Introduction to Euclid's Geometry

CHAPTER 5

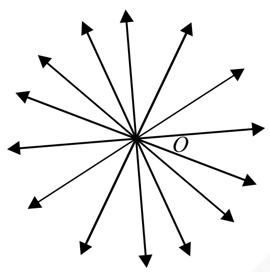
NCERT FOCUS

SOLUTIONS

EXERCISE - 5.1

1. (i) False

Reason : If we mark a point O on the surface of a paper. Using pencil and ruler, we can draw infinite number of straight lines passing through O. (See figure)



(ii) False

Reason : There is one and only one line which passes through two distinct points.

(iii) True

Reason : The postulate 2 says that "A terminated line can be produced indefinitely".

(iv) True

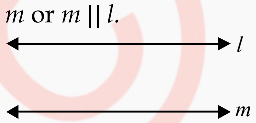
Reason : If two circles are equal, their centres and boundaries coincide. Thus, their radii will coincide.

(v) True

Reason : According to Euclid's axiom 1, things which are equal to the same thing are equal to one another.

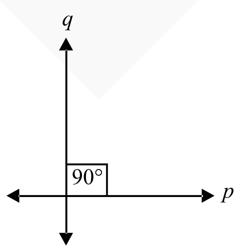
2. Definitions of the required terms are given below :

(i) **Parallel Lines :** Two lines l and m in a plane are said to be parallel, if they have no common point and we write them as $l \parallel m$ or $m \parallel l$.



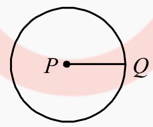
Note: The distance between two parallel lines always remains the same.

(ii) **Perpendicular Lines :** 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 as $p \perp q$ or $q \perp p$.

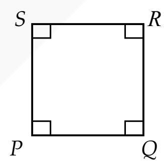


(iii) **Line Segment :** A line segment is a part of line and having a definite length. It has two end-points. In the figure, a line segment is shown having end points A and B. It is written as $\overline{AB}$ or $\overline{BA}$.

(iv) **Radius of a circle :** The distance from the centre to a point on the circle is called the radius of the circle. In the figure, P is centre and Q is a point on the circle, then PQ is the radius.



(v) **Square :** A quadrilateral in which all the four angles are right angles and all the four sides are equal is called a square. In the figure, $PQRS$ is a square.



Yes, we need to have an idea about the terms like point, line, plane, angle, right angle, circle and its centre, quadrilateral, etc. before defining the required terms.

Point : Undefined term

Line : Undefined term

Plane : Undefined term

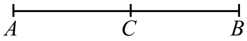
Angle : A figure formed by two rays with a common initial point.

Right angle : Angle whose measure is 90°.

Circle and its centre : Imagine a line segment, which is bent till the ends join. The figure, so obtained is called circle. In other words, we can define it as a figure formed by joining all the points in a plane that are at a fixed distance from a fixed point. The fixed point is called the centre of a circle.

Quadrilateral : A simple closed figure made up of four line segments.

3. Yes, these postulates contain undefined terms such as 'Point and Line'. Also, these postulates are consistent because it is impossible to deduce from these postulates a statement that contradict any axiom or postulates or previously proved statement. No, these postulates do not follow from Euclid's postulates, however they follow from the axiom that "Given two distinct points, there is a unique line that passes through them".

4. 

Since, $AC = BC$ [Given]

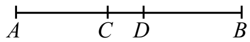
$\therefore$ $AC + AC = BC + AC$ [Using Euclid's axiom 2]

$\Rightarrow$ $2AC = AB$ [$\because$ $AC + BC$ coincides with AB and using Euclid's axiom 4]

$\Rightarrow$ $\frac{1}{2}(2AC) = \frac{1}{2}AB$ [Using Euclid's axiom 7]

$\Rightarrow$ $AC = \frac{1}{2}AB$

5. Let the line segment AB has two mid points 'C' and 'D'.



Then, $AC = \frac{1}{2}AB$ ...(i)

and $AD = \frac{1}{2}AB$ ...(ii)

Now, by using Euclid's axiom 7, we get

$AC = AD$

$\Rightarrow$ AC and AD coincide or we can say that C and D coincide.

Thus, every line segment has one and only one mid-point.

6. Given, $AC = BD$

$\Rightarrow$ $AB + BC = BC + CD$ [Using Euclid's axiom 4]

Subtracting BC from both sides, we get

$AB + BC - BC = BC + CD - BC$ [Using Euclid's axiom 3]

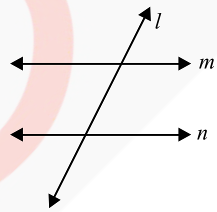
$\Rightarrow$ $AB = CD$

7. As statement is true in all the situations. Therefore, it is considered a 'universal truth.'

EXERCISE - 5.2

1. We can write Euclid's fifth postulate as : 'Two distinct intersecting lines cannot be parallel to the same line.'

2. Yes, if a straight line l falls on two lines m and n such that sum of the interior angles on one side of l is two right angles, then by Euclid's fifth postulate, the lines will not meet on this side of l. Also we know that the sum of the interior angles on the other side of the line l will also be two right angles. Thus, they will not meet on the other side also.



Thus, the lines m and n never intersect each other and so they are parallel.