

Worksheet -17

Subject: - Mathematics

Class: - VIII

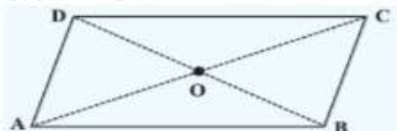
Teacher: - Ms. Nancy

Name: _____ Class & Sec: _____ Roll No. _____ Date: 29.05.2020

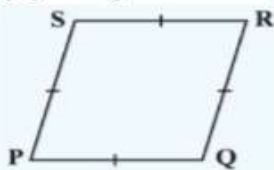
Chapter - 3

Understanding Quadrilaterals

- **Parallelogram:** A quadrilateral with each pair of opposite sides parallel.
 - (1) Opposite sides are equal.
 - (2) Opposite angles are equal.
 - (3) Diagonals bisect one another.



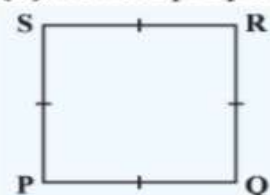
- **Rhombus:** A parallelogram with sides of equal length.
 - (1) All the properties of a parallelogram.
 - (2) Diagonals are perpendicular to each other.



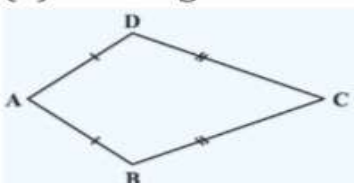
- **Rectangle:** A parallelogram with a right angle.
 - (1) All the properties of a parallelogram.
 - (2) Each of the angles is a right angle.
 - (3) Diagonals are equal.



- **Square:** A rectangle with sides of equal length.
 - (1) All the properties of a parallelogram, rhombus and a rectangle.



- **Kite:** A quadrilateral with exactly two pairs of equal consecutive sides
 - (1) The diagonals are perpendicular to one another
 - (2) One of the diagonals bisects the other.
 - (3) In the figure $m\angle B = m\angle D$ but $m\angle A \neq m\angle C$.



- **Trapezium:** A quadrilateral having exactly one pair of parallel sides.



- **Diagonal:** A simple closed curve made up of only line segments. A line segment connecting two non-consecutive vertices of a polygon is called diagonal.



- **Convex:** The measure of each angle is less than 180° .
- **Concave:** The measure of at least one angle is more than 180° .
- **Quadrilateral:** Polygon having four sides.
- **Element of quadrilateral:**
 - (i) **Sides:** Line segments joining the points.
 - (ii) **Vertice:** Point of intersection of two consecutive sides.
 - (iii) **Opposite sides:** Two sides of a quadrilateral having no common end point.
 - (iv) **Opposite Angles:** Two angles of a quadrilateral not having a common arm.
 - (v) **Diagonals:** Line segment obtained by joining the opposite vertices.
 - (vi) **Adjacent Angles:** Two angles of a quadrilateral having a common arm.
 - (vii) **Adjacent Sides:** Two sides of a quadrilateral having a common end point.

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

Example 7:

RICE is a rhombus (Fig 3.36). Find x, y, z . Justify your findings.

Solution:

$$\begin{aligned} x &= OE & y &= OR & z &= \text{side of the rhombus} \\ &= OI \text{ (diagonals bisect)} & &= OC \text{ (diagonals bisect)} & &= 13 \text{ (all sides are equal)} \\ &= 5 & &= 12 & & \end{aligned}$$

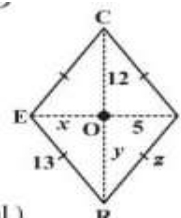


Fig 3.36

3.5.2 A rectangle

A rectangle is a parallelogram with equal angles (Fig 3.37).

What is the full meaning of this definition? Discuss with your friends.

If the rectangle is to be equiangular, what could be the measure of each angle?

Let the measure of each angle be x° .

Then $4x^\circ = 360^\circ$ (Why?)

Therefore, $x^\circ = 90^\circ$

Thus each angle of a rectangle is a right angle.

