CBSE Class 9 Maths Notes Chapter 8: In Class 9 Math, Chapter 8 talks about Quadrilaterals, which are shapes with four straight sides. This chapter helps you understand different kinds of quadrilaterals, like parallelograms, rectangles, squares, rhombuses, and trapeziums.

You'll learn about their special features and how to recognize them. We'll also explore things like opposite sides and angles, diagonals, and special properties like symmetry and congruence. By understanding this chapter well, you'll be better prepared for more advanced math topics later on.

CBSE Class 9 Maths Notes Chapter 8 Quadrilaterals Overview

These notes on Chapter 8, Quadrilaterals, are written by subject experts of Physics Wallah in simple language to help students understand the concepts easily. In this chapter, you will learn about different types of quadrilaterals, such as parallelograms, rectangles, squares, rhombuses, and trapeziums.

The notes explain their properties, like the relationships between sides and angles, and how to identify each type of quadrilateral. By studying these notes, students can grasp the fundamentals of quadrilaterals, which will be useful for more advanced math topics in the future.

CBSE Class 9 Maths Notes Chapter 8 Quadrilaterals PDF

You can access the CBSE Class 9 Maths Notes for Chapter 8 Quadrilaterals in PDF format using the provided link.

These notes provide comprehensive explanations and examples to help you grasp the concepts of triangles effectively.

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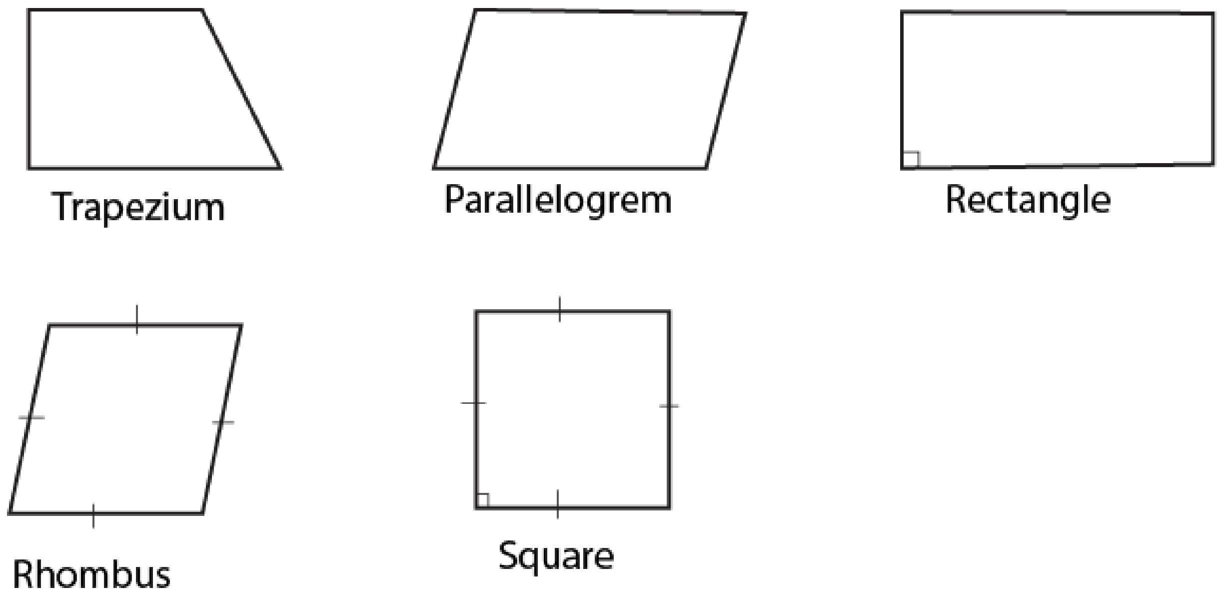
CBSE Class 9 Maths Notes Chapter 8 Quadrilaterals

Quadrilaterals

Quadrilaterals are a specific type of polygon characterized by having exactly four sides. These geometric shapes are formed by the union of four line segments. Common examples of quadrilaterals include squares, rectangles, parallelograms, and trapezoids. Each quadrilateral has four vertices (corners) and four angles. The sum of the interior angles of a quadrilateral is always 360 degrees.

