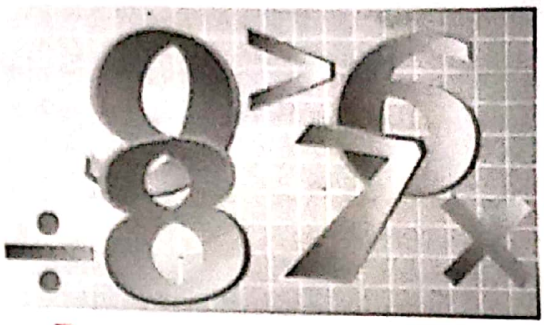
11 Line Segment, Ray and Line



BASIC CONCEPTS

Three geometrical terms, namely, *point*, *line* and *plane*, form the foundation of geometry. These terms cannot be precisely defined. However, we give examples to illustrate the meaning of these terms.

PLANE

A solid has a surface which may be flat or curved. For example, the surface of a wall is flat and the surface of a ball is curved.

Flat surfaces are known as plane surfaces.

In mathematics, a smooth flat surface which extends endlessly in all the directions is called a plane.

A plane has no boundary.

The surface of a smooth wall, the surface of the top of a table, the surface of a smooth black-board, the surface of a sheet of paper, the surface of calm water in a pool are all examples of a portion of a plane.

We draw figures such as a triangle, a rectangle, a circle, etc., in a plane. We call them plane figures.

POINT

POINT *A point is a mark of position.*

A small dot made by a sharp pencil on a plane paper represents a point. • A

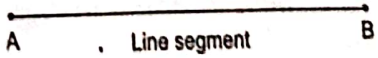
We name a point by a capital letter of the English alphabet.

In the given figure, *A* is a point.

A point has no length, breadth or thickness.

LINE SEGMENT

LINE SEGMENT *Let A and B be two points on a plane. Then, the straight path from A to B is called the line segment AB.* This is denoted by $\overline{AB}$.



Thus, a line segment has a definite length, which can be measured.

The line segment $\overline{AB}$ is the same thing as the line segment $\overline{BA}$.

MEASURING LINE SEGMENTS

To measure a line segment, we need a *ruler*. One edge of a ruler is marked in centimetres (cm). Each cm is divided into 10 equal small divisions, called millimetres (mm).

How to measure a line segment

EXAMPLE. *Measure the length of a given line segment* $\overline{AB}$.

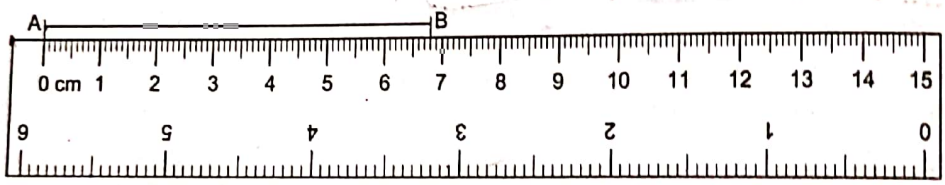
Method Let $\overline{AB}$ be the given line segment. Place the ruler with its edge along the segment $\overline{AB}$ such that the zero mark of the ruler coincides with the point A. Now, we read the mark on the ruler which is against the point B.

We see that the mark on the ruler against B indicates 5 big divisions (cm) and 4 small divisions (mm).
Hence, the length of $\overline{AB}$ is 5 cm 4 mm, that is, 5.4 cm.

How to construct a line segment

EXAMPLE. *Draw a line segment of length* 6.8 cm.

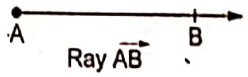
Method Place the ruler on the plane of the paper and hold it firmly.
Mark a point with a fine pencil against the zero cm mark of the ruler. Name it point A.
By sliding the pencil gently along the edge of the ruler, draw a line segment up to the 6 cm 8 mm mark on the ruler. Name the point against this mark as B. Then, $\overline{AB}$ = 6.8 cm.