So, a rectangle is a parallelogram in which every angle is a right angle.

Being a parallelogram, the rectangle has opposite sides of equal length and its diagonals bisect each other.



Fig 3.37

In a parallelogram, the diagonals can be of different lengths. (Check this); but surprisingly the rectangle (being a special case) has diagonals of equal length.

Property: The diagonals of a rectangle are of equal length.

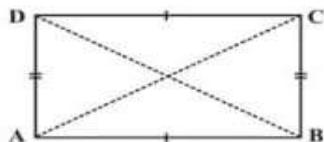


Fig 3.38

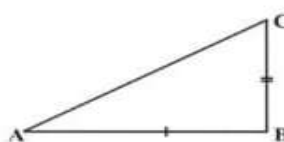


Fig 3.39

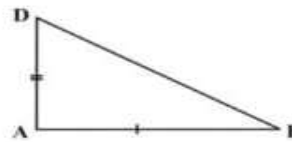


Fig 3.40

This is easy to justify. If ABCD is a rectangle (Fig 3.38), then looking at triangles ABC and ABD separately [(Fig 3.39) and (Fig 3.40) respectively], we have

$$\Delta ABC \cong \Delta ABD$$

This is because

$$\begin{aligned} AB &= AB && \text{(Common)} \\ BC &= AD && \text{(Why?)} \\ m \angle A &= m \angle B = 90^\circ && \text{(Why?)} \end{aligned}$$

The congruency follows by SAS criterion.

Thus $AC = BD$

and in a rectangle the diagonals, besides being equal in length bisect each other (Why?)

Example 8: RENT is a rectangle (Fig 3.41). Its diagonals meet at O. Find x , if $OR = 2x + 4$ and $OT = 3x + 1$.

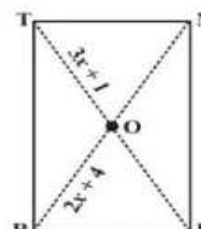
Solution: \overline{OT} is half of the diagonal \overline{TE} ,

\overline{OR} is half of the diagonal \overline{RN} .

Diagonals are equal here. (Why?)

So, their halves are also equal.

Therefore $3x + 1 = 2x + 4$
or $x = 3$



We can justify this also by arguing logically:

$\triangle ABCD$ is a square whose diagonals meet at O (Fig 3.43).

$$OA = OC \quad (\text{Since the square is a parallelogram})$$

By SSS congruency condition, we now see that

$$\triangle AOD \cong \triangle COD \quad (\text{How?})$$

Therefore,

$$m\angle AOD = m\angle COD$$

These angles being a linear pair, each is right angle.

Fig 3.42

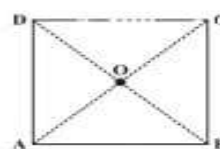
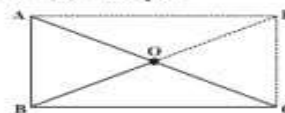


Fig 3.43



EXERCISE 3.4

- State whether True or False.
 - All rectangles are squares.
 - All rhombuses are parallelograms.
 - All squares are rhombuses and also rectangles.
 - All squares are not parallelograms.
 - All kites are rhombuses.
 - All rhombuses are kites.
 - All parallelograms are trapeziums.
 - All squares are trapeziums.
- Identify all the quadrilaterals that have.
 - four sides of equal length
 - four right angles
- Explain how a square is.
 - a quadrilateral
 - a parallelogram
 - a rhombus
 - a rectangle
- Name the quadrilaterals whose diagonals.
 - bisect each other
 - are perpendicular bisectors of each other
 - are equal
- Explain why a rectangle is a convex quadrilateral.
- ABC is a right-angled triangle and O is the mid point of the side opposite to the right angle. Explain why O is equidistant from A , B and C . (The dotted lines are drawn additionally to help you).



