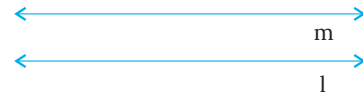


## Construction of Parallel Lines

### i. Definition and Explanation

**What are Parallel Lines?** Parallel lines are two or more lines on a plane that are always the same distance apart and will never intersect, no matter how far they are extended.

- **Real-World Examples:** Railway tracks, the opposite sides of a ruler, lines in a notebook.
- **Symbol:** The symbol for parallel is  $\parallel$ . If line  $l$  is parallel to line  $m$ , we write it as  $l \parallel m$ .



**What is Geometric Construction?** In geometry, "construction" means to draw shapes, angles, or lines accurately using only two tools:

- **A Ruler (or Straightedge):** Used for drawing straight lines.
- **A Compass:** Used for drawing arcs and circles, and for measuring and transferring lengths.

When we construct parallel lines, we are not just "eyeballing" them to look parallel. We are using a precise geometric method that guarantees they are truly parallel.

### ii. Key Points and Important Terms

To construct parallel lines, we must first understand the relationship between angles formed by a transversal.

**Transversal:** A line that intersects two or more other lines at distinct points.

**Key Angles Formed by a Transversal:**

- **Corresponding Angles:** Angles that are in the same relative position at each intersection. If the corresponding angles are equal, the lines are parallel.
- **Alternate Interior Angles:** A pair of angles on opposite sides of the transversal and between the two lines. If the alternate interior angles are equal, the lines are parallel.

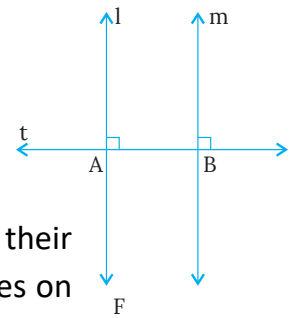
### iii. Detailed Examples: How to Construct Parallel Lines

The goal is always the same: Given a line  $l$  and a point  $P$  not on the line, construct a line  $m$  through  $P$  that is parallel to  $l$ .

There are two primary methods based on the angle properties we just learned.

### Method 1: Drawing two perpendiculars to a common line

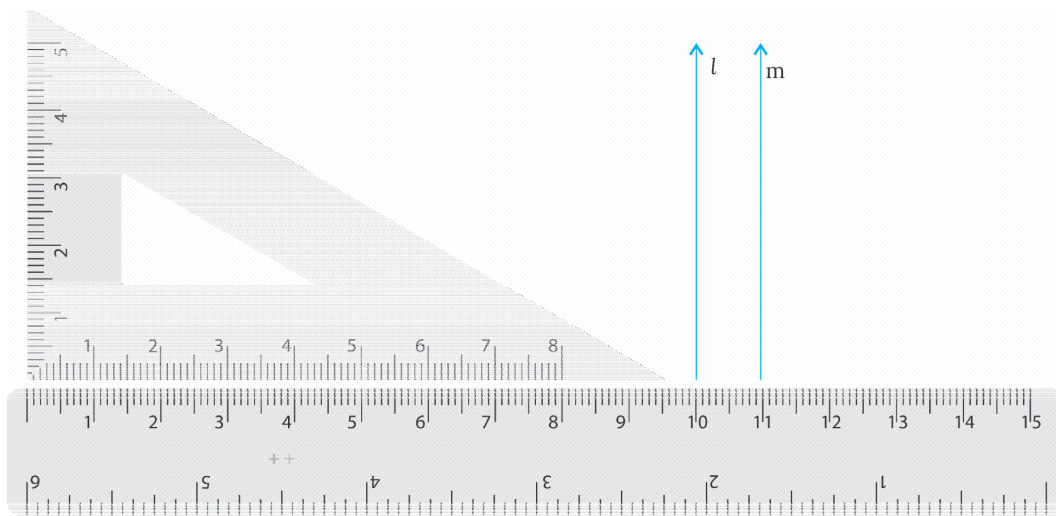
1. Draw a line  $t$ .
2. At two different points on line  $t$ , say  $A$  and  $B$ , draw lines  $l$  and  $m$  respectively, such that  $l \perp t$  and  $m \perp t$ .
3. Since both  $l$  and  $m$  form a  $90^\circ$  angle with the transversal  $t$ , their corresponding angles (or alternate interior angles, or interior angles on the same side) are equal (all  $90^\circ$ ).