RAY

RAY *A line segment extended endlessly in one direction is called a ray.*

Thus, a line segment AB, extended endlessly in the direction from A to B, is a ray, denoted by $\overrightarrow{AB}$

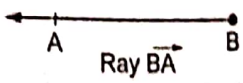


The arrow indicates that the ray $\overrightarrow{AB}$ is endless in the direction from A to B.

The ray $\overrightarrow{AB}$ has one end point, namely A, called its *initial point*.

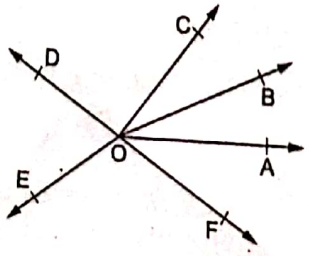
Clearly, *a ray has no definite length.*

Note that $\overrightarrow{BA}$ is a ray with initial point B and extending endlessly in the direction from B to A, as shown alongside.



Clearly, $\overrightarrow{AB}$ and $\overrightarrow{BA}$ are two different rays.

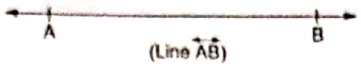
An unlimited number of rays can be drawn in different directions with a given point O as the initial point, as shown in the figure given below.



LINE

LINE *A line segment extended endlessly on both sides is called a line.*

Thus, a line segment $\overline{AB}$ extended on both sides and marked by arrows at the two ends, represents a line, denoted by $\overleftrightarrow{AB}$ or $\overleftrightarrow{BA}$.



(Line $\overleftrightarrow{AB}$)

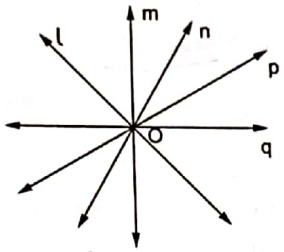
These arrows indicate that the line is endless in both directions. Sometimes, we represent a line by a small letter l, m, n, etc.

In the adjoining figure, l is a line.

Two intersecting planes intersect in a line.

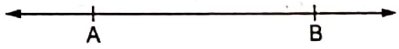
A line has no end points.

RESULT 1. *An unlimited number of lines can be drawn passing through a given point, as shown below.*

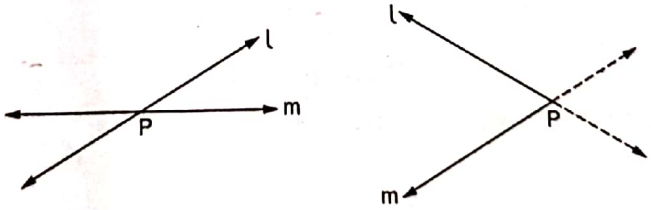


In the above figure, lines l, m, n, p and q all pass through a given point O.

RESULT 2. *If two different points A and B are given in a plane then exactly one line can be drawn passing through these points.*



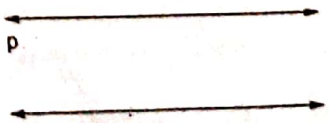
INTERSECTING LINES *If there is a point P common to two lines l and m, we say that the two lines intersect at the point P and this point P is called the point of intersection of the given lines.*



Intersecting lines

PARALLEL LINES If no point is common to two given lines, it would mean that the lines do not intersect. Such lines are known as *parallel lines.*

The rails of a railway line, opposite edges of a ruler and the opposite sides of a rectangle are examples of parallel lines.



Parallel lines

It is clear that either one point is common to two given lines or no point is common to them.

So, we obtain the following result.

RESULT 3. *Two lines in a plane either intersect at exactly one point or are parallel.*

CONCURRENT LINES *Three or more lines in a plane are said to be concurrent if all of them pass through the same point and this point is called the point of concurrence of the given lines.*

Class - 6

Do yourself :

1. Define :
    1. Point
    2. Line-segment
    3. Line
    4. Ray
2. Explain intersecting lines and parallel lines with figure.
3. Explain concurrent line with example.
4. Explain collinear points with examples.
5. Write three properties of line segment, ray and line.
6. Distinguish between line-segment, ray and line.
7. Define non-collinear points.