



Chapter 5: Plane Geometry & Loci

Chapter 1 — Lines | Detailed Notes & Solved Examples

1. Point, Line and Line Segment

A point represents an exact position. It has no length or breadth. A point is usually represented by a capital letter such as A, B or C.

A line is a straight path that extends indefinitely in both directions. A line passing through A and B is written as AB with arrows indicating that it continues in both directions.

A line segment is a part of a line with two fixed endpoints. Its length is finite and is written as AB.

A ray starts from one fixed point and continues indefinitely in one direction. Ray AB starts at A and passes through B.

Figure	Endpoints	Extension
Point	Represents one position	No extension
Line	No endpoints	Both directions
Line segment	Two endpoints	No extension beyond endpoints
Ray	One endpoint	One direction

2. Types of Lines

The important types of lines used in elementary geometry are horizontal lines, vertical lines, parallel lines, intersecting lines, perpendicular lines and transversals.

3. Horizontal Line

A horizontal line runs from left to right without moving upward or downward. It is often used as a reference line when discussing angles of elevation and depression.

4. Vertical Line

A vertical line runs upward and downward. A vertical line is perpendicular to a horizontal line.

Angle between a horizontal line and a vertical line = 90°

5. Parallel Lines

Two lines are parallel if they remain the same distance apart and do not meet, even when extended indefinitely.

$$l_1 \parallel l_2$$

Everyday examples include railway tracks, opposite edges of a ruler and the horizontal lines in a notebook.

6. Intersecting Lines

Two lines that meet at a point are called intersecting lines. The point where they meet is called the point of intersection. The angles formed at the intersection may be acute, obtuse or right angles.

7. Perpendicular Lines

Two lines are perpendicular when they meet at a right angle.

$$l_1 \perp l_2$$



Angle formed by perpendicular lines = 90°

8. Parallel Lines vs Perpendicular Lines

Property	Parallel Lines	Perpendicular Lines
Do they meet?	Never meet	Meet at one point
Angle	No fixed angle between them	90°
Symbol	$\parallel$	$\perp$
Example	Railway tracks	Wall and floor

9. Transversal

A transversal is a line that intersects two or more lines at distinct points. When a transversal cuts two parallel lines, several important pairs of angles are formed.

10. Corresponding Angles

Corresponding angles occupy the same relative position at the two intersections of a transversal with two lines.

For parallel lines: Corresponding angles are equal.

For example, if one corresponding angle is 65° , the other corresponding angle is also 65° .

11. Alternate Interior Angles

Interior angles lie between the two lines. When the two lines are parallel, alternate interior angles are equal.

Alternate interior angles = Equal

12. Alternate Exterior Angles

Exterior angles lie outside the two lines. When two parallel lines are cut by a transversal, alternate exterior angles are equal.

Alternate exterior angles = Equal

13. Co-interior Angles

Co-interior angles are the interior angles lying on the same side of the transversal. When the two lines are parallel, they are supplementary.

Co-interior angles have sum = 180°

14. Important Properties

Angles on a straight line = 180°

Angles around a point = 360°

Vertically opposite angles are equal.

Corresponding angles are equal when lines are parallel.

Alternate interior angles are equal when lines are parallel.

Alternate exterior angles are equal when lines are parallel.

Co-interior angles add up to 180° when lines are parallel.

15. Detailed Solved Examples



Example 1

Two adjacent angles on a straight line are 65° and x . Find x .

Angles on a straight line have a sum of 180° .

$$x + 65^\circ = 180^\circ.$$

$$x = 180^\circ - 65^\circ = 115^\circ.$$

Answer: $x = 115^\circ$

Example 2

Four angles around a point are 80° , 90° , 70° and x . Find x .

Angles around a point add up to 360° .

$$80^\circ + 90^\circ + 70^\circ + x = 360^\circ.$$

$$240^\circ + x = 360^\circ.$$

$$\text{Therefore } x = 120^\circ.$$

Answer: $x = 120^\circ$

Example 3

Two parallel lines are cut by a transversal. One corresponding angle is 75° . Find the other corresponding angle.

