

LESSON PLAN 8

CLASS : 9 SUBJECT : MATHEMATICS TEACHER'S NAME :

NAME OF THE UNIT	SUB-TOPICS	NO OF PERIODS REQUIRED			Time line for teaching	
		Teaching	Practice	TOTAL	From	To
QUADRILATERALS	8.1 PROPERTIES OF A PARALLELOGRAM THEOREM 8.1 to 8.7	7	9	16		
	8.2 THE MID-POINT THEOREM THEOREM 8.8 & 8.9	2	2	4		
	TOTAL	9	11	20		
PRE-REQUISITES & SKILLS	Every Pupil is expected to have basic knowledge in # quadrilateral and its basic parts and properties # types of quadrilaterals and their basic properties. # parallelogram, its properties and some special parallelograms and their properties # methods of proving a mathematical statement or a theorem(learnt in appendix-I, proofs in mathematics chapter). # Usage of Mathematical instrument box					

Learning Outcomes

After Completion of this lesson every student will be able to

- # check different types of properties of quadrilaterals, especially parallelograms
- # state and prove different properties of parallelograms
- # apply the properties of parallelograms and solve sums related with these properties
- # appreciate the beauty and part of quadrilaterals, especially parallelograms in real life geometry.







Teaching Learning Process

INTRODUCTION /INDUCTION

Teacher introduces the chapter of Quadrilaterals by recalling their previous basic knowledge in it in their previous lesson of understanding quadrilaterals and draws the attention of children towards the various properties of parallelograms which they have learnt but not proved. Now teacher creates enthusiasm in children by provoking them to try and prove various properties of parallelograms through the techniques they have learnt in the Appendix-I (Proofs in Mathematics) of semester-I.

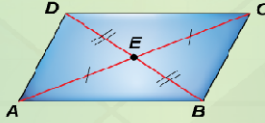
Experience & Reflection

Pupils will recollect their knowledge on Quadrilateral and its properties and utilize that in exploring and learning new concepts of proving various properties of parallelograms
Students will experience the usage of the Properties of parallelograms and the way of proving them and appreciate their usage.

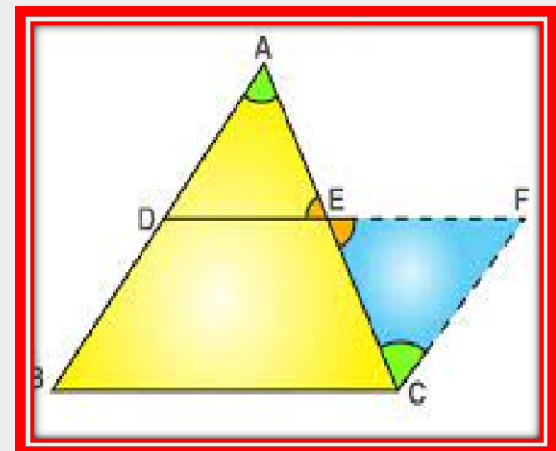
Type	Properties
 Parallelogram	<ul style="list-style-type: none"> ▪ Opposite sides are equal and parallel ▪ Opposite angles are equal
 Rectangle	<ul style="list-style-type: none"> ▪ Opposite sides are equal and parallel ▪ All angles are right angles (90°)
 Square	<ul style="list-style-type: none"> ▪ Opposite sides are parallel ▪ All sides are equal ▪ All angles are right angles (90°)
 Rhombus	<ul style="list-style-type: none"> ▪ Opposite sides are parallel ▪ All sides are equal ▪ Opposite angles are equal ▪ Diagonals bisect each other at right angles (90°)
 Trapezoid	<ul style="list-style-type: none"> ▪ One pair of opposite sides is parallel
 Kite	<ul style="list-style-type: none"> ▪ Two pairs of adjacent sides are equal ▪ One pair of opposite sides are equal ▪ One diagonal bisects the other ▪ Diagonals intersect at right angle (90°)

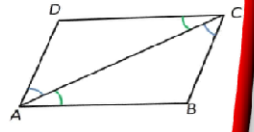
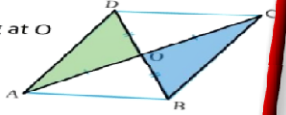
Definition

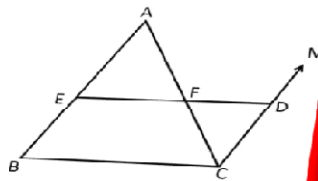
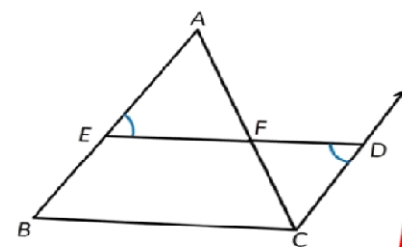
Diagonals of a Parallelogram The diagonals of a parallelogram bisect each other. Each diagonal divides the parallelogram into two congruent triangles.




