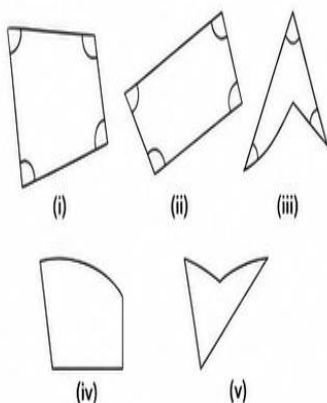


4 QUADRILATERALS

SUMMARY OF CONCEPTS & DEFINITIONS

1. QUADRILATERAL - BASICS

- A quadrilateral is a four-sided polygon.
- The angles of a quadrilateral are the angles between its sides.
- Figs. (i), (ii) and (iii) are quadrilaterals. The others are not.

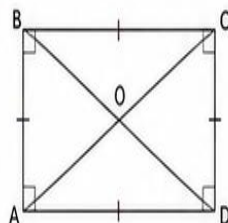


Quadrilateral = 4 sides, 4 vertices, 4 angles

2. RECTANGLE

Definition: A rectangle is a quadrilateral in which—

- All angles are right angles (90°).
- Opposite sides are equal.



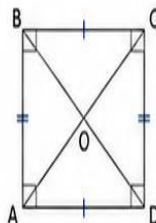
Properties (using diagonals)

- Diagonals are equal. ($AC = BD$)
- Diagonals bisect each other. ($OA = OC$ and $OB = OD$)
- Diagonals make any angle with these properties.
- Opposite sides are equal.
- All angles are 90° .

3. SQUARE

Definition: A square is a quadrilateral in which—

- All angles are right angles (90°), and
- All sides are of equal length.

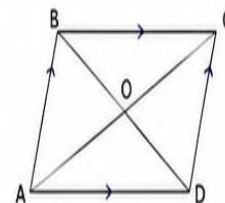


Properties

- All properties of a rectangle.
- All sides are equal ($AB = BC = CD = DA$).
- Diagonals are equal and bisect each other at right angles.
- Each diagonal bisects the angles of the square.

4. PARALLELOGRAM

Definition: A parallelogram is a quadrilateral in which both pairs of opposite sides are parallel.

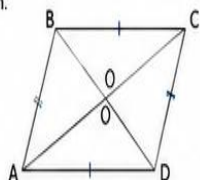


Properties (using diagonals)

- Opposite sides are equal and parallel.
- Opposite angles are equal.
- Consecutive (adjacent) angles are supplementary (add up to 180°).
- Diagonals bisect each other. ($OA = OC$, $OB = OD$)
- Diagonals are not necessarily equal.

5. RHOMBUS

Definition: A rhombus is a quadrilateral in which all four sides are of equal length.

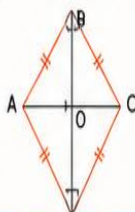


Properties (using diagonals)

- All sides are equal ($AB = BC = CD = DA$).
- Opposite sides are parallel.
- Opposite angles are equal.
- Consecutive angles are supplementary.
- Diagonals bisect each other.
- Diagonals are perpendicular to each other.
- Each diagonal bisects the angles of the rhombus.

6. KITE

Definition: A kite is a quadrilateral in which two pairs of adjacent sides are equal.

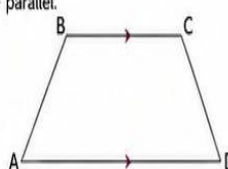


Properties (using diagonals)

- Two pairs of adjacent sides are equal.
- One pair of opposite angles is equal ($\angle A = \angle C$).
- The diagonals are perpendicular to each other.
- One diagonal bisects the other.
- The diagonal along the axis of symmetry (BD) bisects the angles at B and D.

7. TRAPEZIUM (Trapezoid)

Definition: A trapezium is a quadrilateral in which only one pair of opposite sides are parallel.



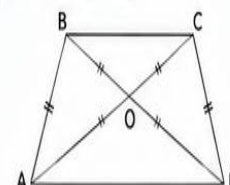
Properties

- Exactly one pair of opposite sides is parallel.
- The other two sides are non-parallel.
- No special relation between angles and diagonals.