Understanding the properties and types of quadrilaterals is fundamental in geometry, as they form the basis for more complex shapes and are widely used in various mathematical applications.

Examples of Quadrilaterals

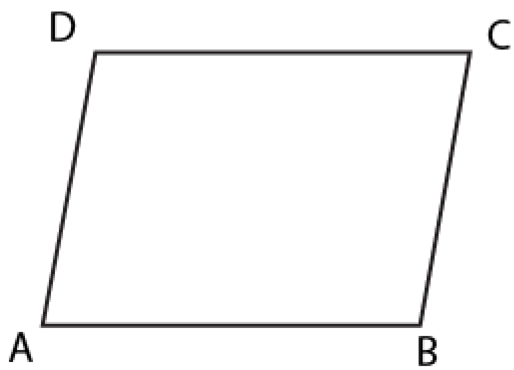


Parallelograms

A parallelogram is a specific type of quadrilateral defined by its unique properties. One defining characteristic of a parallelogram is that its opposite sides are both parallel and equal in length. This means that if you extend the opposite sides indefinitely, they will never intersect. Parallelograms encompass various other quadrilaterals, including rectangles, rhombuses, and squares, each possessing additional properties beyond those of a standard parallelogram.

In contrast, a trapezium is another type of quadrilateral, but it differs from a parallelogram in that only one pair of its opposite sides are parallel. Therefore, it does not qualify as a parallelogram. Despite this distinction, trapeziums share similarities with parallelograms, such as having opposite sides of equal length.

Understanding the properties and distinctions of parallelograms and trapeziums is crucial in geometry, as they form the basis for many geometric concepts and mathematical calculations.



In the diagram,

Opposite Sides

AB // DC$AB \parallel DC$ and AD // BC$AD \parallel BC$

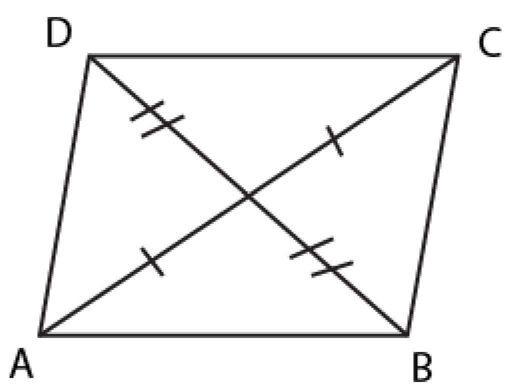
AB=DC$AB=DC$ and AD=BC$AD=BC$

- Opposite Angles are Equal.

From figure,

Aˆ=Cˆ$\hat{A}=\hat{C}$ and Bˆ=Dˆ$\hat{B}=\hat{D}$

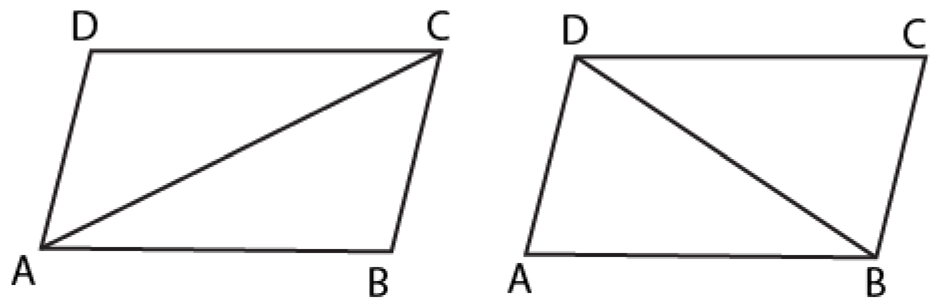
Diagonals of a Parallelogram Bisect Each Other



