# CHAPTER TEST: INTRODUCTION TO EUCLID'S GEOMETRY (HOTS)

**Mathematics | Class IX | (2026/EUCLID-HOTS/09/001)**

**Time: 1.5 Hours** **Max. Marks: 40**

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## General Instructions:

- All questions are compulsory.
- Section A: 8 MCQs (1 mark each).
- Section B: 4 Very Short Answer questions (2 marks each).
- Section C: 3 Short Answer questions (3 marks each).
- Section D: 3 Long Answer/HOTS questions (5 marks each).

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### Section A: Multiple Choice Questions (1 Mark Each)

1. The number of line segments determined by $n$ distinct points, no three of which are collinear, is:

   (a) $n$ (b) $n-1$ (c) $\frac{n(n-1)}{2}$ (d) $2n$

2. Which of these is a "Playfair's Axiom" equivalent?

   (a) Two distinct intersecting lines can be parallel to the same line.
   (b) For every line $l$ and point $P$ not on $l$, there exists a unique line $m$ through $P$ parallel to $l$.
   (c) The sum of angles in a triangle is always 180° in all geometries.
   (d) A line segment can be extended indefinitely.

3. If a straight line falling on two straight lines makes the interior angles on the same side together equal to 180°, then the two lines:

   (a) Meet on the left (b) Meet on the right (c) Are parallel (d) Are perpendicular

4. Euclid's second axiom states that if equals are added to equals, the wholes are equal. This applies to:

   (a) Magnitudes of same kind (b) All mathematical objects (c) Only angles (d) Only lines

5. In spherical geometry, the sum of angles of a triangle is:

   (a) Equal to 180° (b) Less than 180° (c) Greater than 180° (d) Zero

6. A point $C$ is called the midpoint of $AB$ if $C$ lies on $AB$ and $AC = CB$. This assumes:

   (a) Existence of point $C$ (b) Uniqueness of point $C$ (c) Both (a) and (b) (d) None

7. "Lines are very long" is not a Euclidean definition because:

(a) It uses undefined terms like "very long" (b) It is a postulate (c) Lines are infinite (d) It is an axiom

8. The boundaries of a surface are:

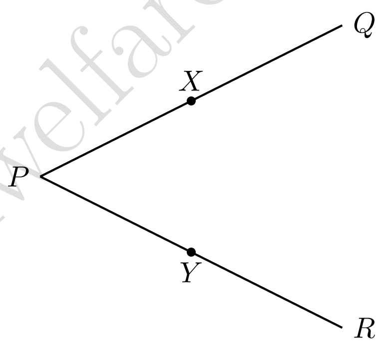
   (a) Surfaces (b) Points (c) Lines (d) Solids

### Section B: Very Short Answer Questions (2 Marks Each)

1. If $A, B$ and $C$ are three points on a line and $B$ lies between $A$ and $C$, prove that $AC > AB$. Which axiom supports this?
2. Why is Euclid's Fifth Postulate considered "different" or more complex than the first four?
3. If a point $L$ lies on the line segment $MN$ and another point $K$ lies on $LN$, prove that $MK + KN = MN$.
4. Solve $x - 10 = 15$ using Euclid's axioms. State the axiom clearly.

### Section C: Short Answer Questions (3 Marks Each)

1. Prove that "Two distinct lines cannot have more than one point in common" using the method of contradiction.
2. In the figure below, if $QX = RY$ and $PX = PY$, prove that $PQ = PR$. State the axiom used.




3. Define 'Perpendicular Lines' and 'Square'. List the terms that must be defined before these can be understood.

### Section D: Long Answer / HOTS Questions (5 Marks Each)

1. **Conceptual Proof:** "Through two distinct points, there is a unique line."
   (i) Is this a postulate or a theorem?
   (ii) How does this statement limit the nature of "lines" in Euclidean geometry compared to geometry on a sphere?
   (iii) Draw a diagram showing why this fails on a sphere (using the concept of Great Circles).
2. **Axiomatic Application:** Prove that an equilateral triangle can be constructed on any given line segment. Strictly mention which Euclid's Postulate or Axiom is being invoked at every step of the construction.

3. **Advanced Logic:** Consider the following two statements: (1) There exists a pair of straight lines that are everywhere equidistant from one another. (2) The sum of the angles of a triangle is equal to two right angles. Are these statements equivalent to Euclid's Fifth Postulate? Explain the relationship between these statements and the development of non-Euclidean geometries.