Note: If the non-parallel sides are equal, it is called an **isosceles trapezium**. Then, the base angles are equal and diagonals are equal.

8. ISOSCELES TRAPEZIUM

Definition: A trapezium in which the non-parallel sides are equal.



Properties

- One pair of opposite sides is parallel.
- Non-parallel sides are equal.
- Base angles are equal ($\angle A = \angle D$, $\angle B = \angle C$).
- Diagonals are equal ($AC = BD$).
- Consecutive angles on the same leg are supplementary.

9. QUICK COMPARISON TABLE

Figure	Definition (Key Condition)	Opposite Sides	Opposite Angles	Consecutive Angles	Diagonals	Special Property
Rectangle	4 right angles; opposite sides equal	Equal	Equal	Supp.	Equal; bisect each other	All angles 90°
Square	4 right angles; all sides equal	Equal	Equal	Supp.	Equal; bisect at 90°	All sides equal
Parallelogram	Both pairs opposite sides parallel	Equal & //	Equal	Supp.	Bisect each other	Diagonals not necessarily equal
Rhombus	All sides equal	Equal & //	Equal	Supp.	Bisect; $\perp$ to each other	Diagonals bisect angles
Kite	Two pairs adjacent sides equal	—	One pair equal	—	$\perp$ to each other; one bisects the other	One diagonal bisects angles
Trapezium	One pair of opposite sides parallel	—	—	—	No special relation	—
Isosceles Trapezium	One pair parallel; non-parallel sides equal	—	Base angles equal	Same leg supp.	Diagonals are equal	—

10. KEY TAKEAWAYS

- A quadrilateral has 4 sides, 4 vertices and 4 angles.
- Rectangles have 4 right angles and opposite sides equal.
- Squares have all properties of rectangles + all sides equal.
- Parallelograms have both pairs of opposite sides parallel.
- Rhombuses have all sides equal.
- Kites have two pairs of adjacent sides equal.
- Trapeziums have one pair of opposite sides parallel.
- Isosceles trapeziums have equal non-parallel sides and equal base angles.
- Diagonals help in identifying and proving properties.

Think!
Diagonals help us reveal the hidden relationships in quadrilaterals!

QUADRILATERAL

WORKSHEET-1

Section A: MCQs(PART -I) ($10 \times 1 = 10$ marks)

1. A simple closed figure made of only line segments is called a:

- (A) Curve (B) Polygon (C) Circle (D) Ray

2. The sum of interior angles of a triangle is:

- (A) 90° (B) 180° (C) 270° (D) 360°

3. Which of the following is NOT a quadrilateral?

- (A) Square (B) Rectangle (C) Pentagon (D) Rhombus

4. A quadrilateral has _____ diagonals.

- (A) 1 (B) 2 (C) 3 (D) 4

5. Two angles of a quadrilateral are 70° each and a third is 110° . The fourth angle is:

- (A) 100° (B) 110° (C) 120° (D) 130°

6. A parallelogram in which all sides are equal is called a:

- (A) Rectangle (B) Trapezium (C) Rhombus (D) Square

7. In a rectangle, each interior angle measures:

- (A) 60° (B) 90° (C) 120° (D) 450°

8. Which of the following statements is TRUE about a square?

- (A) Opposite sides are unequal (B) Diagonals are perpendicular bisectors of each other

- (C) Only one pair of parallel sides (D) Diagonals are unequal

9. The number of sides of a polygon whose interior angle sum is 1080° is:

- (A) 6 (B) 7 (C) 8 (D) 9

10. Which of the following pairs of angles are supplementary?

- (A) 45° and 55° (B) 60° and 130° (C) 70° and 110° (D) 80° and 90°

MCQs(PART-2) (10 × 1 = 10 marks)

11. The sum of all interior angles of a quadrilateral is always:

- (A) 180° (B) 270° (C) 360° (D) 540°

12. In parallelogram ABCD, if $\angle A = 65^\circ$, then $\angle C = ?$

- (A) 115° (B) 65° (C) 90° (D) 125°

13. Which property is EXCLUSIVE to a rectangle (not common to all parallelograms)?

- (A) Opposite sides are equal (B) Diagonals bisect each other
(C) Each angle is 90° (D) Opposite angles are equal

