

ACTIVITY

Comparison Of Diagonals In Different Quadrilaterals

Objective

To explore the similarities and differences between the different quadrilaterals like a parallelogram, rectangle, rhombus, and square with respect to their diagonals.

Material Required

Glazed papers, ruler, a pair of scissors, pencil, tracing paper.

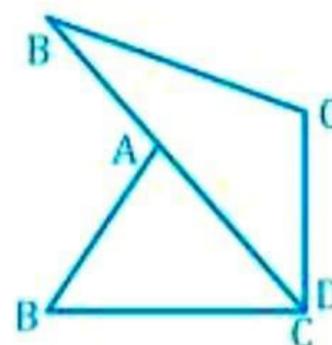
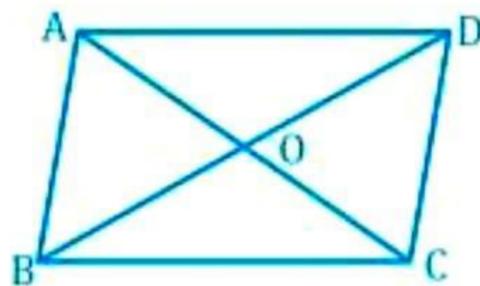
Theory

1. Properties of parallelogram, rectangle, square, rhombus.
2. In parallelogram, diagonals are not equal.
3. In a rectangle, diagonals are equal.
4. In a rhombus, diagonals are not equal but bisect each other at 90°
5. In a square, diagonals are equal and bisect each other at 90° .

Procedure

Case I:

Make a parallelogram on a glazed paper by paper folding and name it ABCD. Join AC and BD. Draw and cut replicas of $\triangle ABC$ and $\triangle BCD$. Coincide the diagonals AC and BD.

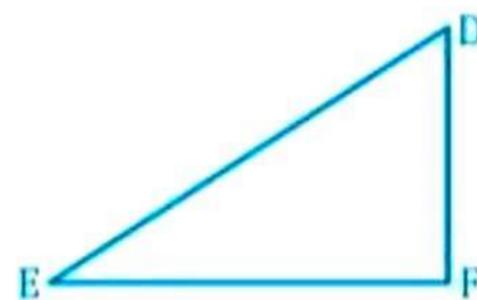
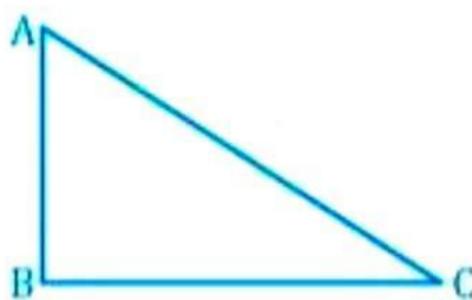
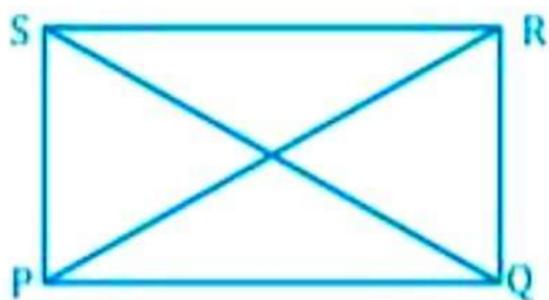


Observation:

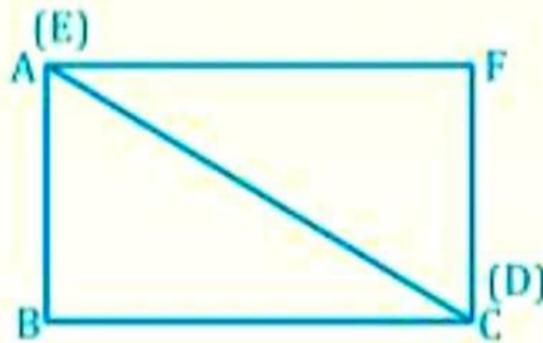
We observe that diagonal $AC \neq$ diagonal BD .

Case II:

Make a rectangle by paper folding on glazed paper. Name it as PQRS. Join PR and QS. Cut replicas of $\triangle PQS$ and $\triangle PQR$, name them $\triangle BCA$ and $\triangle EFD$.



