

Circle Theorems & Solids

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 \perp radius 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:

$$\text{Angle at C} = \frac{50^\circ}{2} = 25^\circ$$

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 V = vertices, E = edges, F = faces

Example

Cube: $V = 8$, $E = 12$, $F = 6$

Check: $8 - 12 + 6 = 2$