4. Therefore, line  $l$  will be parallel to line  $m$  ( $l \parallel m$ ). This method is very accurate if your perpendiculars are precise.

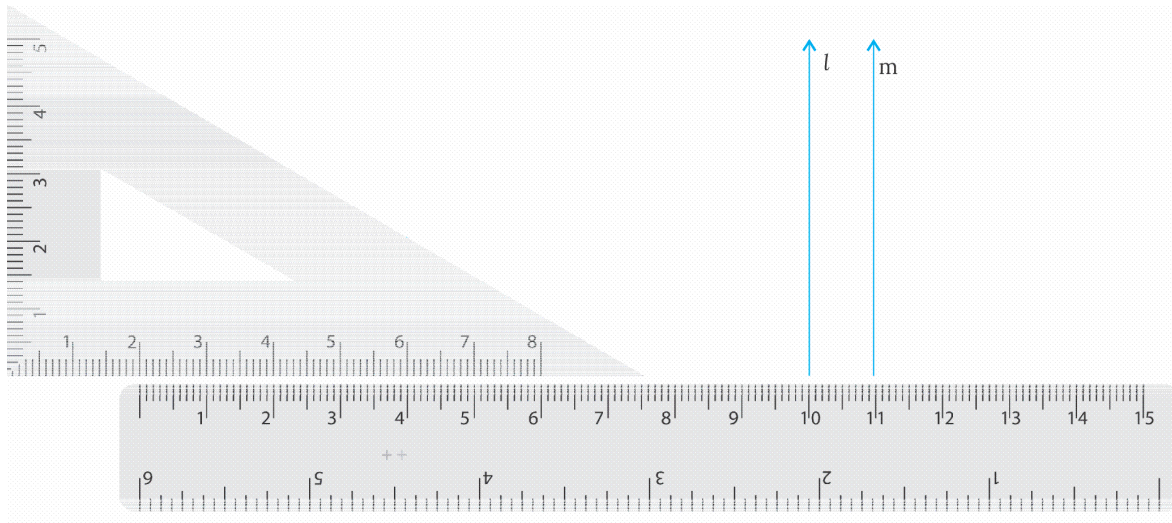
### Method 2:

1. Place a ruler firmly on your paper. This ruler acts as a guide.
2. Place a set square against the edge of the ruler.
3. Draw a line along one of the edges of the set square (e.g., the longer edge or one of the shorter edges). Let's call this line  $l$ .



4. Hold the ruler firmly and slide the set square along the ruler's edge, keeping the same edge of the set square against the ruler.
5. Draw another line along the same edge of the set square in its new position. Let's call this line  $m$ .
6. Since the angle between the set square's edge and the ruler's edge remains constant as you slide it, the lines  $l$  and  $m$  will be parallel. The ruler acts as a transversal, and the angle formed by the set square's edge and the ruler's edge is a constant corresponding angle.

This sliding set square method is particularly efficient for drawing multiple parallel lines quickly.



#### iv. Summary of Main Concepts

- **Parallel Lines:** Lines in a plane that never intersect. We denote them with the symbol  $||$ .
- **The Principle:** The construction of parallel lines relies on creating equal angles with a transversal.
- **Two Key Methods:**
  - **Corresponding Angles Method:** Create two equal angles in the same relative position.
  - **Alternate Interior Angles Method:** Create two equal angles on opposite sides of the transversal and between the lines.
- **Essential Tools:** A ruler (straightedge) and a compass are the only tools used for geometric construction.
- **Key to Success:** Accuracy is crucial. Do not change the compass width when transferring an angle. Practice is the best way to master this skill.