In the diagram,

OD=OB$OD=OB$ and OA=OC$OA=OC$

Each diagonal divides the parallelogram into two congruent triangles

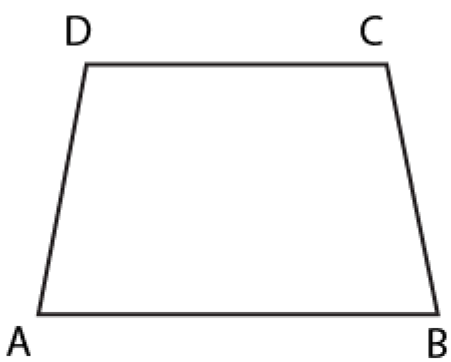


In the diagram,

$\triangle ABC \cong \triangle CDA$

$\triangle ABD \cong \triangle CDB$

Opposite Sides of a Quadrilateral



- Two sides of a quadrilateral, which have no common point, are called opposite sides.
- In the diagram, AB and DC is one pair of opposite sides.
- DC and BC is the other pair of opposite side

Understanding Quadrilateral Properties

Quadrilaterals are four-sided polygons with distinct properties that define their angles and sides. One fundamental aspect of quadrilaterals is the concept of consecutive sides, opposite angles, and consecutive angles.

Consecutive sides are two sides of a quadrilateral that share a common endpoint. For example, in a quadrilateral ABCD, AB and BC form one pair of consecutive sides, while BC and CD, CD and DA, and DA and AB represent the other three pairs of consecutive sides.

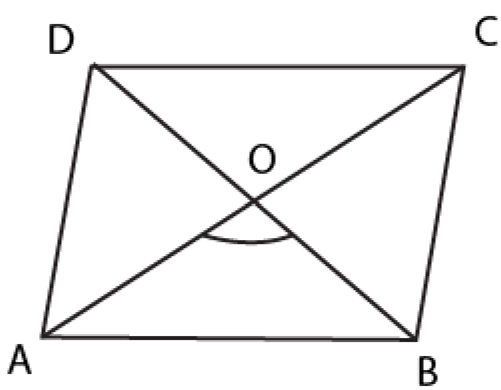
Opposite angles in a quadrilateral are a pair of angles that do not share a side in their intersection. In the quadrilateral ABCD, angles A and C form one pair of opposite angles, while angles B and D constitute another pair of opposite angles.

Consecutive angles, on the other hand, are two angles of a quadrilateral that include a side in their intersection. For instance, angles A and B represent one pair of consecutive angles, while angles B and C, C and D, and D and A form the other three pairs of consecutive angles.

Understanding these properties helps in identifying and analyzing quadrilaterals, facilitating geometric calculations and problem-solving in various mathematical contexts.

Theorem 1 Statement

- The diagonals of a parallelogram bisect each other.
- If two sides of a triangle are unequal, the longer side has the greater angle opposite to it.
- ABCD$ABCD$ is a parallelogram in which diagonals ACAC and BDBD intersect each other at OO.



To prove:

The diagonals ACAC and

BDBD

bisect eac$\hat{B}$ and $\hat{D}$ areh other that is,

$AO=OC$ and

$BO=DO$.

Proof:

$AB \parallel CD$ (By definition of parallelogram)

AC is a transversal.

$\therefore O\hat{A}B=O\hat{C}D$ ..... (i) (Alternate angles are equal in a parallelogram)

Also,

$AB=DC$ (Opposite sides are equal in a parallelogram)

Now in ΔAOB and $\Delta COD

$AB=DC$ (Opposite sides of parallelogram are equal)

$O\hat{A}B=O\hat{C}D$ (Proved by (i))

$A\hat{O}B=C\hat{O}D$ (Vertically opposite angles are equal)

Therefore,

$\triangle AOB \cong \triangle COD$

(AAS Congruency condition)

Therefore,

$AO=OC$ and $BO=OD$(corresponding parts of congruent triangles are congruent) that is the diagonals of a parallelogram bisect each other.

Sufficient Conditions for a Quadrilateral to be a Parallelogram

Identifying a parallelogram involves understanding its defining properties. These properties provide sufficient conditions for determining whether a quadrilateral is a parallelogram.

