Properties of a Parallelogram

A parallelogram is a quadrilateral in which both pairs of opposite sides are parallel. It looks like a slanted rectangle or a pushed square, but it still follows specific rules.

Properties of a Parallelogram:

i. Opposite sides are equal in length.

 \rightarrow AB = CD and AD = BC

- ii. Opposite angles are equal.
- $\rightarrow \angle A = \angle C$ and $\angle B = \angle D$
- iii. Adjacent angles are supplementary.
- $\rightarrow \angle A + \angle B = 180^{\circ}, \angle B + \angle C = 180^{\circ}, \text{ etc.}$
- iv. Diagonals bisect each other.
- \rightarrow AC and BD intersect at a point and cut each other into equal halves.
- v. Each diagonal divides the parallelogram into two congruent triangles.

Visual Understanding:

Let's say we have a parallelogram ABCD, with:

AB // CD and AD // BC

Diagonals AC and BD intersecting at point O

Then:

AO = OC and BO = OD

 $\angle A = \angle C, \angle B = \angle D$

AB = CD and AD = BC

∠A + ∠B = 180°

Example 1:

In a parallelogram PQRS, $\angle P = 70^{\circ}$. Find all other angles.

Solution:

In a parallelogram, opposite angles are equal and adjacent angles are supplementary.

Given: ∠P = 70°

 $\Rightarrow \angle R = 70^{\circ}$ (opposite angle) $\Rightarrow \angle Q = 180^{\circ} - 70^{\circ} = 110^{\circ}$ (adjacent angle) $\Rightarrow \angle S = 110^{\circ}$ (opposite to ∠Q)

Answer:∠Q = 110°, ∠R = 70°, ∠S = 110°

Example 2:

In parallelogram ABCD, diagonal AC and BD intersect at O. If AO = 5 cm and BO = 6 cm, find the lengths of AC and BD.

Solution:

In a parallelogram, diagonals bisect each other.

Given: AO = 5 cm, so OC = 5 cm \rightarrow AC = AO + OC = 5 + 5 = 10 cm Given: BO = 6 cm, so OD = 6 cm \rightarrow BD = BO + OD = 6 + 6 = 12 cm Answer: AC = 10 cm, BD = 12 cm

Summary Points:

- A parallelogram has opposite sides parallel and equal.
- Opposite angles are equal, and adjacent angles are supplementary.
- Diagonals bisect each other.
- The sum of all interior angles = 360°.
- It is a special type of quadrilateral with symmetrical properties.