Circle Theorems & Solids

Amari Cross & Matthew Williams • Math • May 6, 2026

Circle theorem questions are usually reasoning questions in disguise. You are not only calculating an angle; you are proving that a particular relationship must be true because of the way points, chords, tangents, and arcs are arranged.

Solids questions test whether you can connect a 3D object to its faces, edges, vertices, surface area, or volume. In Paper 02, diagrams may combine several ideas, so label the diagram, identify the theorem or formula, and then calculate. A clear sentence explaining the chosen rule can protect marks even if arithmetic goes wrong later.

Basic Definitions

Circle vocabulary tells you which theorem or formula is relevant. For example, a tangent question uses different facts from a chord or arc question.

- **Arc:** Part of the circumference
- **Chord:** Line segment joining two points on circle
- **Sector:** Region bounded by two radii and an arc
- **Segment:** Region bounded by a chord and arc
- **Tangent:** Line touching circle at exactly one point

Key Theorems

Circle theorems are relationships that are always true in a circle. In Paper 02, quote the theorem as your reason before or after calculating the angle.

Theorem 1: Angle at center is twice angle at circumference (for same arc)

$$\text{Angle at center} = 2 \times \text{Angle at circumference}$$

Theorem 2: Angle in semicircle is 90°

(Angle subtended by diameter at any point on circle is a right angle)

Theorem 3: Angles in same segment are equal

(All angles subtended by same arc on same side are equal)

Theorem 4: Opposite angles in cyclic quadrilateral sum to 180°

(Quadrilateral with all vertices on circle; opposite angles supplementary)

Theorem 5: Tangent perpendicular to radius

(Tangent to circle ¥adius at point of contact)

Theorem 6: Two tangents from external point are equal

(If two tangent lines from outside point touch circle, they have same length)

Theorem 7: Alternate segment theorem

(Angle between tangent and chord = angle in alternate segment)

Applying Circle Theorems

Before calculating, identify the arc, chord, tangent, or cyclic quadrilateral involved. The diagram usually contains more information than the numbers alone.

> 📋 **Example**
> **In circle, arc AB subtends angle 50° at center. Find angle at point C on circumference:**
> By Theorem 1:
> [MathBlock]
> \text{Angle at C} = \frac{50°}{2} = 25°
> [/MathBlock]

Part 13: Solids

Types of Solids

Solids are 3D objects, so describe them using faces, edges, vertices, surface area, and volume. A net can help you see all the faces that make up the surface.

- **Prism:** Two parallel identical faces (bases), with rectangular faces connecting them
- Triangular prism, rectangular prism (cuboid), cylinder
- **Pyramid:** Polygonal base with triangular faces meeting at apex
- Triangular pyramid (tetrahedron), square pyramid, etc.
- **Cylinder:** Two circular bases, curved side surface
- **Cone:** Circular base with apex connected by curved surface

- **Sphere:** All points equidistant from center

Euler's Formula

Euler's formula connects the structure of many solids. It is a quick way to check whether your count of faces, vertices, or edges is consistent.

For any polyhedron (solid with flat faces):

V - E + F = 2

Where [Math: V] = vertices, [Math: E] = edges, [Math: F] = faces

> 📋 **Example**
> **Cube:** [Math: V = 8], [Math: E = 12], [Math: F = 6]
> Check: [Math: 8 - 12 + 6 = 2]