

Brief Description (Objective): Students will be able to apply properties of parallelogram to solve problems

Notes to the teacher: Teacher may present the questions and allow the students to write or say the answers before revealing them. MCQs and subdivisions 2 and 3 of the second question may be done in the class. Rest of the questions in the document can be given for additional practice. No teaching aids provided as attachment.

I) Choose the correct option

- 1) Opposite angles of a quadrilateral PQRS are equal. If $PQ = 5$ cm, then length of RS is
a) 3cms b) 4 cms c) 5 cms d) 10 cms
- 2) If diagonals of a quadrilateral bisect each other at right angles, then it is a
a) Parallelogram b) Rhombus c) Kite d) Trapezium
- 3) If in a rectangle, PQRS, diagonal PR bisects $\angle P$ as well as $\angle R$, then PQRS is a
a) Square b) Rhombus c) Kite d) None of these
- 4) A quadrilateral in which two pairs of adjacent angles are equal is known as
a) Square b) Rhombus c) Kite d) Parallelogram

Solution:

- 1) c) 5 cms
2) b) Rhombus
3) a) Square

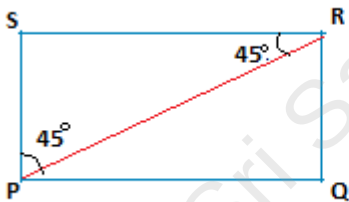


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Diagonal PR bisects $\angle P$ as well as $\angle R$

In $\triangle PSR$, $\angle P = \angle R = 45^\circ$

Thus, $RS = PS$ which implies $PQ = RQ$. All sides of PQRS are equal

Thus, PQRS is a square

4) c) Kite

II) 1) In a parallelogram, prove that bisectors of any two consecutive angles meet at right angles

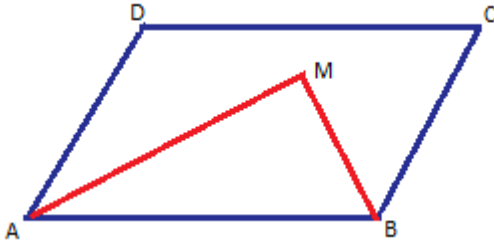


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Solution:

Given: AM and BM are bisectors of $\angle A$ and $\angle B$ respectively in parallelogram ABCD

To prove: $\angle AMB = 90^\circ$

Proof:

[Note to the teacher: The teacher may ask students to consider the triangle which contains $\angle AMB$, i.e. the $\triangle AMB$]

In $\triangle AMB$, $\angle MAB = \frac{1}{2} \times \angle A$ and $\angle MBA = \frac{1}{2} \times \angle B$

$$\angle MAB + \angle MBA = \frac{1}{2} \angle A + \frac{1}{2} \angle B = \frac{1}{2} (\angle A + \angle B) = \frac{1}{2} (180^\circ) = 90^\circ$$

(In a parallelogram, sum of consecutive angles is 180°)

$$\angle AMB = 180^\circ - (\angle MAB + \angle MBA) = 180^\circ - (90^\circ) = 90^\circ$$

2) PQRS is a parallelogram. M is a point on PQ such that $PM = \frac{1}{3} PQ$ and N is a point on RS such that $RN = \frac{1}{3} RS$. Prove that PMRN is a parallelogram.

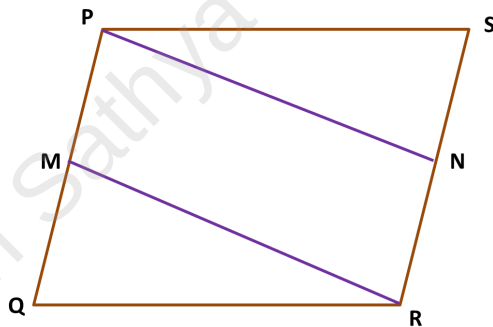


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Solution:

Given: PQRS is a parallelogram, $PM = \frac{1}{3} PQ$ and $RN = \frac{1}{3} RS$.

To prove: PMRN is a parallelogram

[Note to the teacher: The teacher may start the proof by asking which property of a parallelogram can be used to prove that PMRN is a parallelogram. The teacher may give the hint as follows: As lengths of PM and RN are given, we can use the property, in a quadrilateral, if opposite sides are equal, then it's a parallelogram]

Proof: In PMRN, $PM = \frac{1}{3} PQ = \frac{1}{3} RS$ (PQRS is a parallelogram, thus, $PQ = RS$)

$$= RN \quad (1)$$

[Note to the teacher: The teacher may ask the following questions. In quadrilateral PMRN, one pair of opposite sides are equal. What is the other pair?

Expected answer: MR, NP

Consider two triangles which contain MR, NP as sides and prove that they are congruent using any one law of congruence.]

Consider ΔMQR and ΔNSP

$$\text{In } \Delta MQR, MQ = PQ - PM = PQ - \frac{1}{3} PQ = \frac{2}{3} PQ$$

$$\text{Similarly in } \Delta NSP, NS = \frac{2}{3} RS$$

$$\text{Thus, } MQ = \frac{2}{3} PQ = \frac{2}{3} RS = NS$$

Also, $QR = SP$ and $\angle Q = \angle S$ (Using the property, in a parallelogram, opposite sides and opposite angles are equal)

Using SAS rule of congruences, $\Delta MQR \equiv \Delta NSP$.

Thus $MR = NP$ _____ (2)

From equations (1) and (2), opposite sides of PMRN are equal, thus PMRN is a parallelogram.

