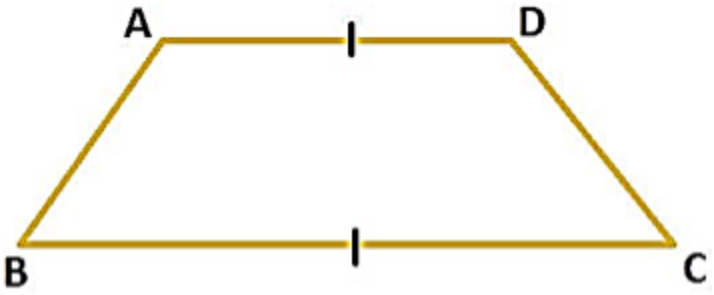
Chapter- 17

Special Types of Quadrilaterals

1. Trapezium

If a quadrilateral has one pair of parallel sides then it is a Trapezium.

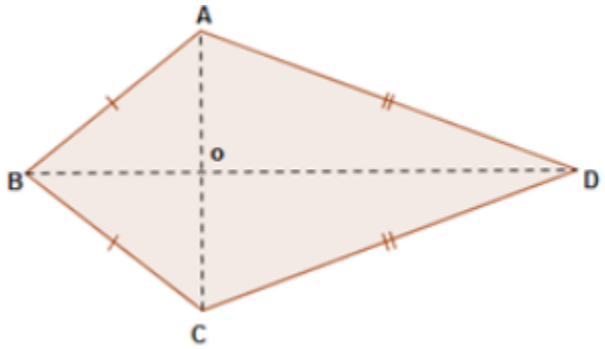


Here AD‖BC in quadrilateral ABCD, hence it is a trapezium.

Remark: If the non-parallel sides of a trapezium are equal then it is called **Isosceles Trapezium**.

2. Kite

If the two pairs of adjacent sides are equal in a quadrilateral then it is called a **Kite**.



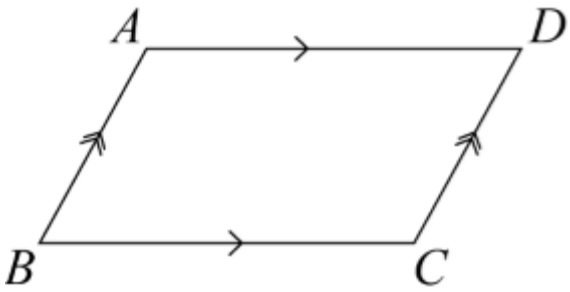
Here AB = BC and AD = CD

Properties of a kite

- The two diagonals are perpendicular to each other.
- One of the diagonal bisects the other one.
- ∠A = ∠C but ∠B ≠∠D

3. Parallelogram

If the two pairs of opposite sides are parallel in a quadrilateral then it is called a **Parallelogram**.



Here, AB ‖ DC and BC ‖ AD, hence ABCD is a parallelogram.

Elements of a Parallelogram

Some terms related to a parallelogram ABCD

1. Opposite Sides – Pair of opposite sides are

AB and DC,

AD and BC

2. Opposite Angles – Pair of opposite angles are

∠ A and ∠C

∠B and ∠D

3. Adjacent Sides – Pair of adjacent sides are

AB and BC

BC and DC

DC and AD

AB and AD

4. Adjacent Angles – Pair of adjacent angles are

∠A and ∠B

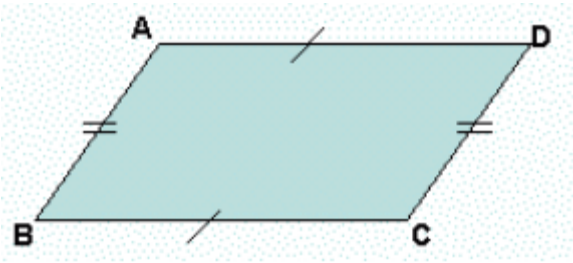
∠B and ∠C

∠C and ∠D

∠A and ∠D

Properties of a Parallelogram

1. The opposite sides of a parallelogram will always be equal.

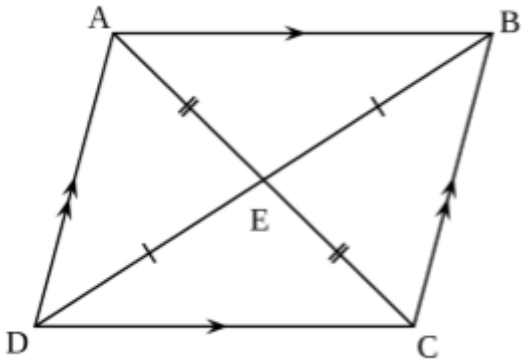


Here, AB = DC and AD = BC.

