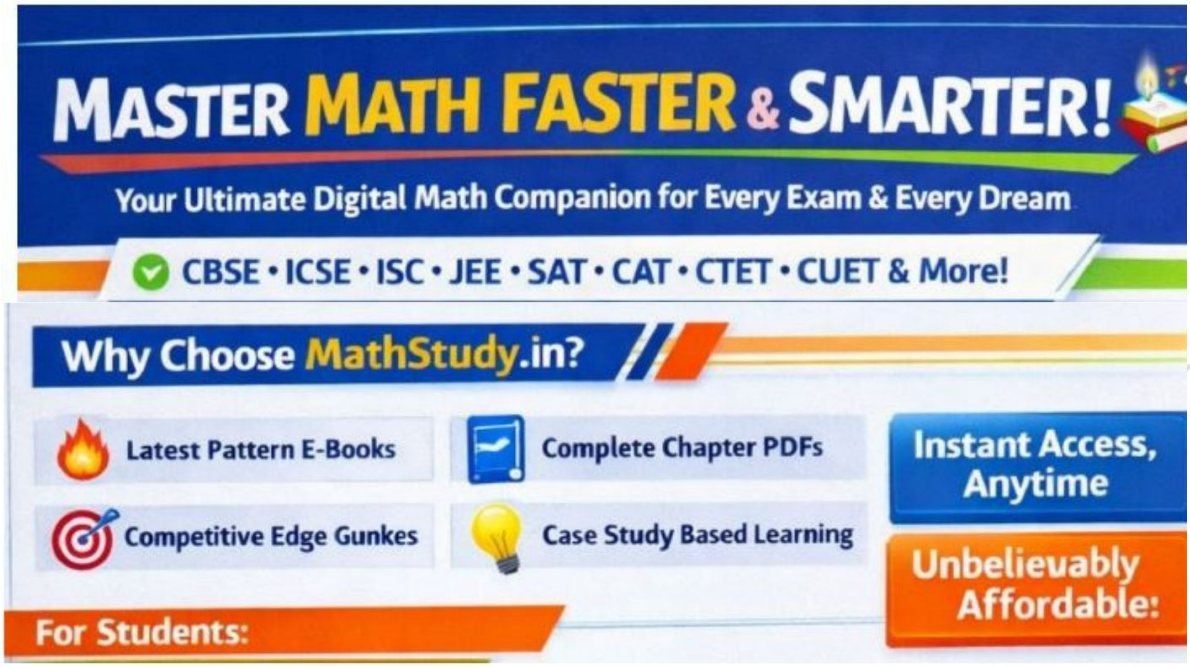
CHAPTER TEST: INTRODUCTION TO EUCLID'S GEOMETRY

Mathematics | Class IX (2026/EUCLID/09/LongAns/003)

Time: 1 Hour **Max. Marks: 25**



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DETAILED SOLUTIONS: EUCLID'S GEOMETRY

Mathematics | Class IX | SET – 3

Q1. Theorem: Every line segment has one and only one midpoint.

Proof (Method of Contradiction):

- Let us assume that a line segment AB has **two** distinct midpoints, say C and D.
- Since C is the midpoint of AB, $AC = \frac{1}{2}AB$ ...(1)
- Since D is the midpoint of AB, $AD = \frac{1}{2}AB$ ...(2)
- According to **Euclid's Axiom 1**: *"Things which are equal to the same thing are equal to one another."*
- From (1) and (2), we get $AC = AD$.
- This equality implies that points C and D must coincide with each other.
- This contradicts our initial assumption that C and D are distinct points.
- **Conclusion:** A line segment has one and only one midpoint.

Q2. Solution of Equation: $x - 15 = 25$.

Step 1: Add 15 to both sides of the equation.

$$x - 15 + 15 = 25 + 15$$

Axiom used: Euclid's Axiom 2: *"If equals are added to equals, the wholes are equal."*

Step 2: Simplify the equation.

$$x = 40$$

Geometric Example: Suppose we have two equal line segments AB and CD. If we add another line segment XY to both AB and CD, the resulting line segments $(AB + XY)$ and $(CD + XY)$ will be equal to each other.

Q3. Proof:

- Given that Q lies between P and R.
- By **Axiom 4** (Things which coincide with one another are equal), we can write the whole segment as the sum of its parts:

$$PR = PQ + QR$$

- Now, we need to show $PR - QR = PQ$.
- According to **Euclid's Axiom 3**: *"If equals are subtracted from equals, the remainders are equal."*
- Subtract QR from both sides of the equality $PR = PQ + QR$:

$$PR - QR = (PQ + QR) - QR$$

$$PR - QR = PQ$$

- **Hence Proved.**

Q4. Proof:

- Given: $\angle 1 = \angle 3$, $\angle 2 = \angle 4$, and $\angle 3 = \angle 4$.

- Since $\angle 1 = \angle 3$ and $\angle 3 = \angle 4$, then by **Euclid's Axiom 1** (Things equal to the same thing are equal to one another), we get:

$$\angle 1 = \angle 4$$

- Now, we have $\angle 1 = \angle 4$ and we are given $\angle 2 = \angle 4$.
- Applying **Axiom 1** again: since both $\angle 1$ and $\angle 2$ are equal to $\angle 4$, they must be equal to each other.

$$\angle 1 = \angle 2$$

- **Axiom used:** Things which are equal to the same thing are equal to one another.

Q5. Hierarchical Transition of Geometric Entities: Euclid described a top-down approach from tangible solids to abstract points:

Entity	Boundary/Transition	Dimensions
Solid	A solid is bounded by surfaces.	3 Dimensions (L, B, H)
Surface	The boundaries of surfaces are lines.	2 Dimensions (L, B)
Line	The ends/boundaries of lines are points.	1 Dimension (Length)
Point	A point has no parts or magnitude.	0 Dimensions

Description: As we move from Solid to Point, we lose one dimension at each stage. A solid is three-dimensional; its boundaries (surfaces) are two-dimensional; the boundaries of surfaces (lines) are one-dimensional; and the boundaries of lines (points) have no dimension.