Place two replicas such that AC and ED coincide each other and side AB is opposite to side FD.



Observation:

Here we notice that $AC = DE$. (As they overlap each other)

\therefore diagonal $AC =$ diagonal DE

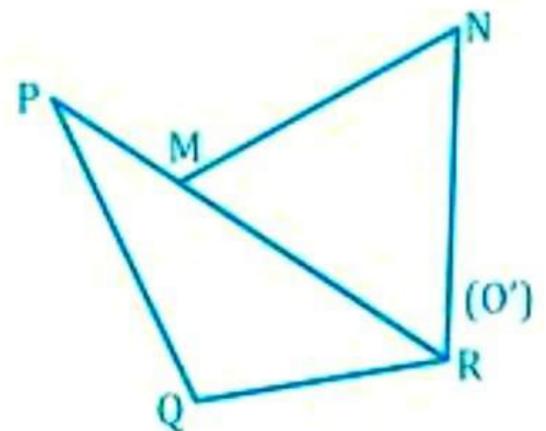
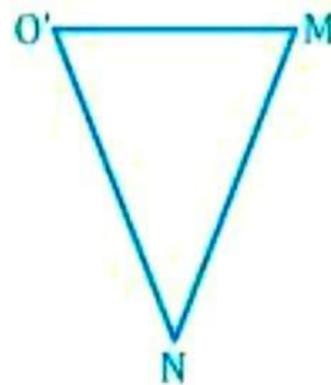
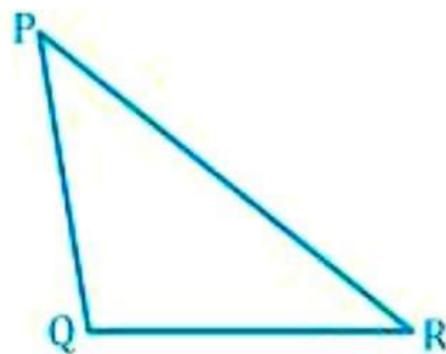
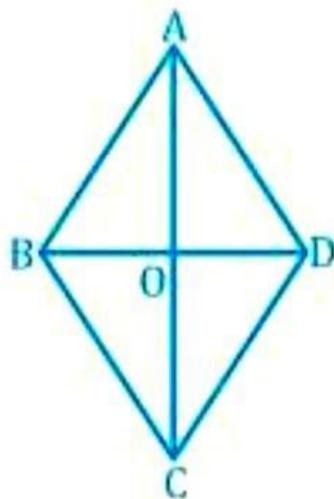
$\therefore QS = PR$

Case III:

Make a rhombus by paper folding on glazed paper. Name it as ABCD. Join AC and BD.

Draw and cut replicas of ΔABC and ΔDCB , name them as ΔPQR and $\Delta MNO'$ respectively.

Place two replicas such that PR and MO' coincide each other.

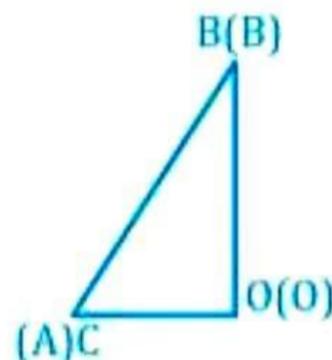
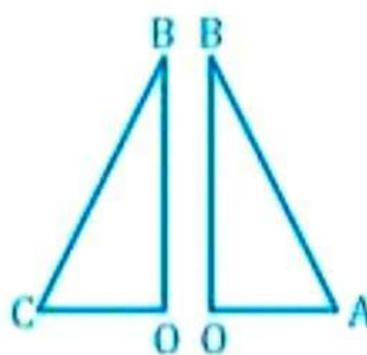


Observation:

We observe that $PR \neq O'M$.

\therefore diagonal $AC \neq$ diagonal BD

Draw and cut replicas of ΔAOB and ΔBOC , verify the congruency of two triangles by placing one over the other.



