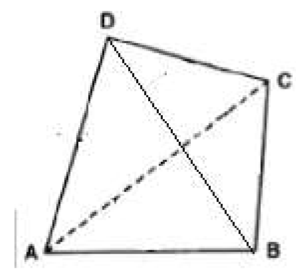
CHAPTER-8
QUADRILATERALS
HANDOUT-MODULE-1

QUADRILATERAL

- A polygon formed by joining four points in an order is called a quadrilateral.
- A quadrilateral has four sides, four angles and four vertices

ANGLE SUM PROPERTY OF A QUADRILATERAL

- **STATEMENT:** The sum of the angles of a quadrilateral is 360º
- **GIVEN:** A quadrilateral ABCD



- **TO PROVE:** $\angle A + \angle B + \angle C + \angle D = 360°$
- **CONSTRUCTION :** Join AC
- **PROOF :** By angle sum property of Δ we get
  In Δ ADC,
  $\angle DAC + \angle ACD + \angle D = 180°$------------ (1)
  In Δ ABC,
  $\angle CAB + \angle ACB + \angle B = 180°$------------ (2)
  Adding (1) and (2), we get
  $\angle DAC + \angle ACD + \angle D + \angle CAB + \angle ACB + \angle B = 180° + 180° = 360°$
  Also, $\angle DAC + \angle CAB = \angle A$ and $\angle ACD + \angle ACB = \angle C$
  So, $\angle A + \angle D + \angle B + \angle C = 360°$.

TYPES OF QUADRILATERALS

1. Trapezium - One pair of opposite sides of quadrilateral are parallel.
2. Parallelogram - Both pairs of opposite sides of quadrilaterals are parallel
3. Rectangle - A parallelogram with one of its angles a right angle.
4. Rhombus - The parallelogram with all sides equal
5. Square - The parallelogram with one angle 90° and all sides equal .
6. Kite - A quadrilateral with two pairs of adjacent sides equal

IMPORTANT POINTS

- A square, rectangle and rhombus are all parallelograms.
- A square is a rectangle and also a rhombus.
- A parallelogram is a trapezium.
- A kite is not a parallelogram.
- A trapezium is not a parallelogram (as only one pair of opposite sides is parallel in a trapezium and we require both pairs to be parallel in a parallelogram).
- A rectangle or a rhombus is not a square.

Theorem 8.1 : A diagonal of a parallelogram divides it into two congruent triangles.

- **GIVEN :** Parallelogram ABCD and AC be a diagonal. The diagonal AC divides parallelogram ABCD into two triangles, Δ ABC and Δ CDA.
- **TO PROVE :** $\Delta ABC \cong \Delta CDA$
- **PROOF :** In Δ ABC and Δ CDA,

- BC || AD and AC is a transversal
- ∴ $\angle$ BCA = $\angle$ DAC (Pair of alternate angles)
- AB || DC and AC is a transversal
- ∴ $\angle$ BAC = $\angle$ DCA (Pair of alternate angles)
- AC = CA (Common)
- So, Δ ABC $\cong$ Δ CDA (ASA rule)
- i.e. diagonal AC divides parallelogram ABCD into two congruent triangles ABC and CDA.

Theorem 8.2 : In a parallelogram, opposite sides are equal

Theorem 8.3 : If each pair of opposite sides of a quadrilateral is equal, then it is a parallelogram.

Theorem 8.4 : In a parallelogram, opposite angles are equal.

Theorem 8.5 : If in a quadrilateral, each pair of opposite angles is equal, then it is a parallelogram.

Theorem 8.6 : The diagonals of a parallelogram bisect each other.

Theorem 8.7 : If the diagonals of a quadrilateral bisect each other, then it is a parallelogram.

Theorem 8.8 : A quadrilateral is a parallelogram if a pair of opposite sides is equal and parallel.