One key property is that if a quadrilateral is a parallelogram, then its opposite sides are equal. Conversely, if both pairs of opposite sides of a quadrilateral are equal, then the quadrilateral is a parallelogram.

Another condition is that if the diagonals of a quadrilateral bisect each other, the quadrilateral is a parallelogram. This means that the point where the diagonals intersect divides each diagonal into two equal parts.

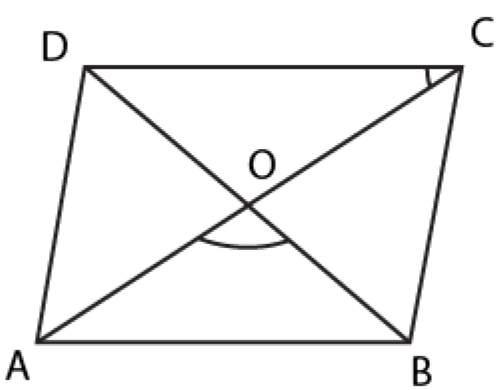
Additionally, if either pair of opposite sides of a quadrilateral are equal and parallel, then the quadrilateral is a parallelogram. This condition emphasizes the significance of parallelism in identifying parallelograms.

Understanding these conditions enables us to efficiently recognize and classify parallelograms, aiding in geometric analysis and problem-solving.

Theorem 22

Statement:

If the diagonals of a quadrilateral bisect each other, then the quadrilateral is a parallelogram.



Given:

$ABCD$ is a quadrilateral in which diagonals AC and BD intersect at O such that $AO=OC$ and $BO=OD$.

To prove:

$ABCD$ is a parallelogram.

Proof:

In triangles AOB and COD,

$AO=CO$ (Given)

$BO=OD$ (Given)

$A\hat{O}B=C\hat{O}D$ (Vertically opposite angles are equal)

Therefore,

$\Delta AOB \cong \Delta COD$

(SAS Congruency condition)

Therefore,

$O\hat{A}B=O\hat{C}D$ ($cpct$)

Since these are alternate angles made by the transversal AC intersecting AB and CD

Therefore,

$AB \parallel CD$

Similarly,

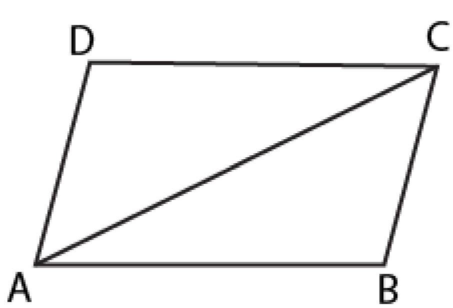
$AD \parallel BC$

Hence, $ABCD$ is a parallelogram.

Theorem 3:

Statement:

A quadrilateral is a parallelogram if one pair of opposite sides are equal and parallel.



Given:

$ABCD$ is a quadrilateral in which $AB \parallel CD$ and $AB = CD$.

To prove:

$ABCD$ is a parallelogram.

Construction:

Join AC.

Proof:

In triangles ABC and ADC,

$AB = CD$ (Given)

$B\hat{A}C = A\hat{C}D$ (Alternate angles are equal)

$AC = AC$ (Common side)

Therefore,

$\Delta ABC \cong \Delta CDA$

(SAS Congruency condition)

$B\hat{C}A = D\hat{A}C$ (Corresponding parts of corresponding triangles)