Here, $BC = AB$, $OB = BO$, $OC = OA$

$\therefore \Delta BOC = \Delta BOA$

$\therefore \angle BOC = \angle BOA$

$\therefore \angle BOC + \angle BOA = 180^\circ$ (linear pair angles)

$2\angle BOC = 180^\circ$ from (i)

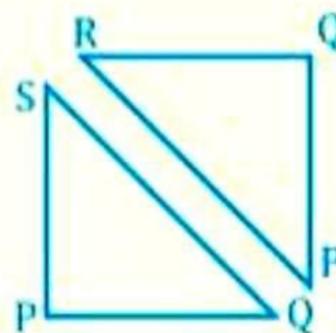
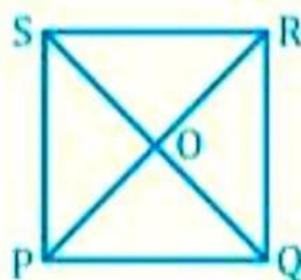
$\therefore \angle BOC = 90^\circ$

Thus, it is verified that in a rhombus, diagonals are not equal but bisect each other at 90° .

Case IV:

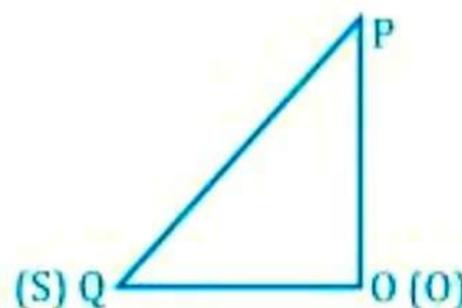
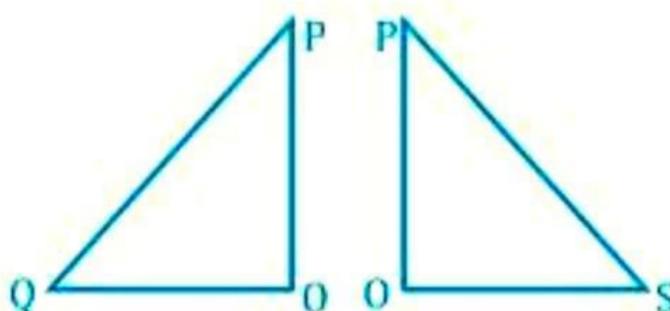
Make a square by paper folding on glazed paper. Name it as PQRS. Join PR and SQ.

Draw and cut replicas of ΔPQS and ΔPQR .



Place two replicas along their diagonals SQ and PR. Here, we observe that both diagonals overlap each other completely. Thus, diagonal SQ = diagonal PR.

Draw and cut replicas of ΔPOQ and ΔPOS . Place these replicas as shown in fig. below.



Observation:

Here,

$$PQ = SP \quad (\text{sides of a square})$$

$$OP = OP \quad (\text{common side})$$

$$OQ = OS \quad (\text{By observation})$$

$$\Delta POQ = \Delta POS \quad (\text{By SSS})$$

$$\therefore \angle POQ = \angle POS \quad (\text{C.P.C.T.})$$

$$\text{But } \angle POQ + \angle POS = 180^\circ \quad (\text{linear pair angles})$$

$$2\angle POQ = 180^\circ$$

$$\angle POQ = 90^\circ$$

This implies that in a square, diagonals are equal and bisect each other at 90° .

Observation

By paper folding and cutting activity, it is very much clear that rectangle, square, rhombus, and parallelogram differ by their diagonal properties.

In a parallelogram, diagonals are not equal, in rectangle diagonals are equal, in rhombus diagonals are not equal but bisect each other at 90° , in a square, diagonals are equal and bisect each other at 90° .