$AE = EC$
 $BE = ED$
 $\triangle ABD \cong \triangle CDB$
 $\triangle ABC \cong \triangle ADC$



EXPLICIT TEACHING/TEACHER MODELLING (I DO)	GROUP WORK (WE DO)	INDEPENDENT WORK (YOU DO)	NOTES						
<p>8.1. PROPERTIES OF A PARALLELOGRAM THEOREM 8.1 TO 8.7</p> <p>Teacher introduces the concept by recalling the properties of a Parallelogram which they were familiar with in the chapter of understanding quadrilaterals and demonstrates the proofs of various properties of a parallelogram by some activities</p> <p>while proving that a diagonal of a parallelogram divides it into two congruent triangles, a parallelogram shaped paper may be cut along its diagonal. Later those two triangles may be placed on one another to check their identity</p>	<p>Pupils will work in groups and try to recall their previous apprehensions on various properties of a parallelogram and will try to prove the authenticity</p> <div data-bbox="575 503 1234 982" style="border: 2px solid red; border-radius: 15px; padding: 10px;"> <p>Theorem 8.4: In a parallelogram, opposite angles are equal</p> <p>Given: A parallelogram ABCD with AC as its diagonal</p> <p>To prove: $\angle A = \angle C$ & $\angle B = \angle D$</p> <p>Proof: Opposite sides of parallelogram is parallel So, $AB \parallel DC$ and $AD \parallel BC$</p> <table border="0" style="width: 100%;"> <tr> <td style="width: 50%; vertical-align: top;"> <p>Since $AB \parallel DC$ & AC is the transversal $\angle BAC = \angle DCA$ (Alternate ... (1) angles)</p> </td> <td style="width: 50%; vertical-align: top;"> <p>Since $AD \parallel BC$ & AC is the transversal $\angle DAC = \angle BCA$ (Alternate ... (2) angles)</p> </td> </tr> </table> </div> <div data-bbox="388 990 1081 1445" style="border: 2px solid red; border-radius: 15px; padding: 10px;"> <p>Theorem 8.6: The diagonals of a parallelogram bisect each other</p> <p>Given: ABCD is a Parallelogram with AC and BD diagonals & O is the point of intersection of AC and BD</p> <p>To Prove: $OA = OC$ & $OB = OD$</p> <p>Proof: Since, opposite sides of Parallelogram are parallel.</p> <table border="0" style="width: 100%;"> <tr> <td style="width: 50%; vertical-align: top;"> <p>$AD \parallel BC$ with transversal BD $\angle ODA = \angle OBC$ (Alternate interior angles)</p> </td> <td style="width: 50%; vertical-align: top;"> <p>$AD \parallel BC$ with transversal AC $\angle OAD = \angle OCB$ (Alternate interior angles)</p> </td> </tr> </table> </div>	<p>Since $AB \parallel DC$ & AC is the transversal $\angle BAC = \angle DCA$ (Alternate ... (1) angles)</p>	<p>Since $AD \parallel BC$ & AC is the transversal $\angle DAC = \angle BCA$ (Alternate ... (2) angles)</p>	<p>$AD \parallel BC$ with transversal BD $\angle ODA = \angle OBC$ (Alternate interior angles)</p>	<p>$AD \parallel BC$ with transversal AC $\angle OAD = \angle OCB$ (Alternate interior angles)</p>	<p>Every individual will participate in the activity and learns the way of proving</p> <div data-bbox="1234 446 1890 966" style="border: 2px solid red; border-radius: 15px; padding: 10px;"> <p>Theorem 8.1: A diagonal of a parallelogram divides it into two congruent triangles</p> <p>Given: A parallelogram ABCD with AC as its diagonal</p> <p>To prove: $\triangle ABC \cong \triangle ADC$</p> <p>Proof: Opposite sides of parallelogram is parallel So, $AB \parallel DC$ and $AD \parallel BC$</p> <table border="0" style="width: 100%;"> <tr> <td style="width: 50%; vertical-align: top;"> <p>Since $AB \parallel DC$ & AC is the transversal $\angle BAC = \angle DCA$ (Alternate ... (1) angles)</p> </td> <td style="width: 50%; vertical-align: top;"> <p>Since $AD \parallel BC$ & AC is the transversal $\angle DAC = \angle BCA$ (Alternate ... (2) angles)</p> </td> </tr> </table> </div> <div data-bbox="1050 966 1890 1453" style="border: 2px solid red; border-radius: 15px; padding: 10px;"> <p>Theorem 8.7: If the diagonals of a quadrilateral bisect each other, then it is a parallelogram.</p> <p>Given: ABCD is a quadrilateral with AC and BD are diagonals intersecting at O Diagonals bisect each other i.e. $OA = OC$ & $OB = OD$</p> <p>To Prove: ABCD is a parallelogram</p> <p>Proof: In $\triangle AOD$ and $\triangle COB$</p> <p>$OA = OC$ (Given) $\angle AOD = \angle COB$ (Vertically opposite angles) $OD = OB$ (Given) $\triangle AOD \cong \triangle COB$ (SAS congruency)</p> </div>	<p>Since $AB \parallel DC$ & AC is the transversal $\angle BAC = \angle DCA$ (Alternate ... (1) angles)</p>	<p>Since $AD \parallel BC$ & AC is the transversal $\angle DAC = \angle BCA$ (Alternate ... (2) angles)</p>	<p>Proofs of theorem 8.1 to 8.7 along with associated examples and exercise 8.1</p>  
<p>Since $AB \parallel DC$ & AC is the transversal $\angle BAC = \angle DCA$ (Alternate ... (1) angles)</p>	<p>Since $AD \parallel BC$ & AC is the transversal $\angle DAC = \angle BCA$ (Alternate ... (2) angles)</p>								
<p>$AD \parallel BC$ with transversal BD $\angle ODA = \angle OBC$ (Alternate interior angles)</p>	<p>$AD \parallel BC$ with transversal AC $\angle OAD = \angle OCB$ (Alternate interior angles)</p>								
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EXPLICIT TEACHING/TEACHER MODELLING (I DO)	GROUP WORK (WE DO)	INDEPENDENT WORK (YOU DO)	NOTES
<p>8.2 . THE MID-POINT THEOREM (THEOREM 8.8 & 8.9)</p> <p>Teacher elicits responses by questioning on different ways of proving the Mid point theorem "The line segment joining the mid points of two sides of a triangle is parallel to the third side" and finally demonstrates the way of proving it by completing a parallelogram by extending the line segment. Later teacher provokes children to prove the converse of this theorem.</p> <div data-bbox="157 901 934 1461" style="border: 2px solid red; border-radius: 15px; padding: 10px; margin: 10px;"> <p><i>The line drawn through the mid-point of one side of a triangle, parallel to another side bisects the third side.</i></p> <p><u>Given</u> : ΔABC where E is mid point of AB, F is some point on AC & $EF \parallel BC$</p>  <p><u>To Prove</u> : F is a mid point of AC.</p> <p><u>Construction</u> : Through C draw $CM \parallel AB$ Extend EF and let it cut CM at D.</p> </div>	<p>Teacher conducts a group activity involving children to elicit responses from them about the ways of proving midpoint theorem and makes children indulge in the activity and learn the proof.</p>	<p>Every pupil is focused to learn the concept by indulging them in doing its applicative sums</p> <div data-bbox="934 527 1890 1193" style="border: 2px solid red; border-radius: 15px; padding: 10px; margin: 10px;"> <p><i>The line segment joining the mid-points of two sides of a triangle parallel to the third side.</i></p> <p><u>Given</u> : $ABCD$ is a triangle where E and F are mid points of AB and AC respectively</p>  <p><u>To Prove</u> : $EF \parallel BC$</p> <p><u>Construction</u> : Through C draw a line segment parallel to AB & extend EF to meet this line at D.</p> <p><u>Proof</u> : Since $AB \parallel CD$ (By construction) with transversal ED.</p> </div>	<p>Proofs of theorem 8.8 & 8.9 along with examples and exercise sums of 8.2</p>