Corresponding angles are equal when the lines are parallel.

$$\text{Therefore } x = 75^\circ.$$

Answer: $x = 75^\circ$

Example 4

Two parallel lines are cut by a transversal. One alternate interior angle is 62° . Find the other.

Alternate interior angles are equal for parallel lines.

$$\text{Therefore } x = 62^\circ.$$

Answer: $x = 62^\circ$

Example 5

Two parallel lines are cut by a transversal. One co-interior angle is 115° . Find the other co-interior angle.

Co-interior angles are supplementary.

$$x + 115^\circ = 180^\circ.$$

$$x = 65^\circ.$$

Answer: $x = 65^\circ$

Example 6

Two parallel lines are cut by a transversal. One angle is 70° . Find the angles adjacent to it.



An adjacent angle forms a linear pair with 70° .

$$x + 70^\circ = 180^\circ$$

Therefore $x = 110^\circ$.

The vertically opposite angle to 70° is also 70° .

Thus, the eight angles consist of four angles of 70° and four angles of 110° .

Answer: Adjacent angles = 110° ; vertically opposite angle = 70°

Example 7

Two corresponding angles are $(3x + 20)^\circ$ and $(5x - 40)^\circ$. Find x and the angle.

Corresponding angles are equal.

$$3x + 20 = 5x - 40$$

$$60 = 2x$$

Therefore $x = 30$.

The angle is $3(30) + 20 = 110^\circ$.

Answer: $x = 30$; each corresponding angle = 110°

Example 8

Two co-interior angles are $(2x + 10)^\circ$ and $(3x - 20)^\circ$. Find x .

Co-interior angles are supplementary.

$$(2x + 10) + (3x - 20) = 180$$

$$5x - 10 = 180$$

$$5x = 190$$

Therefore $x = 38$.

The angles are 86° and 94° , whose sum is 180° .

Answer: $x = 38$

16. How to Identify the Correct Angle Relationship

Do not rely only on the appearance of a diagram. First identify the relationship between the angles.

If the angles form a straight line, their sum is 180° .

If the angles are vertically opposite, they are equal.

If parallel lines are cut by a transversal, check whether the angles are corresponding, alternate interior, alternate exterior or co-interior.

17. Important Theorems Related to Parallel Lines

Theorem 1: If a transversal intersects two parallel lines, corresponding angles are equal.

Theorem 2: If a transversal intersects two parallel lines, alternate interior angles are equal.

Theorem 3: If a transversal intersects two parallel lines, alternate exterior angles are equal.

Theorem 4: If a transversal intersects two parallel lines, interior angles on the same side of the transversal are supplementary.

18. Converse Results

The converse of these results is also useful. For example, if a transversal makes a pair of corresponding angles equal, the two lines are parallel. Similarly, equality of a suitable pair of alternate interior angles can establish that the lines are parallel.

19. Common Mistakes

- Do not assume that every pair of adjacent angles is equal. They are supplementary only when they form a linear pair.
- Do not confuse corresponding angles with alternate angles.
- Corresponding and alternate angles are equal only under the required parallel-line condition.
- Use 360° for angles around a point, not for angles on a straight line.
- Always write the degree symbol when giving an angle measure.

20. Quick Revision Table

Situation	Result
Angles on a straight line	Sum = 180°
Angles around a point	Sum = 360°
Vertically opposite angles	Equal
Corresponding angles	Equal, when lines are parallel
Alternate interior angles	Equal, when lines are parallel
Alternate exterior angles	Equal, when lines are parallel
Co-interior angles	Sum = 180° , when lines are parallel
Perpendicular lines	Form 90°

21. Final Revision

Straight line $\rightarrow 180^\circ$

Around a point $\rightarrow 360^\circ$

Vertically opposite $\rightarrow$ Equal

Corresponding $\rightarrow$ Equal

Alternate interior $\rightarrow$ Equal

Alternate exterior $\rightarrow$ Equal

Co-interior $\rightarrow 180^\circ$

Perpendicular $\rightarrow 90^\circ$

The key to solving line and angle questions is to first identify the relationship between the angles. Once the correct relationship is recognised, the calculation is usually straightforward.