

B. B. S. S. Sec. School

Class - VIIIth Sub - Maths

Ch - 7 Understanding shapes

Topic \rightarrow (i) Parallelogram \rightarrow

In a parallelogram

- (i) Opposite sides are equal
- (ii) Opposite angles are equal
- (iii) Each diagonal bisects the parallelogram.

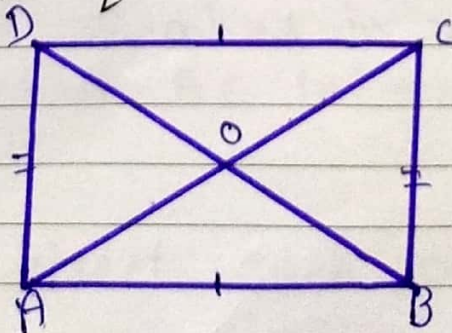
(ii) Rectangle \rightarrow A quadrilateral whose each angle is equal to 90° , is called

(iii) Rhombus \rightarrow A quadrilateral whose all sides are equal, is called a rhombus.

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

(v) Trapezium \rightarrow A quadrilateral whose one pair of opposite sides are parallel, is called a trapezium.

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



(1)

Given \rightarrow 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

$AB \parallel DC$, $BC \parallel AD$

and $\angle A = \angle B = \angle C = \angle D = 90^\circ$

Now, in rectangle ABCD, since $AB \parallel DC$ and $BC \parallel AD$

\therefore ABCD is a parallelogram.

\Rightarrow BD and AC bisect each other.

(Because diagonals of parallelogram bisect each other.)
Hence proved BD and AC bisect each other.

Now, considering $\triangle DAB$ and $\triangle CBA$, we have

$AD = BC$	(Opposite sides of gram)
$AB = AB$	(common)
$\angle DAB = \angle CBA$	(90° each)
$\triangle DAB \cong \triangle CBA$	(by SAS)
$BD = AC$	(By C.P.C.T)

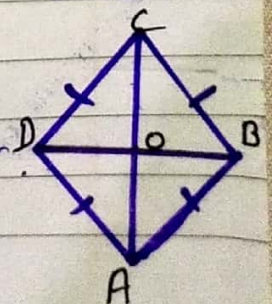
Theorem - 2 Diagonals of a rhombus bisect each other at right angle.

Given \rightarrow ABCD is a rhombus in which diagonals BD and AC intersect each other at O.

To Prove \rightarrow

i) BD and AC bisect each other.

ii) $BD \perp AC$.



(2)

Proof \rightarrow 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

$$CD = BC \quad (\text{Sides of the rhombus ABCD})$$

$$OB = OD \quad (\text{Proved by (i)})$$

$$OC = OC \quad (\text{Common})$$

$$\triangle COB \cong \triangle COD \quad (\text{By SSS})$$

(ii)

$$\rightarrow \angle COD = \angle COB \quad (\text{By c.p.c.t.})$$

$$\text{But we have } \angle COD + \angle COB = 180^\circ \quad (\text{Linear pair}) \quad \text{(iii)}$$

From (ii) and (iii) we have

~~$$2\angle$$~~
$$2\angle COD = 180^\circ$$

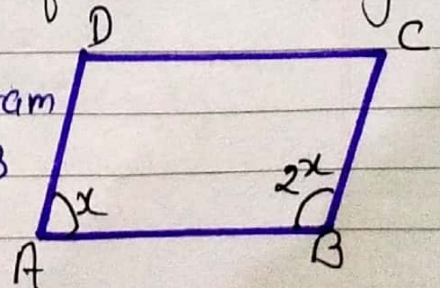
$$\angle COD = 180^\circ \div 2$$

$$\angle COD = 90^\circ$$

$$\Rightarrow BD \perp AC$$

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

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



(3)

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.

$$\angle C = \angle A = 60^\circ$$

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

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

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

Since, opposite sides of a parallelogram are equal.

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

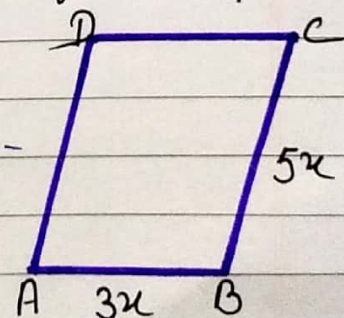
Now, the perimeter of ABCD is given by

$$AB + BC + CD + DA = 48 \text{ cm}$$

$$3x + 5x + 3x + 5x = 48 \text{ cm}$$

$$16x = 48 \text{ cm}$$

$$x = 48 \div 16 = 3 \text{ cm}$$



(4)

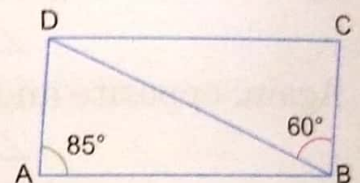
$$\text{Hence } AB = CD = 3u = 3 \times 3 = 9 \text{ cm}$$

$$\text{Also } BC = DA = 5u = 5 \times 3 = 15 \text{ cm.}$$

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

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 $\angle DAB = 85^\circ$ and $\angle DBC = 60^\circ$, then calculate :
(i) $\angle CDB$
(ii) $\angle ABD$



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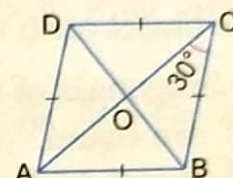
ASSIGNMENT 7.3

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) $\angle DAB = 90^\circ$
- (iii) $AB = AD$ and $\angle DAB = 90^\circ$

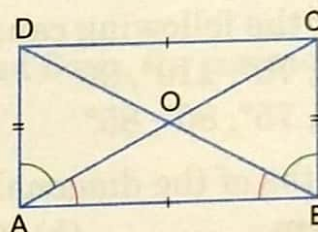
6. In the adjoining figure, ABCD is a rhombus. Find the measure of the following angles, if $\angle ACB = 30^\circ$:



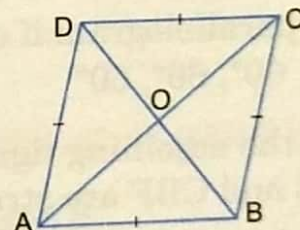
- (i) $\angle BOC$
- (ii) $\angle CBO$
- (iii) $\angle OAD$
- (iv) $\angle ABO$

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

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

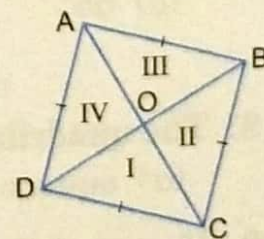


9. Prove that diagonals of a rhombus bisect each other at right angles as given in the adjoining figure.

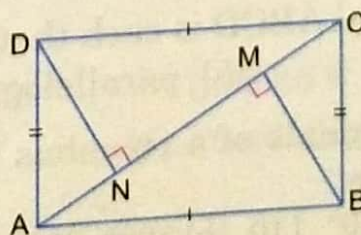


10. Prove that a rhombus with one angle 90° is a square.

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 $AN = CM$.



(7)