CHECK FOR UNDERSTANDING QUESTIONS

1. Factual	1) Prove that If in a quadrilateral, each pair of opposite angles is equal, then it is a parallelogram 2) State and Prove the Mid-point theorem.
2. Open Ended/Critical Thinking	1) Can you guess what type of quadrilateral emerge out of the angular bisectors of a rectangle. Is it a square? If so prove it. 2) If in the context of mid point theorem, instead of the line segment joining the midpoints if we consider the line segment joins in such a way that it passes through both the sides in a ratio say 2:3, still will the line segment passes parallel to the third side? If so justify your answer
3. Student Practice questions & Activities	<div style="background-color: #ffffcc; padding: 5px;"> <p>In parallelogram ABCD, two points P and Q are taken on diagonal BD such that DP = BQ (see Fig. 8.12). Show that:</p> <p>(i) $\triangle APD \cong \triangle CQB$ (ii) $AP = CQ$ (iii) $\triangle AQB \cong \triangle CPD$ (iv) $AQ = CP$ (v) APCQ is a parallelogram</p> </div> <div style="text-align: right; margin-top: 10px;">  <p align="right">Fig. 8.12</p> </div> <div style="background-color: #add8e6; padding: 5px; margin-top: 10px;"> <p>ABC is a triangle right angled at C. A line through the mid-point M of hypotenuse AB and parallel to BC intersects AC at D. Show that</p> <p>(i) D is the mid-point of AC (ii) $MD \perp AC$ (iii) $CM = MA = \frac{1}{2} AB$</p> </div>
4. Assessment	Exercise sums and worksheet on Quadrilaterals