

GRADE 11 STUDY GUIDE | 2024

Euclidean Geometry

Mathematics

1. Parallel Lines (Revision)

When two parallel lines are cut by a transversal:

- Corresponding angles are EQUAL (F-shape)
- Alternate angles are EQUAL (Z-shape)
- Co-interior (same-side interior) angles are SUPPLEMENTARY (sum to 180 deg)

KEY: ALWAYS give a reason in brackets when stating geometric facts, e.g. "angles on a straight line" or "vert. opp. angles".

2. Triangles

Important Properties

- Sum of interior angles of a triangle = 180 deg
- Exterior angle = sum of two non-adjacent interior angles
- Sides opposite equal angles are equal (and vice versa)
- Pythagoras: In a right triangle, $\text{hyp}^2 = \text{leg1}^2 + \text{leg2}^2$

Congruence (same shape AND size)

- SSS: three sides equal
- SAS: two sides and the included angle equal
- AAS: two angles and a corresponding side equal
- RHS: right angle, hypotenuse and one side equal

Similarity (same shape, different size)

- AAA (AA): two pairs of equal angles
- SSS: three pairs of sides in proportion
- SAS: two pairs of sides in proportion AND included angle equal

KEY: In similar triangles, corresponding sides are in the same ratio and corresponding angles are equal.

3. Quadrilaterals

Properties of special quadrilaterals:

- Parallelogram: opp sides parallel & equal; opp angles equal; diagonals bisect each other

Rectangle: parallelogram + all angles 90 deg; diagonals equal

- Rhombus: parallelogram + all sides equal; diagonals bisect at right angles; diagonals bisect angles
- Square: rectangle + rhombus (all properties of both)
- Trapezium: ONE pair of parallel sides
- Kite: two pairs of adjacent sides equal; one diagonal bisects the other at right angles; one pair of opp angles equal

4. Circle Theorems

Theorem 1: Angle at Centre

The angle subtended by an arc at the centre of a circle is DOUBLE the angle subtended by the same arc at any point on the circumference (on the same side of the chord).

Theorem 2: Angles in the Same Segment

Angles inscribed in the same segment of a circle (subtended by the same chord) are EQUAL.

Theorem 3: Angle in a Semicircle

The angle subtended by a diameter at the circumference is 90 deg.

Theorem 4: Cyclic Quadrilateral

Opposite angles of a cyclic quadrilateral are SUPPLEMENTARY (sum to 180 deg).

Theorem 5: Tangent-Chord Angle (Tan-Chord)

The angle between a tangent to a circle and a chord drawn from the point of tangency equals the inscribed angle on the opposite side of the chord (alternate segment theorem).

Theorem 6: Tangent Properties

A tangent to a circle is perpendicular to the radius at the point of tangency. Tangents drawn from an external point are equal in length.

KEY: In a RIDER (proof question): always start from what you are GIVEN. State each step as a fact + reason. Work logically toward what you need to PROVE.

5. Proportion & Midpoint Theorems

Midpoint Theorem: The line joining the midpoints of two sides of a triangle is parallel to the third side and half its length.

Basic Proportionality (Side Splitter): A line parallel to one side of a triangle divides the other two sides proportionally.