Since these are alternate angles,

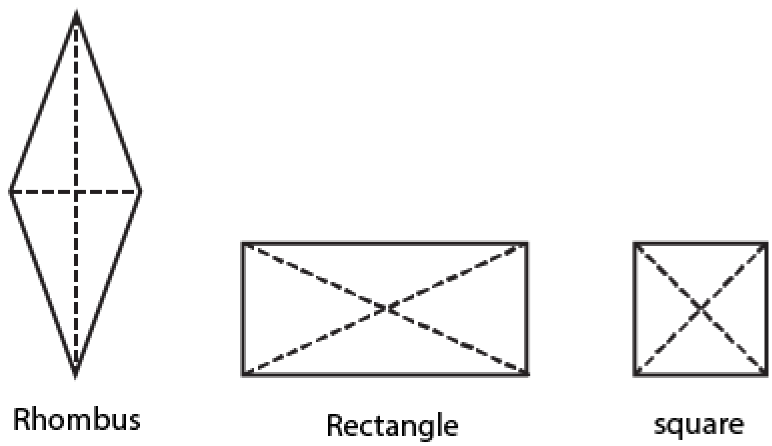
$AB \parallel CD$

Thus, in the quadrilateral $ABCD$, $AB \parallel CD$ and $AD \parallel BC$

Therefore, $ABCD$ is a parallelogram.

Special Parallelograms

Parallelograms encompass a diverse set of quadrilaterals, including rectangles, rhombuses, and squares. Each of these special parallelograms has distinct properties and characteristics.



Rectangle:
A rectangle is a parallelogram with all interior angles measuring 90 degrees, making it a right angle. Consequently, opposite sides of a rectangle are equal in length.

Rhombus:
A rhombus is a parallelogram with all sides of equal length. This means that opposite sides are equal and parallel. However, the angles of a rhombus are not necessarily 90 degrees, except in the case of a square.

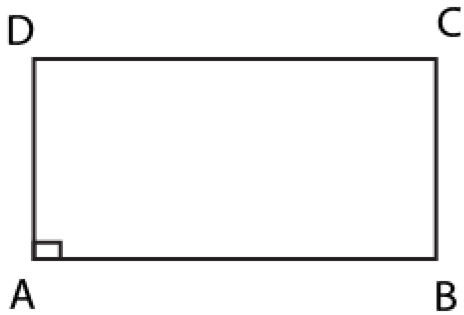
Square:
A square is a special case of both a rectangle and a rhombus. It possesses all the properties of a rectangle, including right angles, and all the sides are equal in length like a rhombus.

Relationships Between Special Parallelograms:
In terms of relationships, every rectangle and rhombus is inherently a parallelogram. Therefore, they are depicted as subsets of a parallelogram. Furthermore, because a square possesses the characteristics of both a rectangle and a rhombus, it is represented by the overlapping shaded region in the diagram.

Understanding the distinctions and relationships between these special parallelograms is crucial for geometry and problem-solving applications.

Rectangle

A rectangle is a parallelogram with one of its angles as a right angle.



In the above figure,

Let, $\hat{A} = 90^\circ$

Since,

$AD \parallel BC$,

$\hat{A} + \hat{B} = 180^\circ$

(Sum of interior angles on the same side of transversal AB)

Therefore,

$\hat{B} = 90^\circ$

Here,

$AB \parallel CD$ and $\hat{A} = 90^\circ$ (Given)

Therefore,

$\hat{A} + \hat{D} = 180^\circ$

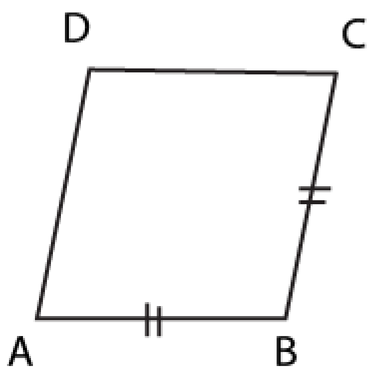
$\therefore \hat{D} = 90^\circ$

$\therefore \hat{C} = 90^\circ$

Corollary: Each of the four angles of a rectangle is a right angle.

Rhombus

A rhombus is a parallelogram with a pair of its consecutive sides equal.



$ABCD$ is a rhombus in which $AB = BC$.