Result

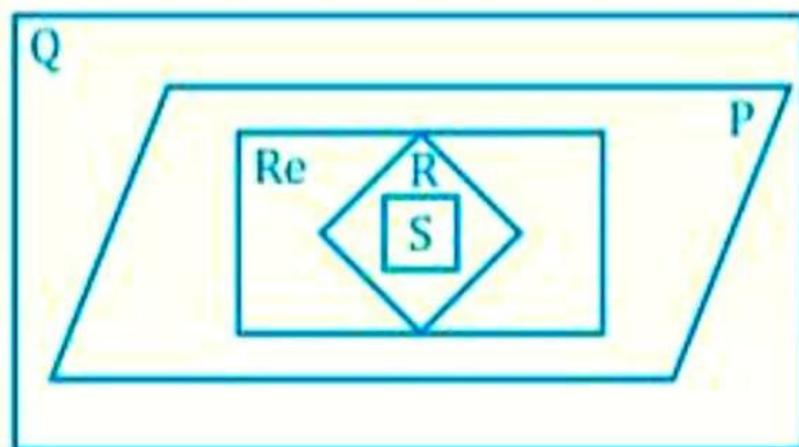
We verified that, in a parallelogram, diagonals are not equal, in square diagonals are equal and bisect each other at 90° . In a rectangle, diagonals are equal and bisect each other at 90° . In a rhombus, diagonals are not equal but bisect at 90° . In this way, these figures differentiate each other based on their diagonals.

Learning Outcome

Though square, rectangle, and rhombus all have the properties of a parallelogram but they are different based on their diagonals.

Activity Time

Draw all types of quadrilaterals on the same plane by using different glazed paper.



Q – Quadrilateral

P – Parallelogram

Re – Rectangle

R – Rhombus

S – Square

We conclude that all squares are rhombus, rectangle and parallelogram.

Viva Voce

Q1. What is the angle sum property of a quadrilateral?

Ans: The sum of all angles of a quadrilateral is a complete angle, i.e. 360° .

Q2. The sum of three angles of a quadrilateral is 280° . Find the measure of the fourth angle.

Ans: Fourth angle = $360^\circ - 280^\circ = 80^\circ$

Q3. Is it true that every parallelogram is a rectangle?

Ans: No, only that parallelogram is a rectangle whose all angles are 90° .

Q4. In which quadrilateral(s), diagonals are perpendicular to each other?

Ans: Rhombus

Q5. Is it true that the diagonals of a rhombus are equal?

Ans: No

Q6. What are the conditions that any quadrilateral be a square?

Ans: (i) All four sides of a quadrilateral are equal.

(ii) Each angle of a quadrilateral is 90° .

(iii) Diagonals are equal and bisect each other.

Q7. Is it true that a parallelogram is always a trapezium, but a trapezium is not always a parallelogram?

Ans: True

Q8. How many vertices a quadrilateral has?

Ans: A quadrilateral has 4 vertices.

Q9. Can all the angles of a quadrilateral be right angles? Give reason.

Ans: Yes, all the angles of a quadrilateral can be right angles. e.g., Square and rectangle.

Multiple Choice Questions

- Q 1. Which of the following is not true for a parallelogram?**
(a) Diagonals bisect each other
(b) Opposite sides are equal
(c) Opposite angles are equal
(d) Opposite angles are bisected by the Diagonals
- Q 2. A quadrilateral with only one pair of opposite sides parallel is called:**
(a) Trapezium (b) Square (c) Rectangle (d) Rhombus
- Q 3. The consecutive angles of a parallelogram are:**
(a) Complementary (b) Supplementary
(c) Equal (d) None of these
- Q 4. The quadrilateral formed by joining the mid-points of the sides of a quadrilateral ABCD taken in order is a square only if:**
(a) ABCD is a rhombus
(b) Diagonals of ABCD are equal
(c) Diagonals of ABCD are equal and perpendicular
(d) Diagonals of ABCD are perpendicular
- Q 5. If in a parallelogram its diagonals bisect each other at right angles and are equal, then it is a:**
(a) Square (b) Rhombus (c) Rectangle (d) Parallelogram
- Q 6. Which of the following quadrilaterals has two pairs of adjacent sides equal and diagonals intersecting at right angles?**
(a) Square. (b) Rhombus. (c) Kite. (d) Rectangle.
- Q 7. Which of the following is not true?**
(a) Every square is a rectangle
(b) Every rectangle is a quadrilateral
(c) Every parallelogram is a trapezium
(d) None of these
- Q 8. If in a parallelogram its diagonals bisect each other and are equal then it is a:**
(a) Squares (b) Rectangle (c) Rhombus (d) Parallelogram

ANSWER KEY

1. (d) 2. (a) 3. (b) 4. (c) 5. (a) 6. (b) 7. (c) 8. (b)