

# ELEMENTS OF GEOMETRY

## A POINT

### Definition Point

A **point** is a single location in space, represented by a dot.



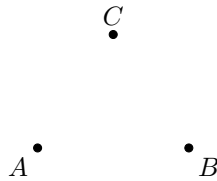
### Definition Point Notation

A point is named using a capital letter, written as  $A$ .



Points have no size, shape, or dimension. They simply mark a position.

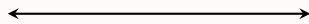
**Ex:** The diagram below shows three points labeled  $A$ ,  $B$ , and  $C$ :



## B LINES, SEGMENTS AND RAYS

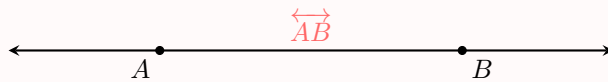
### Definition Line

A **line** is a straight collection of points that extends infinitely in both directions.

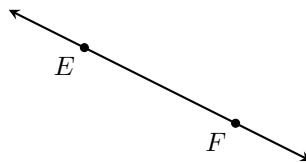


### Definition Line Notation

A line is named using two points on it, written as  $\overleftrightarrow{AB}$ .



**Ex:** Name the line shown below:



*Answer:* The line is  $\overleftrightarrow{EF}$ .

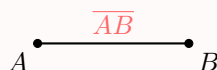
### Definition Line Segment

A **line segment** is a part of a line with two endpoints. It has a definite length.



### Definition Line Segment Notation

A line segment is named by its endpoints, written as  $\overline{AB}$ .



**Ex:** Name the segment shown below:



Answer: The segment is  $\overline{EF}$ .

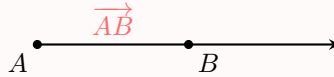
### Definition Ray

A **ray** is a part of a line that starts at one endpoint and extends infinitely in one direction.

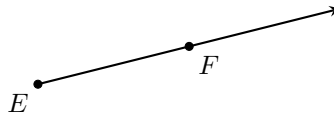


### Definition Ray Notation

A ray is named by its endpoint and another point on it, written as  $\overrightarrow{AB}$ .



Ex: Name the ray shown below:

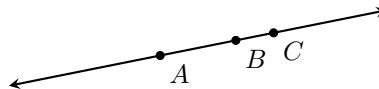


Answer: The ray is  $\overrightarrow{EF}$ .

### Definition Collinear Points

**Collinear points** are points that all lie on the same straight line.

Ex: The points  $A$ ,  $B$  and  $C$  are collinear points.

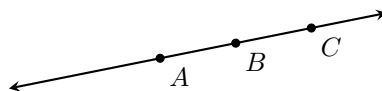


## C ELEMENT RELATION

### Definition Element Relation

The relation **is a point of** (or “belongs to”) is used to show that a point lies on a geometric figure, such as a line or a segment. We write this relation using the symbol  $\in$ .

Ex:



$$C \in \overleftrightarrow{AB} \text{ and } C \notin \overline{AB}$$

In this figure, point  $C$  lies on the line through points  $A$  and  $B$ , so we write  $C \in \overleftrightarrow{AB}$  and say that  $C$  is a point of the line  $\overleftrightarrow{AB}$ . However,  $C$  does not lie on the segment between  $A$  and  $B$ , so  $C \notin \overline{AB}$ .

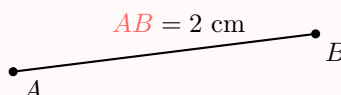
## D LENGTH

### Definition Length of a Line Segment

The **length** of a line segment is the distance between its two endpoints, measured in units such as centimeters (cm) or meters (m).

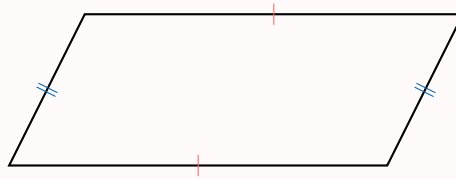
### Definition Length Notation

If  $\overline{AB}$  is a segment, its length is denoted by  $AB$  (without the bar). In diagrams, we may also write  $AB$  for the length of segment  $AB$ .

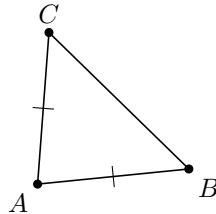


### Definition Equal Lengths

Line segments are **equal in length** if they have the same length. We use **tick marks** on the segments to show that they are equal: segments with the same number of tick marks have the same length.



**Ex:** Identify two segments that have the same length.

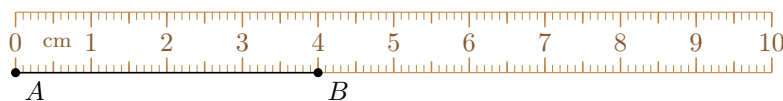


*Answer:* Segments  $\overline{AB}$  and  $\overline{AC}$  have the same length, as shown by the identical tick marks on each of them. Therefore,  $AB = AC$ .

### Method Measuring Length

We measure the length of a segment with a ruler. Place one endpoint on the 0 mark, then read the number at the other endpoint: that number is the length of the segment.

**Ex:** Measure the length of segment  $\overline{AB}$ .



*Answer:* By aligning a ruler with segment  $\overline{AB}$ , we measure the length as  $AB = 4$  cm. So the length of segment  $AB$  is 4 cm.

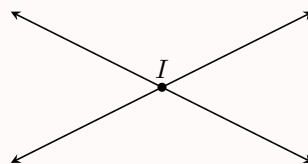
### Definition Midpoint of a Line Segment

The **midpoint** of a line segment is a point that lies on the segment and divides it into two segments of equal length. For example, if  $I$  is the midpoint of segment  $\overline{AB}$ , then  $I \in \overline{AB}$  and  $AI = IB$ .

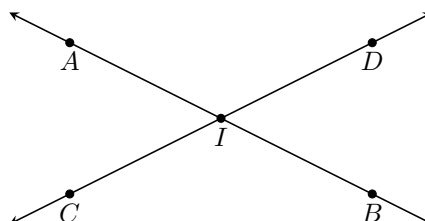
## E INTERSECTION POINT

### Definition Intersection Point

An **intersection point** is a point where two or more geometric objects, such as lines or segments, meet.



**Ex:** Find the intersection point of the lines  $\overleftrightarrow{AB}$  and  $\overleftrightarrow{CD}$ .



*Answer:* The intersection point is  $I$ .

## F PARALLEL LINES

### Definition Parallel Lines

Two **parallel lines** are lines that never intersect, no matter how far they extend.



### Definition Parallel Line Notation

Parallel lines are indicated using matching arrowheads on each line.

