B. B. S. S. Sec. School
Class- VIIIth Sub- Maths
Ch - 7 Understanding Shapes

Topic → (I) Parallelogram →
In a parallelogram
(I) Opposite sides are equal
(II) Opposite angles are equal.
(III) Each diagonal bisects the parallelogram.

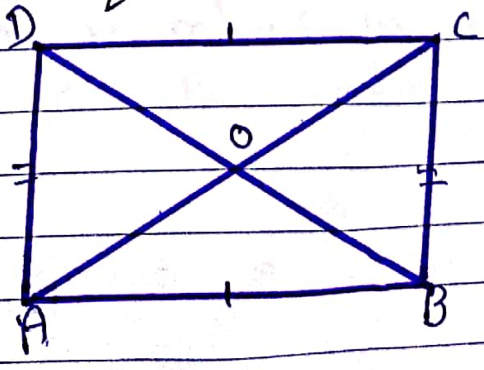
(II) Rectangle → A quadrilateral whose each angle is equal to 90°, is called

(III) Rhombus :→ A quadrilateral whose all sides are equal, is called a rhombus.

(IV) Square → A quadrilateral whose all sides are equal and each angle is equal to 90°, is called a square.

V) Trapezium → A quadrilateral whose one pair of opposite sides are parallel, is called a trapezium.

Theorem 1 → Diagonals of a rectangle are equal and bisect each other.



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Given → A rectangle ABCD with diagonals AC and BD.

To prove :-

(i) BD and AC bisect each other

ii) AC = BD

Proof : As ABCD is a rectangle

AB ∥ DC , BC ∥ AD

and ∠A = ∠B = ∠C = ∠D = 90°

Now, in rectangle ABCD, since AB ∥ DC and BC ∥ AD

∴ ABCD is a parallelogram.

⇒ BD and AC bisect each other.

(Because diagonals of parallelogram bisect each other.)

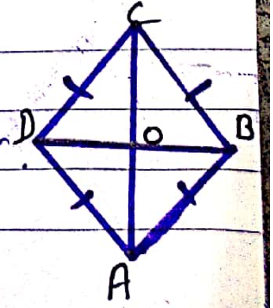
Hence proved BD and AC bisect each other.

Now, considering Δ DAB and Δ CBA, we have

AD = BC	(opposite sides of ∥gram
AB = AB	(common)
∠DAB = ∠CBA	(90° each)
Δ DAB ≅ Δ CBA	(by SAS)
BD = AC	(By c.p.c.t)

Theorem -2 Diagonals of a rhombus bisect each other at right angle.

Given → ABCD is a rhombus in which diagonals BD and AC Intersect each other at O.



To Prove →

i) BD and AC bisect each other.

ii) BD ⊥ AC.

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Proof → ABCD is a rhombus
$AB = BC = CD = DA$
ABCD is a parallelogram (as opposite sides are equal)
BD and AC bisect each other,

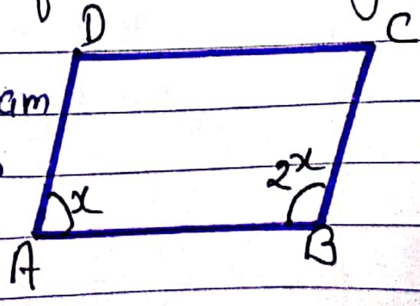
Hence BD and AC bisect each other. (i)

Since BD and AC bisect each other, $OB = OD$
Similarly, we can prove that $OC = OA$
Now, considering $\triangle COB$ and $\triangle COD$, we have

$CD = BC$ (sides of the rhombus ABCD)
$OB = OD$ (Proved by (i))
$OC = OC$ (Common)
$\triangle COB \cong \triangle COD$ (By SSS)
→ $\angle COD = \angle COB$ (By c.p.c.t.) (ii)
But we have $\angle COD + \angle COB = 180°$ (Linear pair) (iii)

From (ii) and (iii) we have
$\cancel{2\angle}$ $2\angle COD = 180°$
$\angle COD = 180° \div 2$
$\angle COD = 90°$
$\Rightarrow BD \perp AC$

Example → Two adjacent angles of a parallelogram are in the ratio 1:2. Find the measure of each angles.



Solution → Suppose ABCD is a parallelogram and measures of $\angle A$ and $\angle B$ are in the ratio 1:2

Let $\angle A = x$, then $\angle B = 2x$

Now, $AD \parallel BC$ and AB is transversal.

So, $\angle A + \angle B = 180^\circ$

[$\because$ Sum of the interior angles on one side of parallel line is 180°.]