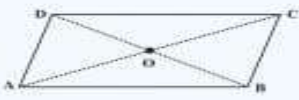
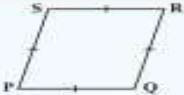

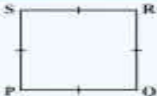
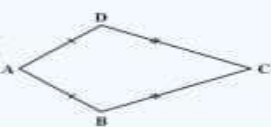
56 ■ MATHEMATICS



THINK, DISCUSS AND WRITE

- A mason has made a concrete slab. He needs it to be rectangular. In what different ways can he make sure that it is rectangular?
- A square was defined as a rectangle with all sides equal. Can we define it as rhombus with equal angles? Explore this idea.
- Can a trapezium have all angles equal? Can it have all sides equal? Explain.

WHAT HAVE WE DISCUSSED?

Quadrilateral	Properties
Parallelogram: A quadrilateral with each pair of opposite sides parallel. 	(1) Opposite sides are equal. (2) Opposite angles are equal. (3) Diagonals bisect one another.
Rhombus: A parallelogram with sides of equal length. 	(1) All the properties of a parallelogram. (2) Diagonals are perpendicular to each other.
Rectangle: A parallelogram with a right angle. 	(1) All the properties of a parallelogram. (2) Each of the angles is a right angle. (3) Diagonals are equal.
Square: A rectangle with sides of equal length. 	All the properties of a parallelogram, rhombus and a rectangle.
Kite: A quadrilateral with exactly two pairs of equal consecutive sides. 	(1) The diagonals are perpendicular to one another. (2) One of the diagonals bisects the other. (3) In the figure $m\angle B = m\angle D$ but $m\angle A \neq m\angle C$.

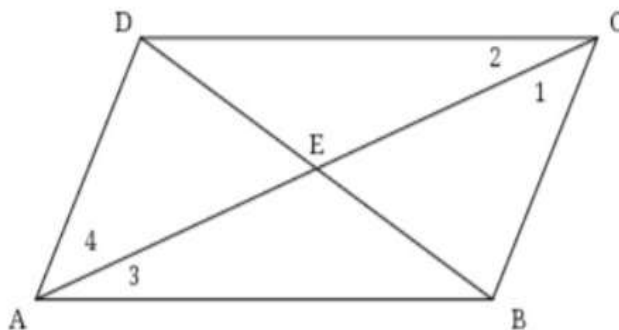
Parallelogram Worksheet

I. Complete each statement.

- In a parallelogram, opposite sides are _____ and _____.
- In a parallelogram, consecutive angles are _____.
- In a parallelogram, diagonals _____ each other, which means they split each other in _____.

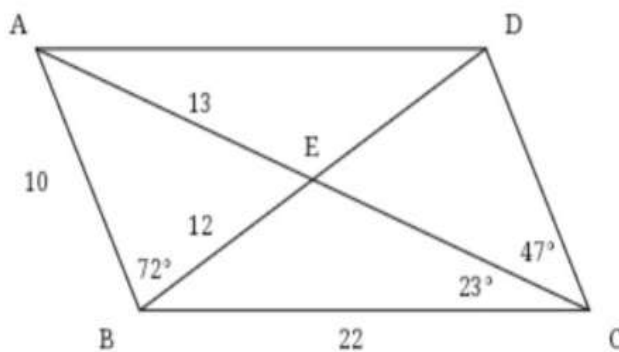
II. Complete each statement, using Parallelogram DCBA

- If $AD = 20$, then $BC =$ _____
- If $AB = 13$, then $DC =$ _____
- If $DB = 22$, then $DE =$ _____
- If $AE = 18$, then $AC =$ _____
- If $m\angle ADC = 115^\circ$, then $m\angle ABC =$ _____
- If $m\angle DAB = 75^\circ$, $m\angle ADC =$ _____
- If $m\angle AED = 72^\circ$, $m\angle DEC =$ _____
- If $AC = 30$ and $AE = 3x + 3$, then $x =$ _____
- If $m\angle 1 = 30^\circ$, then $m\angle 4 =$ _____
- If $m\angle ADC = 130^\circ$, and $m\angle 1 = 35^\circ$, $m\angle 2 =$ _____
- If $DC = 6x + y$, $BC = 3x + 2y$, $AB = 25$, and $AD = 14$, then $x =$ _____ and $y =$ _____