14. In a parallelogram, adjacent angles are:

- (A) Equal (B) Supplementary (C) Complementary (D) Vertically opposite

15. A quadrilateral that has exactly ONE pair of parallel sides is called a:

- (A) Parallelogram (B) Rhombus (C) Trapezium (D) Kite

16. The diagonals of a rhombus bisect each other at:

- (A) 45° (B) 60° (C) 90° (D) 180°

17. ABCD is a parallelogram. If $AB = 7$ cm and $BC = 5$ cm, the perimeter is:

- (A) 12 cm (B) 24 cm (C) 35 cm (D) 22 cm

18. Which of the following is NOT a property of a parallelogram?

- (A) Opposite sides are parallel (B)) Diagonals are equal in length
(C) Opposite angles are equal (D) Consecutive angles are supplementary

19. If the diagonals of a quadrilateral bisect each other at right angles and all sides are equal, the quadrilateral is a:

- (A) Rectangle (B) Rhombus (C) Square (D) Trapezium

20. In a quadrilateral PQRS, $\angle P + \angle Q = 200^\circ$. Then $\angle R + \angle S = ?$

- (A) 160° (B) 180° (C) 200° (D) 360°

Section B: Short Answer ($10 \times 2 = 20$ marks)

1. Find the value of x if the four angles of a quadrilateral are x° , $(x + 20)^\circ$, $(x + 30)^\circ$ and $(x + 50)^\circ$.

2. Two adjacent angles of a parallelogram are in the ratio 2:7. Find all four angles of the parallelogram.

3. The perimeter of a rhombus is 52 cm. Find the length of each side.

4. In parallelogram ABCD, $\angle A = 3x + 10^\circ$ and $\angle B = 5x - 30^\circ$. Find the value of x and both angles.

5. Name the type of quadrilateral formed if one pair of opposite sides is parallel and non-equal, and the other pair is non-parallel. Give one real-life example.

6. In a parallelogram PQRS, the diagonals intersect at O. If $PO = 4.5$ cm, find PR. Also find SQ if $SO = 3.2$ cm.

7. State whether the following is True or False with a reason: 'Every rhombus is a parallelogram, but every parallelogram is not a rhombus.'

8. A quadrilateral has angles in the ratio 1:2:3:4. Find each angle and name the type of quadrilateral (if any special type applies).

9. Define a kite. How many pairs of equal adjacent sides does a kite have? Draw a rough labelled sketch.

10. The length of one diagonal of a rhombus is 16 cm and the area is 96 cm^2 . Find the length of the other diagonal.

- 11.** In quadrilateral ABCD, $\angle A = 90^\circ$, $\angle B = (2x + 15)^\circ$, $\angle C = (3x - 5)^\circ$ and $\angle D = (x + 10)^\circ$.
(a) Find x . (b) Find all four angles. (c) Is ABCD a parallelogram? Justify.

- 12.** Prove that the diagonal of a parallelogram divides it into two congruent triangles.
Use parallelogram ABCD with diagonal AC. State the properties used at each step.

- 13.** ABCD is a rhombus. The diagonals AC and BD intersect at O. If $AC = 24$ cm and $BD = 10$ cm, (a) find all sides of the rhombus, (b) find its perimeter, and (c) find its area.

- 14.** A garden in the shape of a parallelogram has base 45 m and the corresponding height 20 m.
(a) Find the area of the garden.
(b) If fencing costs ₹35 per metre and the adjacent side of the parallelogram is 30 m, find the cost of fencing the garden.

15. Show with a counter-example that the statement 'If a quadrilateral has two pairs of equal opposite angles, it must be a parallelogram' is NOT always true. Also state when it IS true.

16. The angles of a quadrilateral are $(3y - 5)^\circ$, $(y + 15)^\circ$, $(2y + 10)^\circ$ and $(4y - 20)^\circ$.
(a) Find y . (b) Find each angle. (c) Classify the quadrilateral based on its angles.

