

CHAPTER TEST: INTRODUCTION TO EUCLID'S GEOMETRY

Mathematics | Class IX (2026/EUCLID/09/LongAns/001)

Time: 1 Hour

Max. Marks: 25

DETAILED SOLUTIONS: EUCLID'S GEOMETRY

Mathematics | Class IX | SET – 1

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Q1. Theorem: Two distinct lines cannot have more than one point in common.

Proof (Method of Contradiction):

- Let us assume that two distinct lines l and m have **two** distinct points in common, say P and Q .
- This means that both lines l and m pass through the same two points P and Q .
- However, this contradicts **Euclid's Postulate 1** (as interpreted through Axiom 5.1), which states that: "*Given two distinct points, there is a unique line that passes through them.*"
- Since our assumption leads to the existence of two different lines passing through the same two points, the assumption must be wrong.
- **Conclusion:** Two distinct lines cannot have more than one point in common.

Q2. Given: $AC = BD$.

To Prove: $AB = CD$.

Proof:

- From the figure, point B lies between A and C . Therefore, $AC = AB + BC$ (Axiom 4: Things which coincide with one another are equal to one another).
- Similarly, point C lies between B and D . Therefore, $BD = BC + CD$.
- We are given that $AC = BD$.
- Substituting the values, we get: $AB + BC = BC + CD$.
- According to **Euclid's Axiom 3**: "*If equals are subtracted from equals, the remainders are equal.*"
- Subtracting BC from both sides: $(AB + BC) - BC = (BC + CD) - BC$.
- **$AB = CD$. Hence Proved.**

Q3. Construction of Equilateral Triangle:

Steps of Construction:

- (i) Let AB be the given line segment of any length.
- (ii) Draw a circle with center A and radius AB . (**Postulate 3**: A circle can be drawn with any center and any radius).
- (iii) Draw another circle with center B and radius BA (which is same as AB). (**Postulate 3**).
- (iv) Let the two circles intersect at point C . Join AC and BC . (**Postulate 1**: A straight line may be drawn from any one point to any other point).

Verification:

- $AB = AC$ (Radii of the same circle with center A).
- $AB = BC$ (Radii of the same circle with center B).
- Since AC and BC are both equal to AB , then $AC = BC$ (**Axiom 1**: Things which are equal to the same thing are equal to one another).
- Therefore, $AB = BC = AC$, and $\triangle ABC$ is an equilateral triangle.

Q4. Proof:

- When point B lies between A and C , the line segment AC is composed of the segments AB and BC .

- In Euclid's terminology, the segment AC **coincides** with the sum of segments AB and BC .
- **Axiom 4** states: "*Things which coincide with one another are equal to one another.*"
- Thus, $AB + BC = AC$.
- **Supporting Concept:** This is also related to **Axiom 5:** "*The whole is greater than the part.*" Here, AC is the whole, while AB and BC are parts. The whole is defined exactly as the sum of its non-overlapping parts.

Q5. Analysis of the Statement:

(a) Terms to be defined first:

- **Polygon:** A closed figure made of three or more line segments.
- **Line Segment:** A part of a line with two endpoints.
- **Angle:** The figure formed by two rays meeting at a common endpoint.
- **Right Angle:** An angle equal to 90° (or as Euclid defines: when a line stands on another making adjacent angles equal, each is a right angle).

(b) Undefined terms:

- Yes, there are undefined terms. The most prominent are '**Point**' and '**Line**'.
- While Euclid gave definitions for them, modern mathematics considers them undefined because any definition for them relies on other terms that would then also need defining, leading to infinite circularity.