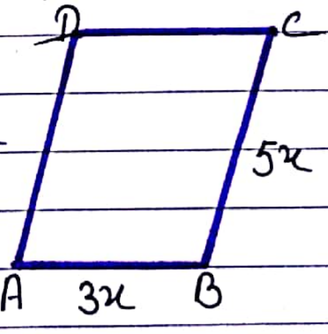
$$x + 2x = 180^\circ \rightarrow 3x = 180^\circ$$
$$x = \frac{180}{3}$$
$$x = 60^\circ$$

$$\angle A = x = 60^\circ$$
$$\angle B = 2x = 2 \times 60^\circ = 120^\circ$$

Again, opposite angles of a parallelogram are equal.

$$\angle C = \angle A = 60$$
$$\text{and } \angle D = \angle B = 120^\circ$$

EXAMPLE → The ratio of sides of a parallelogram is 3:5 and the perimeter is 48 cm. Find the sides of the parallelogram.



Solution → Suppose ABCD be a parallelogram with $AB = 3x$ and $BC = 5x$.

Since, opposite sides of a parallelogram are equal.

$\therefore AB = DC = 3x$ and $BC = AD = 5x$

Now, the perimeter of ABCD is given by

$$AB + BC + CD + DA = 48\text{cm}$$
$$3x + 5x + 3x + 5x = 48 \text{ cm}$$
$$16x = 48\text{cm}$$
$$x = 48 \div 16 = 3\text{cm}$$

Hence $AB = CD = 3x = 3\times 3 = 9$ cm
Also = $BC = DA = 5x = 5\times 3 = 15$ cm.

Note 1. Write all notes in your note book.
2. Do Ex assignment 7.2 and 7.3 in your note book.

Assignment - 7.2

3. The ratio of the adjacent sides of a parallelogram is as 2 : 3, and its perimeter is 40 cm. Find the sides of the parallelogram.

4. The ratio of adjacent sides of a parallelogram is as 2 : 3, and its perimeter is 60 cm. Find the sides of parallelogram.

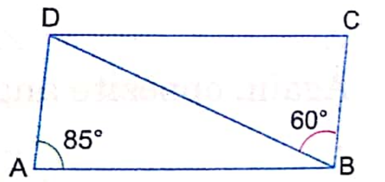
5. The perimeter of a parallelogram is 150 cm. One of its sides is greater than the other by 33 cm. Find the lengths of the sides of the parallelogram.

6. Two adjacent angles of a parallelogram are in the ratio 4 : 5. Find the measure of all the angles.

7. Two adjacent angles of a parallelogram are in the ratio of 2 : 1. Find the measure of each angle.

8. Two adjacent angles of parallelogram are in the ratio 7 : 2. Find the measure of all the angles of parallelogram.

9. In the adjoining Figure, ABCD is a parallelogram. If $\angle DAB = 85°$ and $\angle DBC = 60°$, then calculate :
(i) $\angle CDB$ (ii) $\angle ABD$

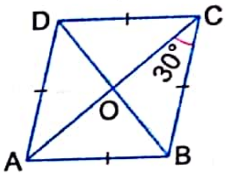


ASSIGNMENT 7.3

4. Which of the following statements are true (T) or false (F) for a rhombus ?
(*i*) It has only two pairs of equal sides. (*ii*) It has two pairs of parallel sides.
(*iii*) Two of its angles are right angles. (*iv*) It has two pairs of equal angles.
(*v*) Its diagonals are equal and perpendicular to each other.
(*vi*) It has all its sides of equal length.
(*vii*) Its diagonals bisect each other at right angle.

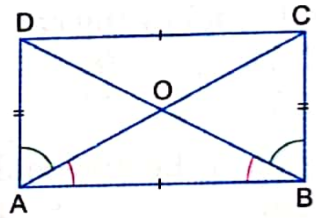
5. ABCD is a parallelogram. What special name will you give it, if the following additional facts are known ?
(*i*) AB = AD (*ii*) $\angle$ DAB = 90° (*iii*) AB = AD and $\angle$ DAB = 90°

6. In the adjoining figure, ABCD is a rhombus.
Find the measure of the following angles, if $\angle$ ACB = 30° :
(*i*) $\angle$ BOC (*ii*) $\angle$ CBO
(*iii*) $\angle$ OAD (*iv*) $\angle$ ABO

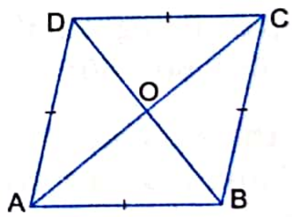


7. In a given rectangle ABCD, diagonals AC and BD intersect at O. If $\angle$ COD = 120°, find $\angle$ OBA.

8. In the given figure, prove that the diagonals of a rectangle are equal.

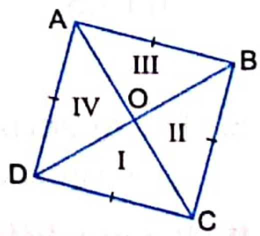


9. Prove that diagonals of a rhombus bisect each other at right angles as given in the adjoining figure.



10. Prove that a rhombus with one angle 90° is a square.

11. Show that the four triangles as shown in the adjoining figure, formed by diagonals and sides of rhombus are congruent.



12. In the given figure, ABCD is a rectangle. BM and DN are perpendiculars to AC from B and D respectively.
Prove that AN = CM.