3) In the given figure, M is the mid – point of side PQ of a parallelogram and $\angle PSM = \angle RSM$. Prove that $RS = 2QR$

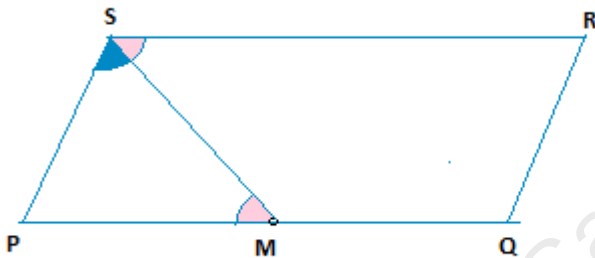


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Solution:

Given: PQRS is a parallelogram and $PQ = 2PM$, $\angle PSM = \angle RSM$

To prove: $RS = 2QR$

[Note to the teacher: The teacher may ask students to prove that two angles in ΔPSM are equal using the given data and alternate angle theorem]

Proof: PQ is parallel to SR.

Thus $\angle RSM = \angle PMS$ _____ (1) (Alternate interior angles)

In ΔPSM , $\angle PSM = \angle RSM$ (given)

But $\angle RSM = \angle PMS$ (equation 1)

Thus, $\angle PSM = \angle PMS$

ΔPSM is an isosceles triangle

$PS = PM$

[Note to the teacher: The teacher may ask students to prove that $PQ = 2PS$]

Now, $PQ = 2PM = 2PS$ ($PS = PM$)

But $PQ = RS$ and $PS = QR$ (Using the property, opposite sides of a parallelogram are equal)

Thus, $RS = 2QR$

[Note to the teacher: The teacher may ask the students to solve the following examples, by explaining the keys to proof]



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Annexure to Master Lesson Plan

What is the purpose of this Master lesson Plan?	This Master Lesson Plan (MLP) prepared by Sri Sathya Sai Vidya Vahini (SSSVV), covers the entire chapter for the given board. The MLP for the chapter given in the textbook is broken down into smaller modules known as assets. Any chapter can be taught using the 7 asset types in SSSVV methodology. Several different assets together complete the entire chapter. Depending on the requirement, each asset is supported by teaching aids such as animated presentation, audio, video, and learning aids such as worksheets. The MLP is for the teacher's preparation and the teaching aids are for use in the classroom.
How to use it?	You can prepare for your class with this MLP by following 3 simple steps: 1. Read your textbook; 2. Go through the information given in the assets (document & multimedia); 3. Prepare your teaching notes. Great! Now you are ready to transact the chapter.
Duration	Kindly note the duration given for each asset. Due care has been taken in planning the assets, to ensure the chapter is completed within the time specified by the Board. Note: Preparation time is not included in the asset duration. The teaching time depends on the duration of the teaching aids and is not impacted by the length of the MLP.
What is a 'Main Script' (MS) Asset?	The Main Script asset is there for explaining the main concepts of the chapter clearly. The information given in the textbook is simplified, organised and structured to give more clarity. Additionally, you may find a video or mnemonics or a graphic organiser to deepen the understanding of the concept.
How to teach using the MS asset?	Please use the blackboard, slides and interaction to develop the concept.
What is an 'Inquisitive Questions' (IQ) asset?	The Inquisitive Questions asset uses questions to promote higher order thinking like the n th why, what-if, new perspectives, cause-effect, and others, creating curiosity.
How to teach using the IQ asset?	You may use the questions to connect with the students, encourage exploration to engage them in the learning process. You may allow multiple responses and instead of rejecting any of the responses, ask why, before revealing the suggested answer or hints.
What is a 'Day to day Relevance' (DD) Asset?	The Day to Day Relevance asset helps students understand the practical relevance of every topic, making them eager participants in the classroom. If students connect the concepts to their environment, they would learn meaningfully without dislike or simply memorizing for exams.
How to teach using the DD	You may use the asset by asking questions about their experience and use it to establish why they are learning the topic. If necessary you may substitute with a

asset?	recent or local example.
What is an 'Interesting Aside' (IA) asset?	The Interesting Aside asset uses attention grabbing tidbits or anecdotes to bring joy and satisfy the child's hunger to know more. This is a quick/short asset intended to bring attention back to the main concept being taught.
How to teach using the IA asset?	You may use this asset to give a piece of interesting information relevant to the topic, without prolonged explanation/discussion. You may suggest appropriate books for further reading.
What is a 'Suggested Activity' (SA) Asset?	The Suggested Activity asset provides a detailed step by step procedure for the teacher to conduct a hands-on activity. This promotes Activity Based Learning.
How to teach using the SA asset?	You may use this asset to energise your students to learn by doing simple, fun-filled activities based on the topic. The asset includes - preparation, activity, and follow-up. You may engage the students in the preparation and follow-up stages to develop collaboration and responsibility. You could try it once, yourself, before the actual delivery to be more comfortable with it. Note: The duration mentioned in the asset is usually for the activity part only.
What is a 'Value Content' (VC) Asset?	The Value Content asset integrates Universal Human Values (such as empathy, inclusivity, respect for nature that translates into responsible behaviour) seamlessly into the curriculum, as the "End of education is character".
How to teach using the VC asset?	You may use this asset to engage with the students to bring out their innate values and connect with the intrinsic values in the topic/concept. The asset includes pointers on the specific pedagogical technique followed.
What is a 'Questions to Assess' (QA) asset?	The Questions to Assess asset uses an interactive approach to check learning of different types of learners, and provides feedback to the teacher for appropriate action. The questions cater to all the levels of Bloom's Taxonomy. Questions from 'Apply' level and above enable students to reflect on their learning.
How to teach using the QA asset?	You may go through the slides to understand its flow and know when to click for the answer (slides include suggested answers). While presenting in the class, you may display the question and encourage multiple responses, before revealing the answer. In some cases, this asset may include extra questions/worksheet that can be given as homework.