Section D: Long Answer ($3 \times 5 = 15$ marks)

17. ABCD is a parallelogram. E is the midpoint of AB and F is the midpoint of CD.
(a) Prove that AEFD is a parallelogram.
(b) Prove that EBCF is also a parallelogram.
(c) What can you conclude about the area of each smaller parallelogram compared to ABCD?
(d) If ABCD has area 120 cm^2 , what is the area of AEFD?

18. A farmer has a quadrilateral plot PQRS where $PQ \parallel SR$. $PQ = 80$ m, $SR = 50$ m, and the perpendicular distance between PQ and SR is 30 m.

- (a) Name this quadrilateral and state two of its properties.
- (b) Find the area of the plot.
- (c) The farmer wants to divide the plot into two triangles by drawing diagonal PR.
If $PR = 58$ m and the height from S to PR is 20 m, find the area of triangle PRS.
- (d) Find the area of triangle PQR. Does the sum match the total area?

19. Investigate: Under what conditions does a parallelogram become

- (i) a rectangle, (ii) a rhombus, and (iii) a square?
- (a) State the additional condition for each.
- (b) Draw and label all three figures.
- (c) Write ANY two properties that are common to all three.
- (d) A quadrilateral has diagonals that are equal in length AND bisect each other.
What type of quadrilateral must it be? Give a reason.

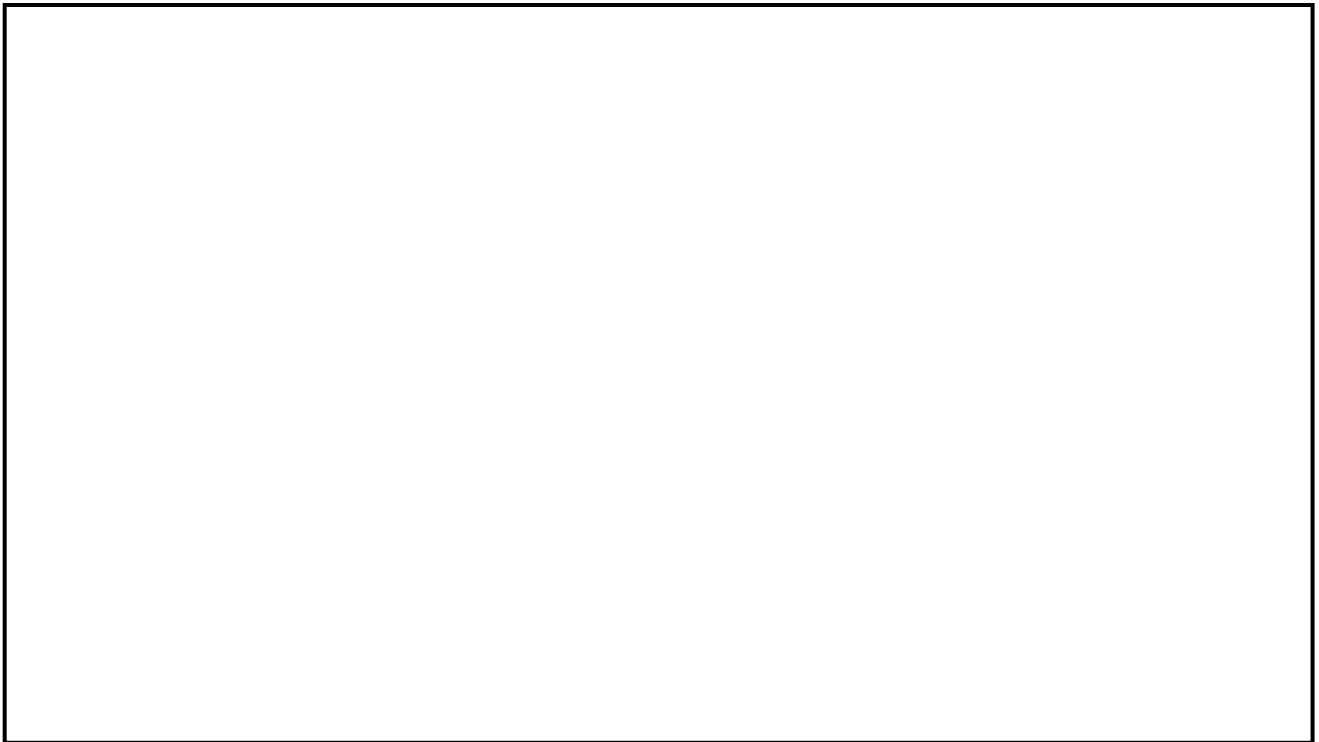
Case Study Based Questions ($4 \times 2 = 8$ marks)

