INTRODUCTION TO EUCLID'S GEOMETRY

5
CHAPTER

IMPORTANT POINTS

- A solid has shape, size, position and can be moved from one place to another, its boundaries are called surfaces.
- The boundaries of the surfaces are curves or straight line and these lines end in points.
- A point is that which has no part.
- A line is breadthless length.
- The ends of a line are points
- A straight line is a line which lies evently with the points on itself.
- A surface is that which has length and breadth only. The edges of a surface are lines.
- A plane surface is a surface which lies evently with the straight lines on itself.
- The assumptions that were specific to geometry are called 'postulate'.
- Common notion, often called 'axioms', were assumptions used throughout mathematics and not specifically linked to geometry.
- **Euclid's five Postulates**
  - (i) **Postulate 1 :** A straight line may be drawn from any one point to any other point
  - (ii) **Postulate 2 :** A terminated line canbe produced indefinitely.
  - (iii) **Postulate 3 :** A circle can be drawn with any centre and any radius.
  - (iv) **Postulate 4 :** All right angles are equal to one another
  - (v) **Postulate 5 :** If a straight line falling on two straight lines makes the interior angles on the same side of it taken together less than two right angles, then the two straight lines, if produced indefinitely, meet on that side on which the sum of angles is less than two right angles.
- An equilateral triangle can be constructed on any given line segment
- Two distinct lines cannot have more than one point in common.
- Two distinct intersecting lines cannot be parallel to the same line.

Euclid's made fine distinction between the two terms

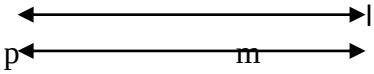
Axioms: *The assumptions, used throughout in mathematics which are obvious universal truths, are termed as axioms*

Some of the axioms given by Euclid are as under:

1. Things which are equal to the same thing are equal to one another.
   If a =b and b=c, then a=c.
2. If equals are added to equals, the whole are equal.
   If a=b and c =d then a + c = b + d, also a=b the a + c = b + c
3. If equal are subtracted from equals, the remainder are equal.
   If a=b the a - c = b - c
4. The whole is greater than the part
5. The things which coincide with one another are equal
6. Things which are double the same things are equal to one another
   If a=b then 2a =2b
7. Things which are halves of the same things are equal to one another
   If a=b then a/2 = b/2
8. If first thing is greater than the second and second thing is greater than the third, then the first is greater than the third. a>b, b>c then a>c

SOME AXIOMS OF POINTS AND LINES

1. A line contains infinitely many points
2. Through a given point, infinitely many lines can be made to pass.
3. Given two distinct points, there exits one and only one line through them
4. If p is appoint outside a line, then one and only one line can be drawn through p which is parallel to l



Postulates: *the assumptions, specific to geometry which are obvious universal truths, are termed as postulates.*

1. A straight line may be drawn from any one point to any other point.
2. A terminated line can be produced indefinitely on either side.
3. A circle can be drawn with any centre and any radius.
4. All right angles are equal to one another.
5. If a straight line falling on two straight lines makes the interior angles on the same side of it taken tighter less than two right angles, then two straight lines, if produced indefinitely, meet on that side on which the angles are less than two right angles.

Euclid's expressed some basic terms such as point, line, plane and solid atc.

Theorem- theorems are statements which are proved, using definition, axioms, postulate and previously proved statements and deductive reasoning.

Point: A small dot made sharp pencil on the surface of a paper gives an idea about a point. It has no dimensions. It has only a position.

Line: A line is an idea that it should be straight and it should extend indefinitely in both the directions. It has no end points and has no definite length.

Surface: The boundaries of a solid are called surface. Surface has two dimensions which are length and breadth. It has no thickness.

Ray: A part of line which has only one end point and extends indefinitely in one direction. A ray has no definite length.

Solid: A solid is an object in space which has three dimensions called length, breadth and thickness. It has shape, size, position and place. Like cube, cuboids.

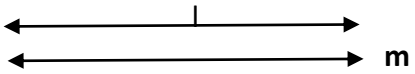
Plane: A plane is a surface in which, when two points are joined by a line, then the line wholly lies in the surface.

1. Generally, a plane represented by a parallelogram.
2. A plane contains an infinite number of lines.
3. At least three distinct points determine a unique plane.

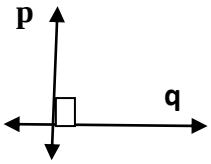
Circle: A circle is the set of all those points in a fixed point and from a constant distant. The fixed point is called the centre of the circle and constant distant is radius.

Angle: Two rays having a common end point from an angle.
Quadrilateral: A closed figure made of four line segment is called a quadrilateral.

1. **Parallel Line:** Two lines 'l' and 'm' in a plane are said to be parallel, if they have no common point and no intersecting point.



2. **Perpendicular Line:** Two lines 'p' and 'q' lying in the same plane are said to be perpendicular if they form a right angle and we write them



3. **Line segment:** A line segment is a part of line having a definite length. It has two end we written as $\overline{AB}$. The length of the line segment can be measured.