Since a rhombus is a parallelogram,

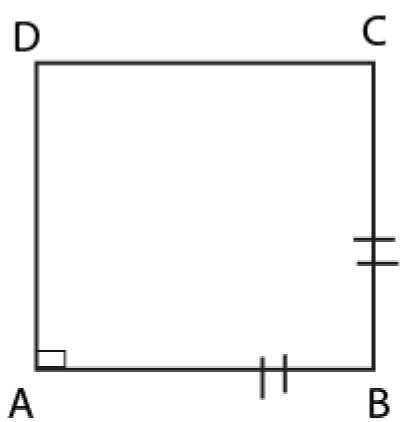
$AB = DC$ and $BC = AD$

Thus, $AB = BC = CD = AD$

Corollary: All the four sides of a rhombus are equal (congruent).

Square

A square is a rectangle with a pair of its consecutive sides equal.



Since square is a rectangle, each angle of a rectangle is a right angle and $AB = DC$, $BC = CD$.

Thus,

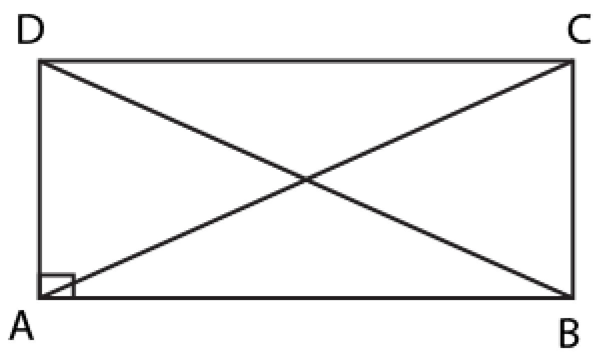
$AB=BC=CD=AD$

Each of the four angles of a square is a right angle and each of the four sides is of the same length.

Theorem 44

Statement:

The diagonals of a rectangle are equal in length.



Given:

$ABCD$ is a rectangle.

AC and BD are diagonals.

To prove:

$AC=BD$

Proof:

Let, $\hat{A}=90^\circ$ (By definition of rectangle)

$\hat{A}+\hat{B}=180^\circ$ (Consecutive interior angle)

$\hat{A}=\hat{B}=90^\circ$

Now in triangles, ABD and ABC,

$AB=AB$ (Common side)

$\hat{A}=\hat{B}=90^\circ$ (Each angle is a right angle)

$AD=BC$ (Opposite sides of parallelogram)

Therefore,

$\Delta ABD \cong \Delta BAC$

Therefore,

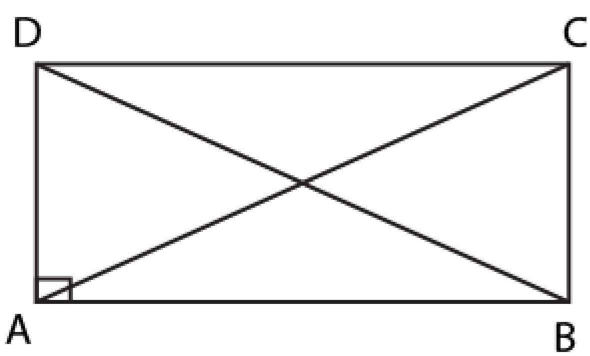
$BD=AC$ (Corresponding parts of corresponding triangles)

Hence the theorem is proved.

Converse of Theorem 44:

Statement:

If two diagonals of a parallelogram are equal, it is a rectangle.



Given:

$ABCD$ is a parallelogram in which $AC=BD$.

To prove:

Parallelogram $ABCD$ is a rectangle.

Proof:

In triangles ABC and DBC,

$AB = DC$ (Opposite sides of parallelogram)

$BC = BC$ (Common side)

$AC = BD$ (Given)

Therefore,

$\Delta ABC \cong \Delta DCB$

(

SSS

congruency condition)

Therefore,

$A\hat{B}C = D\hat{C}B$ (Corresponding parts of corresponding triangles)

But these angles are consecutive interior angles on the same side of transversal BC and $AB \parallel DC$.

