

Grade 12 Mathematics: Euclidean Geometry Study Guide

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Free Study Resources for South African Matric Learners

1. Circle Theorems (Grade 11 Revision)

- Angle at centre = twice angle at circumference (same arc)
- Angles in the same segment are equal
- Angle in a semi-circle = 90 deg
- Opposite angles of cyclic quadrilateral are supplementary (add to 180 deg)
- Exterior angle of cyclic quad = interior opposite angle
- Tangent $\perp$ radius at point of contact
- Two tangents from external point are equal in length

2. Grade 12 Geometry Theorems

Proportion Theorem (Basic Proportionality)

A line drawn parallel to one side of a triangle divides the other two sides proportionally.

If $DE \parallel BC$ in $\triangle ABC$, then $AD/DB = AE/EC$.

Midpoint Theorem

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

Similar Triangles (AAA / SSS / SAS)

Triangles are similar if:

- All corresponding angles are equal (AAA)
- All corresponding sides are proportional (SSS)
- Two pairs of sides proportional with equal included angle (SAS)

If $\triangle ABC \sim \triangle DEF$:

$$AB/DE = BC/EF = AC/DF$$

And:

$$\text{Area}(ABC)/\text{Area}(DEF) = (AB/DE)^2$$

3. Pythagoras & Similar Triangles

In a right-angled triangle, the square on the hypotenuse equals the sum of the squares on the other two sides.

Using similar triangles in a right-angled $\triangle$ (altitude drawn to hypotenuse h from right angle to hypotenuse):

$$h^2 = p \cdot q \quad (\text{where } p, q \text{ are parts of hypotenuse})$$

$$a^2 = p \cdot c$$

$$b^2 = q \cdot c$$

4. Exam Proof Strategy

1. Draw and label a clear diagram
2. State what needs to be proven
3. Give reasons in brackets [] or () after each statement
4. Use correct notation: $\parallel$ for parallel, $\perp$ for perpendicular, $\triangle$ for triangle
5. Quote theorems by their full name

TIP Common reasons to quote: "angles in same segment", "opp angles of cyclic quad", "tan-chord angle = angle in alt seg", "prop theorem, $DE \parallel BC$ "