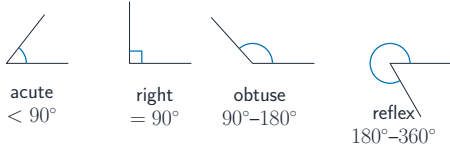
Geometry

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

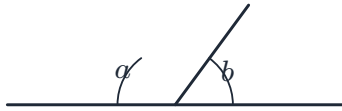
1 Angles

Angle types

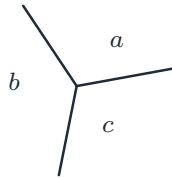


- Angles at a point add up to 360° .
- Angles on a straight line add up to 180° .
- **Vertically opposite angles** 对顶角 (made by two crossing lines) are equal.

Angle facts



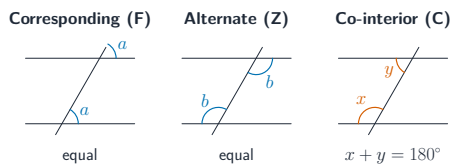
$$a + b = 180^\circ \text{ (straight line)}$$



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

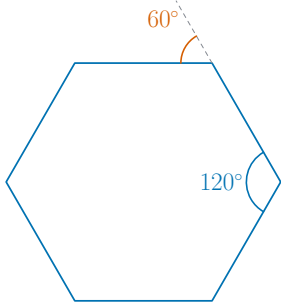
Angles on a line add to 180° ; around a point to 360° ; **vertically opposite** 对顶角 angles are equal. Always [give the reason](#).

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° ; we say they are **supplementary** 互补.

Triangles and polygons

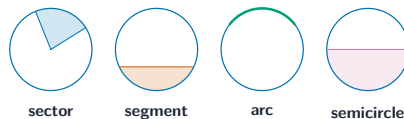
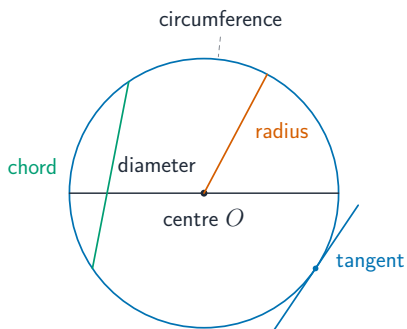


$$\text{interior} + \text{exterior} = 180^\circ$$

- 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.

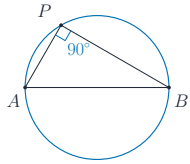
2 Circles

Circle parts

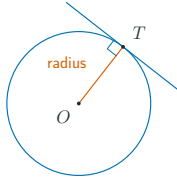


radius 半径, **diameter** 直径, **chord** 弦, **tangent** 切线; a **sector** 扇形 is a slice, a **segment** 弓形 is cut off by a chord.

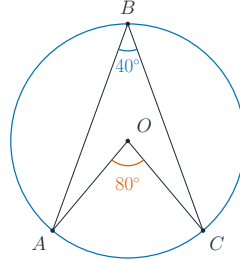
Circle theorems



angle in a
semicircle = 90°



tangent meets
radius = 90°

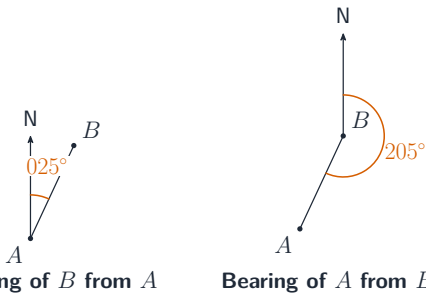


angle at centre = $2 \times$ angle at circumference

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

3 Bearings and similarity

Bearings



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

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° :
square, rectangle, rhombus, kite

symmetry 对称
lines of reflection;
order of rotational 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.

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Recap

Worked example – angles on a straight line

Three angles on a straight line are x , 50° and 70° . Find x .

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

Learn the four: straight line 180° , point 360° , triangle 180° , quadrilateral 360° . In an exam, name the rule you used – it carries a mark.

Topic 4 – key takeaways

1 Parallel

F equal, Z equal, C add to 180°

2 Polygons

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

3 Circles

semicircle 90° ; centre = $2 \times$ circumference

4 Similar

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

Check yourself

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



Answers 1. 180° 2. 60° 3. 90° 4. by k^3