Therefore,

$A\hat{B}C + D\hat{C}B = 180^\circ$

But,

$A\hat{B}C = D\hat{C}B$

Therefore,

$A\hat{B}C = D\hat{C}B = 90^\circ$

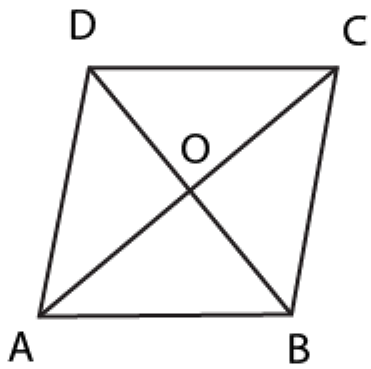
Therefore, by definition of rectangle, parallelogram $ABCD$ is a rectangle.

Hence the theorem is proved.

Theorem 5:

Statement:

The diagonals of a rhombus are perpendicular to each other.



Given:

$ABCD$ is a rhombus.

Diagonal AC and BD intersect at O.

To prove:

AC and BD bisect each other at right angles.

Proof:

A rhombus is a parallelogram such that

$AB = DC = AD = BC \text{ ......(i)}$

Also the diagonals of a parallelogram bisect each other.

Hence,

$BO=DO$ and $AO=OC \text{ ......(ii)}$

Now, compare triangles AOB and AOD,

$AB=AD$ (From (i) above)

$BO=DO$ (From (ii) above)

$AO = AO$ (Common side)

Therefore,

$\Delta AOB \cong \Delta AOD$

(

SSS

congruency condition)

Therefore,

$A\hat{O}B = A\hat{O}D$

(Corresponding parts of corresponding parts)

BD

is a straight line segment.

Therefore,

$A\hat{O}B + A\hat{O}D = 180^\circ$

But,

$A\hat{O}B = A\hat{O}D$

(Proved)

Therefore,

$$A\hat{O}B = A\hat{O}D = \frac{180^\circ}{2}$$
$$A\hat{O}B = A\hat{O}D = 90^\circ$$

That is, the diagonals bisect at right angles.

Hence the theorem is proved.

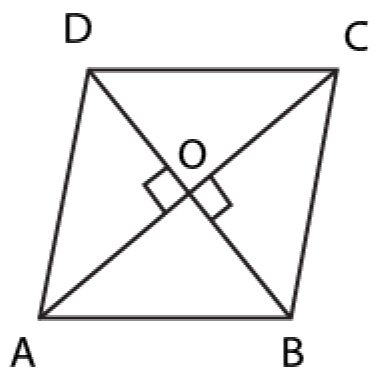
Converse of Theorem 5:

Statement:

If the diagonals of a parallelogram are perpendicular then it is a rhombus.

Given:

$ABCD$ is a parallelogram in which AC and BD are perpendicular to each other.



To prove:

$ABCD$ is a rhombus.

Proof:

Let AC and BD intersect at right angles at O.

$A\hat{O}B = 90^\circ$

In triangles AOD and COD,

$AO = OC$ (Diagonals bisect each other)

$OD = OD$ (Common side)

$A\hat{O}D = C\hat{O}D = 90^\circ$

(Given)

Therefore,

$\Delta AOD \cong \Delta COD$

(

SAS

congruency condition)

$AD = DC$

That is, the adjacent sides are equal.

Therefore, by definition, $ABCD$ is a rhombus.

Hence the theorem is proved.

Benefits of CBSE Class 9 Maths Notes Chapter 8 Quadrilaterals

- **Conceptual Understanding:** These notes provide a comprehensive explanation of the properties and characteristics of quadrilaterals, helping students build a strong conceptual foundation in geometry.
- **Clarity in Definitions:** By clearly defining terms such as parallelograms, rectangles, rhombuses, and squares, the notes ensure that students understand the distinctions between different types of quadrilaterals.
- **Problem-Solving Skills:** Through worked examples and exercises, students can enhance their problem-solving abilities in geometry. Practice questions included in the notes enable students to apply the concepts they've learned to solve a variety of problems.
- **Preparation for Exams:** CBSE Class 9 Maths exams often include questions related to quadrilaterals. These notes serve as a valuable resource for exam preparation, ensuring that students are well-equipped to tackle questions on this topic.