20. The School Playground

The school authority decides to redesign the playground into a parallelogram-shaped field ABCD. The construction team measures $AB = 60$ m, $BC = 40$ m, and $\angle DAB = 70^\circ$. The playground is to be divided into two zones by drawing diagonal BD. The head teacher also wants to install corner boundary posts and a fence along all four sides. She notices that the diagonals of the parallelogram bisect each other at point O, and $OA = 37$ m.

20(i). Find $\angle BCD$ and $\angle ABC$ in the parallelogram ABCD. How are consecutive angles in a parallelogram related? Calculate the total cost of fencing if the rate is ₹50 per metre.

(ii). If $OA = 37$ m, find the full length of diagonal AC. Also, the diagonal $BD = 46$ m. Using these diagonals, Ravi claims he can find the area of each triangle formed. Find the area of triangle ABD if its base $AB = 60$ m and the height from D to AB is 24 m.



21. An interior designer is creating a mosaic floor pattern using rhombus-shaped tiles. Each tile has a perimeter of 48 cm. The diagonals of each tile are in the ratio 3:4. The longer diagonal of one tile is 24 cm. The designer also notices that when four such rhombus tiles are arranged around a common centre point, the angles at the centre always sum to exactly 360° — a property she uses to ensure the tiles fit seamlessly without gaps. She wants to calculate the amount of material needed for 150 such tiles.

21(i). Find the side of each rhombus tile and the length of the shorter diagonal. Using the diagonals, find the area of one tile and verify using the given ratio.

(ii). Find the total area of material needed for 150 tiles. Also, at the centre where four tiles meet, if each tile contributes an angle of 90° , what type of quadrilateral is formed at the centre? Justify with its angle property.

Self Assessment:

I understood all the concepts: ☐ Yes ☐ No

I need more practice: ☐ Yes ☐ No

Name of Concepts having doubts/Not Cleared: _____

Parent's Assessment:

My ward understood the all the concepts: ☐ Yes ☐ No

He/She need more practice: ☐ Yes ☐ No

Name of Concepts having doubts/Not Cleared: _____

Signature of Parent:

Teacher's Assessment

Answers of Worksheet-1

Q.NO.	1	2	3	4	5	6	7	8	9	10
ANS.	B	B	C	B	B	C	B	B	C	C
Q.NO.	11	12	13	14	15	16	17	18	19	20
ANS.	C	B	C	B	C	C	B	B	C	A

Answers of Worksheet-2

Q.NO.	1	2	3	4	5
ANS.	65°	40°, 140°, 40°, 140°	13 cm	x = 25° A = 85° B = 95°	Trapezium
Q.NO.	6	7	8	9	10
ANS.	PR = 9 cm SQ = 6.4 cm	TRUE	36°, 72°, 108°, 144°	A kite has 2 pairs of equal adjacent sides	12 cm
Q.NO.	11	12	13	14	15
ANS.	(a) x = 45° (b) 90°, 105°, 130°, 55° (c) Not a parallelogram	ΔABC is congruent to ΔCDA	(a) 13 cm (b) 52 cm (c) 120 cm²	a) 900 m² b) ₹5,250	A kite can have two pairs of equal opposite angles without being a parallelogram
Q.NO.	16	17	18	19	20(i)
ANS.	a) y = 36° (b) 103°, 51°, 82°, 124°	Both AEFD and EBCF are parallelograms; each has area 60 cm².	(a) Trapezium (b) Area = 1,950 m² (c) Area ΔPRS = 580 m² (d) Matches		i) BCD = 70° ii) ABC = 110° Total fencing cost = ₹10,000
Q.NO.	20(ii)	21(i)	21(ii)		
ANS.	AC = 74 m; Area of ΔABD = 720 m²	Side = 12 cm; shorter diagonal = 18 cm; Area = 216 cm²	Total area = 32,400 cm²; Centre figure is a Square		