III. Find the missing measurements of Parallelogram ADCB.

- $CD =$ _____
- $DA =$ _____
- $AC =$ _____
- $DB =$ _____
- $CE =$ _____
- $DE =$ _____
- $m\angle ABC =$ _____
- $m\angle BCE =$ _____
- $m\angle BCD =$ _____
- $m\angle ADC =$ _____
- $m\angle BAD =$ _____
- $m\angle CDE =$ _____
- $m\angle DAE =$ _____
- $m\angle EAB =$ _____
- $m\angle BEC =$ _____
- $m\angle CED =$ _____
- $m\angle EDA =$ _____
- $m\angle AEB =$ _____
- $m\angle DEA =$ _____



Practice worksheet

Class: VIII

Exercise 3.4

Question 1

State whether true or false:

- (a) All rectangles are squares.
- (b) All rhombuses are parallelograms.
- (c) All squares are rhombuses and also rectangles.
- (d) All squares are not parallelograms.
- (e) All kites are rhombuses.
- (f) All rhombuses are kites.
- (g) All parallelograms are trapeziums.
- (h) All squares are trapeziums.

Answer 1

- (a) False. Since, squares have all sides are equal.
- (b) True. Since, in rhombus, opposite angles are equal and diagonals intersect at mid-point.
- (c) True. Since, squares have the same property of rhombus but not a rectangle.
- (d) False. Since, all squares have the same property of parallelogram.
- (e) False. Since, all kites do not have equal sides.
- (f) True. Since, all rhombuses have equal sides and diagonals bisect each other.
- (g) True. Since, trapezium has only two parallel sides.
- (h) True. Since, all squares have also two parallel lines.

Question 2

Identify all the quadrilaterals that have:

- (a) four sides of equal lengths.
- (b) four right angles.

Answer 2

- (a) Rhombus and square have sides of equal length.
- (b) Square and rectangle have four right angles.

Question 3

Explain how a square is:

- (i) a quadrilateral
- (ii) a parallelogram
- (iii) a rhombus
- (iv) a rectangle

Answer 3

- (i) A square is a quadrilateral, if it has four unequal lengths of sides.
- (ii) A square is a parallelogram, since it contains both pairs of opposite sides equal.
- (iii) A square is already a rhombus. Since, it has four equal sides and diagonals bisect at 90° to each other.
- (iv) A square is a parallelogram, since having each adjacent angle a right angle and opposite sides are equal.

Question 4

Name the quadrilateral whose diagonals:

- (i) bisect each other.
- (ii) are perpendicular bisectors of each other.
- (iii) are equal.

Answer 4

- (i) If diagonals of a quadrilateral bisect each other then it is a rhombus, parallelogram, rectangle or square.
- (ii) If diagonals of a quadrilateral are perpendicular bisector of each other, then it is a rhombus or square.
- (iii) If diagonals are equal, then it is a square or rectangle.

Question 5

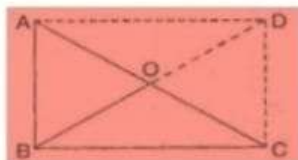
Explain why a rectangle is a convex quadrilateral.

Answer 5

A rectangle is a convex quadrilateral since its vertex are raised and both of its diagonals lie in its interior.

Question 6

ABC is a right-angled triangle and O is the mid-point of the side opposite to the right angle. Explain why O is equidistant from A, B and C. (The dotted lines are drawn additionally to help you.)

**Answer 6**

Since, two right triangles make a rectangle where O is equidistant point from A, B, C and D because O is the mid-point of the two diagonals of a rectangle.

Since AC and BD are equal diagonals and intersect at mid-point.

So, O is the equidistant from A, B, C and D.