🟦 Chapter 8: Quadrilaterals

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🔹 What is a Quadrilateral?

🟦 A quadrilateral is a polygon with 4 sides and 4 angles.
Examples: Square, Rectangle, Rhombus, Parallelogram, Trapezium, Kite

🧠 Sum of all interior angles of any quadrilateral = 360°

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🔸 Types of Quadrilaterals & Their Properties

Type	Key Properties
Parallelogram	Opposite sides equal, opposite angles equal, diagonals bisect each other
Rectangle	All angles 90°, opposite sides equal, diagonals are equal & bisect each other
Rhombus	All sides equal, opposite angles equal, diagonals bisect at 90°
Square	All sides equal, all angles 90°, diagonals are equal & bisect at 90°
Trapezium	Only one pair of opposite sides is parallel
Kite	Two pairs of adjacent sides equal, one diagonal bisects the other at 90°

📏 **Note:**

- In any parallelogram, diagonal divides it into two congruent triangles
- Midpoint theorem: Line joining midpoints of two sides of a triangle is parallel to the third side and half of it

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🧠 Important Theorems

✅ **A quadrilateral is a parallelogram if:**

- Opposite sides are equal
- Opposite angles are equal
- Diagonals bisect each other
- One pair of opposite sides is equal and parallel

✅ The quadrilateral formed by joining midpoints of sides of any quadrilateral is a parallelogram

✅ **In rectangle:** Diagonals are equal
✅ **In rhombus:** Diagonals bisect at 90°
✅ **In square:** Diagonals are equal & perpendicular

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❓ Multiple Choice Quick Practice

🧠 Example:
Q: If ∠BOC = 90° and ∠BDC = 50° in a parallelogram, then ∠OAB = ❓
✅ Answer: 40°

Q: A quadrilateral with angles in ratio 3:7:6:4 → Total = 360°
Solve to find each angle and the type (e.g., trapezium)

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✏️ Reasoning-Based Short Questions

🧠 Can all angles of a quadrilateral be obtuse? ❌ No! 4 obtuse angles > 360°

🧠 Can a quadrilateral have 3 equal angles? ✅ Possible — but not necessarily a parallelogram

🧠 If diagonals of a quadrilateral bisect each other, is it a parallelogram? ✅ Yes!

🧠 If diagonals of a rectangle are perpendicular? ❌ No, that's a rhombus or square

🧠 If a diagonal bisects one angle in a parallelogram → it also bisects the opposite angle ✅ (proven by congruence)

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📐 Application-Based Problems

🧮 Joining midpoints of sides of rhombus → forms a rectangle
🧮 Midpoints of square → again form a square
🧮 In trapezium, line joining midpoints of non-parallel sides is parallel to parallel sides & half their sum

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🔷 Geometry HOTS & Constructions

🎯 In ΔABC, D & E are midpoints of AB and AC → DE ∥ BC and DE = ½ BC
🎯 In parallelogram, if two opposite sides' midpoints are joined and extended, it forms another parallelogram

🎯 If diagonals of a quadrilateral are equal & perpendicular → joining midpoints → square

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🟦 Long Answer Highlights

🧠 Show that the figure formed by joining midpoints of a rhombus is a rectangle:

- Use midpoints → prove opposite sides ∥ and equal
- Use diagonal properties → prove angle = 90°

🧠 Prove: A diagonal of parallelogram bisecting one angle → also bisects opposite angle

- Use alternate angle theorem + congruence

🧠 Quadrilateral bisectors form a rectangle

- Use angle bisector properties and symmetry

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🔚 Summary Table

Property/Concept	Key Result
Sum of interior angles (quadrilateral)	360°
Parallelogram diagonals	Bisect each other
Rectangle diagonals	Equal and bisect each other
Rhombus diagonals	Bisect at 90°
Square diagonals	Equal, bisect at 90°
Midpoints joined (quadrilateral)	Forms a parallelogram
Diagonal bisecting one angle (parallelogram)	Also bisects opposite angle