

Circles

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Name: _____

Date: _____

At a glance

Circle vocabulary and every circle theorem, with the reasons examiners want.

1. Circle words
2. Right angles in circles
3. Angles at the centre and circumference
4. Alternate segment theorem
5. Writing reasons

1. Circle words

☐ I revised this

- **Radius:** centre to edge. **Diameter:** across through the centre ($2 \times$ radius).
- **Chord:** a line joining two points on the circle. **Tangent:** a line touching the circle at one point.
- **Arc:** part of the circumference. **Sector:** a 'pizza slice'. **Segment:** area between a chord and the arc.

Worked example

What is the line from the centre to the point where a tangent touches?

1. It is a radius.

A radius (it meets the tangent at 90°)

2. Right angles in circles

☐ I revised this

- The **angle in a semicircle** is 90° (angle at the circumference standing on a diameter).
- A **tangent meets the radius** at 90° .
- **Tangents from an external point** are equal in length (look for an isosceles triangle or a kite).
- The **perpendicular from the centre to a chord bisects** the chord.

Worked example

AB is a diameter and C is on the circle. Angle $CAB = 35^\circ$. Find angle CBA.

1. Angle $ACB = 90^\circ$ (angle in a semicircle).
2. $180 - 90 - 35$.

55°

3. Angles at the centre and circumference

☐ I revised this

- The **angle at the centre** is twice the angle at the circumference standing on the same arc.
- **Angles in the same segment** (standing on the same chord, same side) are equal.
- **Opposite angles of a cyclic quadrilateral** add to 180° .

Worked example

O is the centre. Angle $AOC = 140^\circ$. B is on the major arc and D on the minor arc. Find angle ADC.

1. Angle $ABC = 70^\circ$ (angle at the centre is twice the angle at the circumference).
2. ABCD is cyclic, so angle $ADC = 180 - 70$.

110°

4. Alternate segment theorem

☐ I revised this

- The angle between a tangent and a chord equals the angle in the **alternate segment** (on the other side of the chord).
- Spot it: a tangent, a chord from the point of contact, and a triangle drawn in the circle.

Worked example

A tangent at T makes 58° with chord TA. B is on the circle in the alternate segment. Find angle TBA.

1. Alternate segment theorem.

58°

5. Writing reasons

☐ I revised this

- Name the theorem every time: 'angle in a semicircle', 'angle at the centre is twice the angle at the circumference', 'opposite angles of a cyclic quadrilateral add to 180° ', 'tangent perpendicular to radius', 'alternate segment theorem'.
- Radii are equal $\rightarrow$ isosceles triangles: use them to find base angles.

Where to start

1. Mark radii and tangents on the diagram.
2. Look for right angles first.
3. Look for isosceles triangles.
4. Then centre/circumference, same segment, cyclic quadrilateral, alternate segment.

Worked example

Tangents from P touch the circle at A and B. Angle APB = 50° . Find angle PAB.

1. PA = PB (tangents from a point).
2. Triangle PAB is isosceles: $(180 - 50) \div 2$.

65°

Common mistakes

Don't write	Write instead
$\times$ Angle at circumference = $2 \times$ angle at centre	$\checkmark$ It's the other way: centre = $2 \times$ circumference
$\times$ Cyclic quadrilateral rules with the centre as a corner	$\checkmark$ All four corners must be on the circle
$\times$ Giving the angle without a reason	$\checkmark$ Each step needs the theorem named
$\times$ Assuming a line is a diameter	$\checkmark$ Only if it goes through the centre

In the exam

- Diagrams are not to scale — use theorems, never measure.
- Find the easy angles first (right angles, isosceles), then the theorems.
- Learn the exact wording of each theorem for the 'give a reason' marks.

My notes