2. The opposite angles of a parallelogram will always be of equal measure.

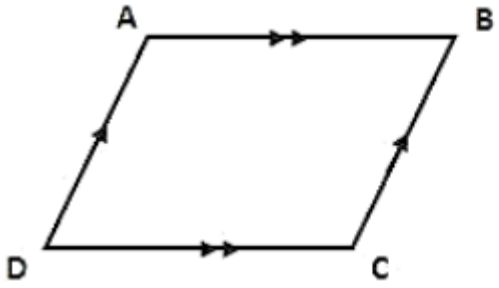
As in the above figure, ∠A = ∠C and ∠D = ∠B.

3. The two diagonals of a parallelogram bisect each other.



Here in ABCD, AC and BD bisect each other at point E. So that AE = EC and DE= EB.

4. The pair of adjacent angles in a parallelogram will always be a supplementary angle.



$$m\angle A + m\angle B = 180°$$
$$m\angle B + m\angle C = 180°$$
$$m\angle C + m\angle D = 180°$$
$$m\angle D + m\angle A = 180°$$

Example

If the opposite angles of a parallelogram are (3x + 5) ° and (61– x) °, then calculate all the four angles of the parallelogram.

Solution

As we know that the opposite angles are equal in a parallelogram so

(3x + 5)° = (61 – x) °

3x + x = 61– 5

4x = 56

x = 14°

Now substitute the value of x in the given angles.

(3x + 5)° = 3(14) + 5

= 42 + 5 = 47°

(61 – x)° = 61 – 14

= 47°

Both the angles are 47° as the opposite angles are equal.

Now to find the other angles let one of the adjacent angles to the above angle is z.

47° + z = 180° (adjacent angles are supplementary angles).

Z = 180° - 47°

= 133°

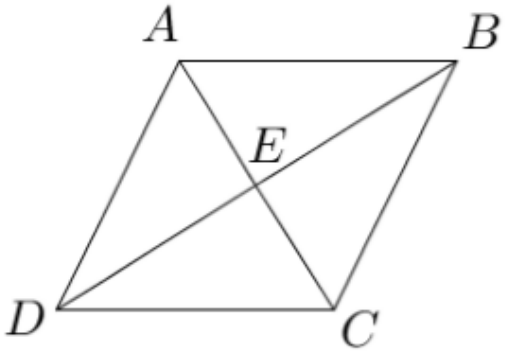
The fourth angle will also be 133° as the opposite angles are equal.

Hence the four angles of the given parallelogram are 47°, 47°, 133° and 133°.

Some Special Parallelograms

1. Rhombus

If a parallelogram has all the four sides equal then it is called a **Rhombus**.



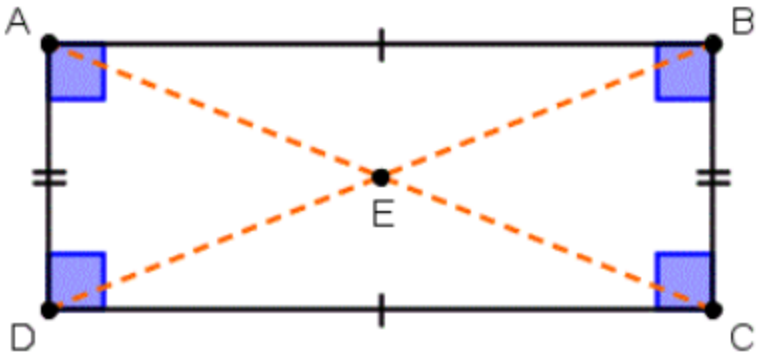
Here, AB = BC = CD = AD.

Properties of a Rhombus

- A rhombus has all the properties of a parallelogram and a kite.
- The special property is that its diagonals are perpendicular bisector to each other.
  - Hence, AE = EC and DE = EB.
  - It makes an angle of 90° at the point of intersection of the diagonals.

2. Rectangle

A parallelogram with equal angles and equal opposite sides is called **Rectangle**.



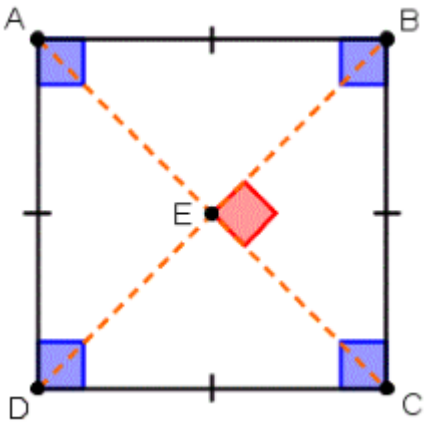
Here, AB = DC and AD = BC.

Properties of a Rectangle

- Opposite sides are parallel and equal.
- Opposite angles are equal.
- Adjacent angles make a pair of supplementary angles.
- Diagonals are of equal length.
- Diagonals bisect each other.
- All the four angles are of 90°.

3. Square

A rectangle with all the four equal sides is called a **Square**.



Here, AB = BC = CD = AD.

Properties of a Square

- All four sides are equal.
- Opposite sides are parallel.
- Diagonals are of equal length.
- Diagonals are perpendicular bisector to each other.
- All the four angles are of 90°.