

E4.7 Circle theorems I

Name: _____ Class: _____ Date: _____

Total: 20 marks

KEY WORDS cyclic quadrilateral 圆内接四边形 • circle theorems 圆定理
 • alternate segment theorem 弦切角定理 • circle 圆 • centre 圆心

Objective

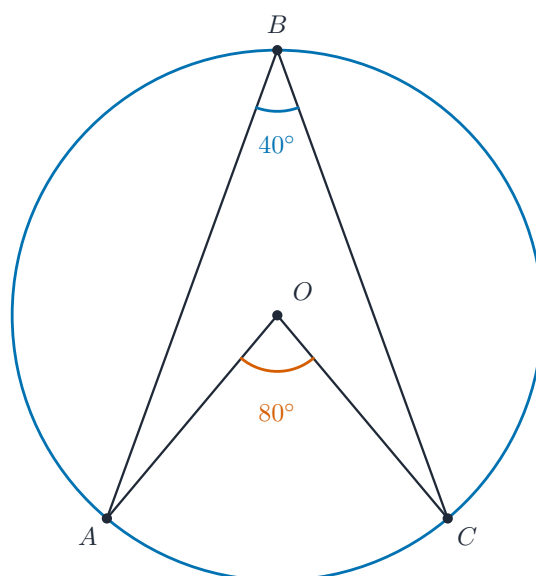
Build the skills to answer Extended exam questions on **circle theorems** 圆定理 — the angle at the **centre**, angles in the **same segment**, the **cyclic quadrilateral** 圆内接四边形, and the semicircle/tangent facts. Always **give a reason**.

You must be able to:

- use “angle at the centre = twice the angle at the circumference”
- use “angles in the same segment are equal” and the cyclic-quadrilateral rule
- use the semicircle and tangent–radius right angles

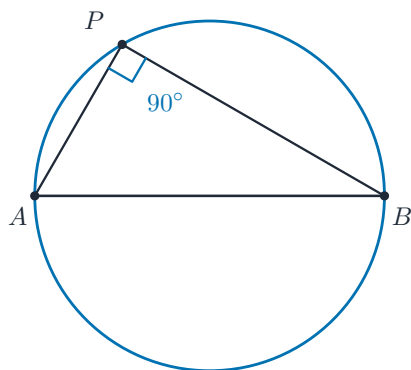
1 Worked examples

■ Circle theorems

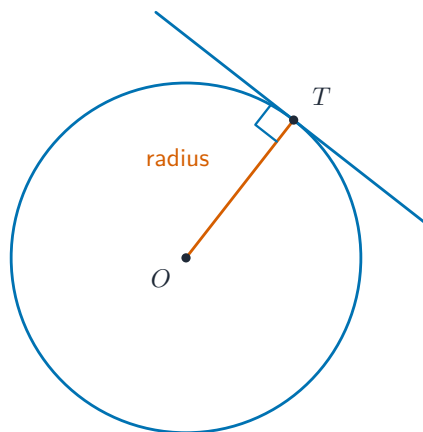


angle at centre = $2 \times$ angle at circumference

Standing on the same arc



angle in a
semicircle = 90°



tangent meets
radius = 90°

Further circle theorems: angle in a semicircle and the tangent

- Angle at **centre** = $2 \times$ angle at **circumference** (same arc).
- Angles in the **same segment** are equal; opposite angles of a **cyclic quadrilateral** add to 180° .
- Angle in a **semicircle** = 90° ; tangent meets radius at 90° .
- **Worked:** circumference angle $40^\circ \rightarrow$ centre angle = $2 \times 40 = 80^\circ$.

Answer shapes: M1 a correct method, A1 the correct answer.

2 Practice

2.1 The angle at the circumference standing on an arc is 35° . Find the angle at the centre on the same arc. [1]

2.2 A triangle is drawn with one side a diameter. State the angle at the point on the circle. [1]

2.3 In a cyclic quadrilateral, one angle is 85° . Find the opposite angle. [2]

3 Exam-style questions

3.1 A, B, C lie on a circle, centre O . The angle AOC at the centre is 130° . Find the angle ABC at the circumference, giving a reason. [2]

3.2 $PQRS$ is a cyclic quadrilateral. Angle $PQR = 95^\circ$ and angle $QRS = 70^\circ$. Find angles PSR and SPQ . [3]

3.3 A , B , C and D lie on a circle with centre O . BD is a diameter. Angle $BAC = 32^\circ$ and angle $ADB = 54^\circ$.

(a) Write down, with a reason, the size of angle BCD . [2]

(b) Find angle BDC , giving your reason. [2]

(c) Find angle ABD , showing your working. [2]

(d) Find angle AOC , giving a reason. [2]

(e) TC is a tangent to the circle at C . Find the angle between TC and the chord CD , naming the theorem you use. [3]
