

Geometry 1 : Axioms, Theorems, Corollaries

Prerequisite Knowledge:
Junior cycle Geometry

Tips for students:

To find an example of a proof by contradiction see Number Theory 3.

LEARNING WORK:

- Axioms
- Corollaries 1-5
- Theorems 1-21
- Converse of a theorem
- Proof by contradiction

Content covered:

Axioms:

- **Axiom 1:** There is exactly one line through any two given points.
- **Axiom 2:** The distance between points, $|AB|$, is never negative.
- **Axiom 3:** A straight angle is 180°
- **Axiom 4:** If two triangles have:
 - (i) two pairs of equal angles and one pair of equal sides,
 - (ii) two pairs of equal sides and one pair of equal angles,
 - (iii) three pairs of equal sides,then the triangles are congruent.
- **Axiom 5:** Given any line l and a point P , there is exactly one line through P that is parallel to l .

Content covered:

Theorems and corollaries:

- **Theorem 1:** Vertically opposite angles are equal in measure
- **Theorem 2:** Isosceles Triangle Theorem
- **Theorem 3:** Alternate angles Theorem
- **Theorem 4:** The three angles in a triangle add up to 180°
- **Theorem 5:** Corresponding angles Theorem
- **Theorem 6:** The exterior angle in a triangle is equal to the sum of the two interior opposite angles
- **Theorem 7:** The largest angle in a triangle is opposite the largest side
- **Theorem 8:** Given a triangle with sides a, b, c :
 - (i) $a + b > c$
 - (ii) $b + c > a$
 - (iii) $a + c > b$
- **Theorem 9:** In a parallelogram opposite sides and opposite angles are equal in measure
 - **Corollary 1:** A diagonal divides a paralleolgram into two congruent triangles
- **Theorem 10:** The diagonals of a parallelogram bisect each other
- **Theorem 11:** If three parallel lines cut off equal segments on some transversal line, then they will cut off equal segments on any other transversal line.
- **Theorem 12:** Given the triangle abc if l is a line parallel to BC and cuts the line $[AB]$ into a ratio of $s : t$ then it will also cut the line $[AC]$ into the ratio $s : t$.
- **Theorem 13:** Similar triangles theorem

Content covered:

Theorems and corollaries:

- **Theorem 14:** Pythagoras Theorem
- **Theorem 15:** Converse of pythagoras theorem.
- **Theorem 16:** For a triangle, when using the formula $\text{Area} = \text{base} \times \text{perpendicular height}$, it doesn't matter which side we take as the base.
- **Theorem 17:** A diagonal of a pasrallelogram bisects the area.
- **Theorem 18:** The area of a paralelogram is calculated as:

 $\text{base} \times \text{perpendicular height}.$
- **Theorem 19:** The angle at the centre of a circle standing on a given arc is twice the size of the angle at the edge of the circle standing on the same arc
 - **Corollary 2:** All angles at the edge of a circle standing on the same arc are equal in measure
 - **Corollary 3:** An angle at the edge of a circle standing on a diameter is 90° .
 - **Corollary 4:** If an angle at the edge of a circle is 90° then it must be standing on a diameter of the circle.
 - **Corollary 5:** If $abcd$ is a cyclic quadrilateral then opposite angles add up to 180°
- **Theorem 20:** At the point of contact, a tangent of a circle is perpendicular to the radius of the circle
 - **Corollary 6:** If two circles share a common tangent at any point, then the point and the centre of each circle are collinear.
- **Theorem 21:** A radius of a circle perpendicular to a chord of the circle, bisects the chord.