Angles and geometrical reasoning

Leaving Certificate · Ordinary Level

Understand the idea

How to start

An angle measures a turn. A straight angle is 180° and a full turn is 360°.

1. Mark the angle you need and the angles you know.
2. Name the angle fact that links them.
3. Write an equation or subtraction using that fact, then calculate.

Key terms & definitions

Axiom
An accepted starting statement in a mathematical system.

Theorem
A statement established by reasoning from accepted facts.

Converse
A statement made by reversing the condition and conclusion.

Corollary
A result that follows from a theorem.

Key ideas

• Angles on a straight line total 180°; angles around a point total 360°. Vertically opposite angles are equal.

• The interior angles of a triangle total 180°. An exterior angle equals the sum of the two opposite interior angles.

• With parallel lines, corresponding angles are equal, alternate angles are equal, and interior angles on the same side total 180°.

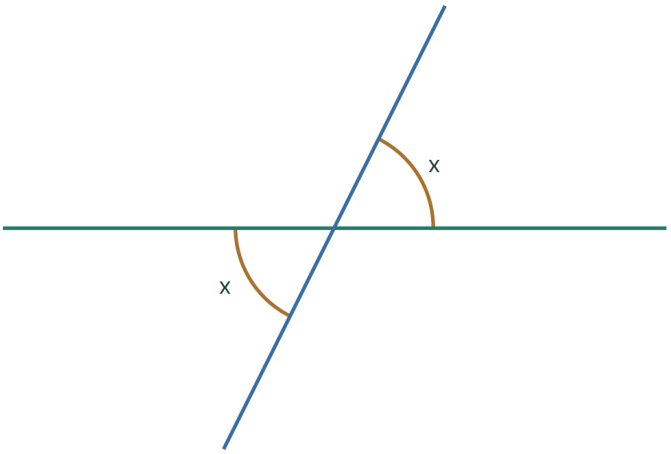
• An isosceles triangle has equal base angles; the converse also holds. An equilateral triangle has three equal sides and three 60° angles.

• An axiom is accepted as a starting point. A theorem is justified from earlier results. A converse reverses a statement and needs its own justification.

• Give a reason for each angle step. A diagram looking equal or parallel is not enough evidence.

• The five starting axioms concern the unique line through two distinct points, measurement of length, measurement of angles, triangle congruence and the unique parallel through a point off a line. Use them as agreed starting facts.

• Understand and explain reasoning, including what each step relies on. Formal theorem proofs are not examined as memorised reproductions.



Vertically opposite angles are equal. Each is supplementary to the same adjacent angle.

Quick reminder

• Name the angle fact before calculating.

• Line : 180°. Point : 360°. Triangle : 180°.

• Parallel-line rules require parallel lines.

Worked examples

Example 01 · Angles on a line, at a point and vertically opposite

Two angles lie on a straight line. One of them is 33°. What is the other angle?

Why this method?

Identify the angle fact and check its conditions. Use it to write an equation for the unknown angle.

$x + 33^\circ = 180^\circ$

Step 1

Let x be the missing angle. Angles making a straight line add to 180°.

$x = 180^\circ - 33^\circ$	**Step 2** Subtract the known angle from the straight angle.
$x = 147^\circ$	**Step 3** Calculate the missing angle.
$147^\circ + 33^\circ = 180^\circ$	**Step 4** Check the two angles make a straight angle.

Think about it: Before moving on: why do vertically opposite angles have to be equal, and not just add to 180°?

Example 02 · Angles in a triangle

A triangle has angles of 61° and 24°. What is the third angle?

Why this method?

Identify the angle fact and check its conditions. Use it to write an equation for the unknown angle.

$180^\circ - 61^\circ - 24^\circ = 95^\circ$	**Step 1** The angles of a triangle add up to 180°

Think about it: Why do we subtract both known angles from 180° to find the third angle?

Example 03 · Angles with parallel lines

Two parallel lines are cut by a transversal. One of the angles formed is 42°. What is the alternate angle to it?

Why this method?

Identify the angle fact and check its conditions. Use it to write an equation for the unknown angle.

$42^\circ = 42^\circ$	**Step 1** Alternate and corresponding angles are equal for parallel lines

Think about it: Before moving on: how can you tell whether two angles are alternate, corresponding or co-interior?

Example 04 · Use the exterior angle theorem

An exterior angle is 126°. One remote interior angle is 58°. Find the other.

$58^\circ + x = 126^\circ$	**Step 1** The exterior angle equals the sum of the two remote interior angles.
$x = 68^\circ$	**Final step** Subtract 58°.

Common mistake

Assuming angles are equal just because two lines look parallel. Corresponding and alternate-angle equalities require parallel lines. Use the given parallel marks or establish that the lines are parallel first.

Exam technique

Write the angle fact beside the calculation rather than giving an unexplained number.

Try it yourself

Work on paper before checking the answers at the end. These questions are for self-checking, not submitted homework.

Question 1

Two angles lie on a straight line. One of them is 125°. What is the other angle?

Question 2

A triangle has angles of 115° and 20°. What is the third angle?

Watch an explanation

Cognito — 5 Simple Angle Rules

Cognito — Alternate, Corresponding & Allied Angles

Open the website chapter to load the embedded players. Use the rates and rules in your question for financial examples.

Self-check answers

Question 1

55

Question 2

45

Open the full chapter online