A **B**

Collinear Points: *Three or more points are collinear if one and only one line can be made to pass through these points.*
Concurrent Lines: *Three or more lines are said to be concurrent line if they all pass a unique a point. The point is called the point of concurrence of the lines.*

EXERCISE

A. Single Choice Questions

Q.1 Given two distinct points, there are so many lines that passes through them -

(A) True

(B) False

(C) Can not be obtained

(D) None of these

Q.2 When any system of axioms is given, it needs to be ensured that the system is consistent -

(A) True (B) False

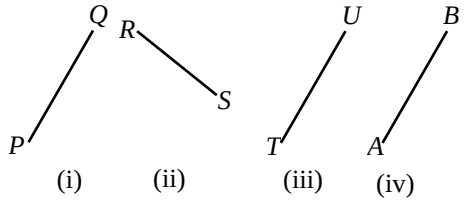
(C) Does not exist (D) None of these

Q.3 If P, Q and R are three points on a line, and Q lies between P and R, then -

(A) PQ + QR = PR (B) PR + RQ = PQ

(C) RP + QR = PQ (D) None of these

Q.4 Which of the following lines are parallel ?



(A) (i) and (ii) (B) (ii) and (iii)

(C) (i), (ii) and (iii) (D) (i), (iii) and (iv)

Q.5 Theorems are statements which are proved, using definitions, axioms, previously proved statements and deductive reasoning -

(A) Yes (B) No

(C) Does not exist (D) None of these

Q.6 If a point Q lies between two points P and R such that PQ = QR, then point Q is called -

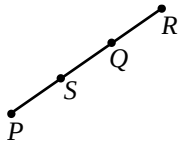
(A) Mid point

(B) Line segment

(C) Segment point

(D) None of these

Q.7 In fig. if PQ = SR, then -



(A) PS = SR (B) PQ ≠ SR

(C) PQ = QR (D) PS = QR

Q.8 Every line segment has one and only one mid-point -

(A) True (B) False

(C) Un predictable (D) None of these

Q.9 An angle is formed when two rays originate from the same end point -

(A) True (B) False
(C) Un predictable (D) None of these

Q.10 A part of a line with two end points is called a -
(A) line-segment (B) segment
(C) point segment (D) None of these

Q.11 A part of a line with one end point is called a -
(A) line (B) ray
(C) line segment (D) None of these

Q.12 If three or more points lie on the same line, they are called collinear points -
(A) True (B) False
(C) Un predictable (D) None of these

Q.13 If three or more points are not lie on the same line, they are called non-collinear points -
(A) True (B) False
(C) Un predictable (D) None of these

Q.14 A circle can be drawn with any centre and any radius -
(A) True (B) False
(C) Does not exist (D) None of these

Q.15 A straight line may not be drawn from any one point to any other point -
(A) True (B) False
(C) Un predictable (D) None of these

Q.16 A terminated line can not be produced indefinitely on both the sides -
(A) True (B) False
(C) Un predictable (D) None of these

Q.17 If two circles are equal, then their radii are equal-
(A) True
(B) False
(C) Can not be obtained
(D) None of these

Q.18 The distance of a point from a line is the length of the perpendicular from the point to the line-
(A) True
(B) False
(C) Can not be obtained
(D) None of these

Q.19 The Euclidean geometry is valid only for the figures in the plane -
(A) True (B) False
(C) Un predictable (D) None of these

Q.20 Things which concide with one another are–
(A) not equal to one another
(B) equal to one another
(C) identical to one another
(D) None of these

B. Fill in the Blanks

Q.21 Axioms or postulates are the ..... which are obvious universal truths.

Q.22 If equals are added to ....., the wholes are equal.

Q.23 If equals are subtracted from equals the ..... are equal.

Q.24 All ..... angles are equal to one another.

Q.25 There are ..... line (s) which pass through two distinct points.

Q.26 Two distinct lines can not have more than..... point in common.

Q.27 A ..... is that which has no part.

Q.28 The ..... of a line are .....

Q.29 The whole is ..... the part.

Q.30 Things which are ..... of the same things are equal to one another.

Q. 31 The assumptions that were specific to geometry are called .....

Q.32 Two distinct intersecting lines cannot be ..... to the same line.

ANSWER KEY

A. SINGLE CHOICE QUESTIONS :

1. (B)	**2.** (A)	**3.** (A)	**4.** (D)
5. (A)	**6.** (A)	**7.** (D)	**8.** (A)
9. (A)	**10.** (A)	**11.** (B)	**12.** (A)
13. (A)	**14.** (A)	**15.** (B)	**16.** (B)
17. (A)	**18.** (A)	**19.** (A)	**20.** (B)

B. FILL IN THE BLANKS :

21. assumptions	**22.** equals	**23.** remainders	**24.** right
25. one	**26.** one	**27.** point	**28.** ends, points
29. greater than	**30.** halves or double	**31.** postulate	**32.** parallel