

Brief Description (Objective): Students will be able to identify a systematic procedure to prove theorems related to parallelograms.

Learning Aid: Learning Aid Provided

Notes to the teacher: The teacher may give the students the following guidelines to help them to prove theorems related to parallelograms in a systematic way. The same guidelines have been given as a learning aid **MS_LA_Key to proving theorems_parallelogram.pdf**. This LA can be put up on the bulletin board for student's reference.

Mathematical theorems may seem complicated at first sight. But if we follow a systematic approach, we will realise that it is not only quite easy but also interesting to prove theorems.

A proof is a series of statements which lead to a conclusion. Proofs begin with one or more given statements. Given statements lead to other statements until the desired conclusion is reached. Each statement in the sequence must be supported by logical reasoning. Mathematical properties, definitions and theorems are used to validate the statements.

1. Read the statement of the theorem at least two times.
2. Divide it into 2 parts: What are the given facts? What are you required to find or prove?
3. In the rough column:

3 a) if in the theorem, **parallelogram is a given fact**, rewrite the statement using the 'If.....then....' structure in English. The 'If' clause will be the given part and the 'then' clause will be the part to be proved.

3 b) If in the theorem, we are **proving that the quadrilateral is a parallelogram** i.e. the converse of 3a the 'then' clause of the theorem becomes the 'if' clause in the converse and the 'if' clause of the theorem will become the 'then' clause of the converse.

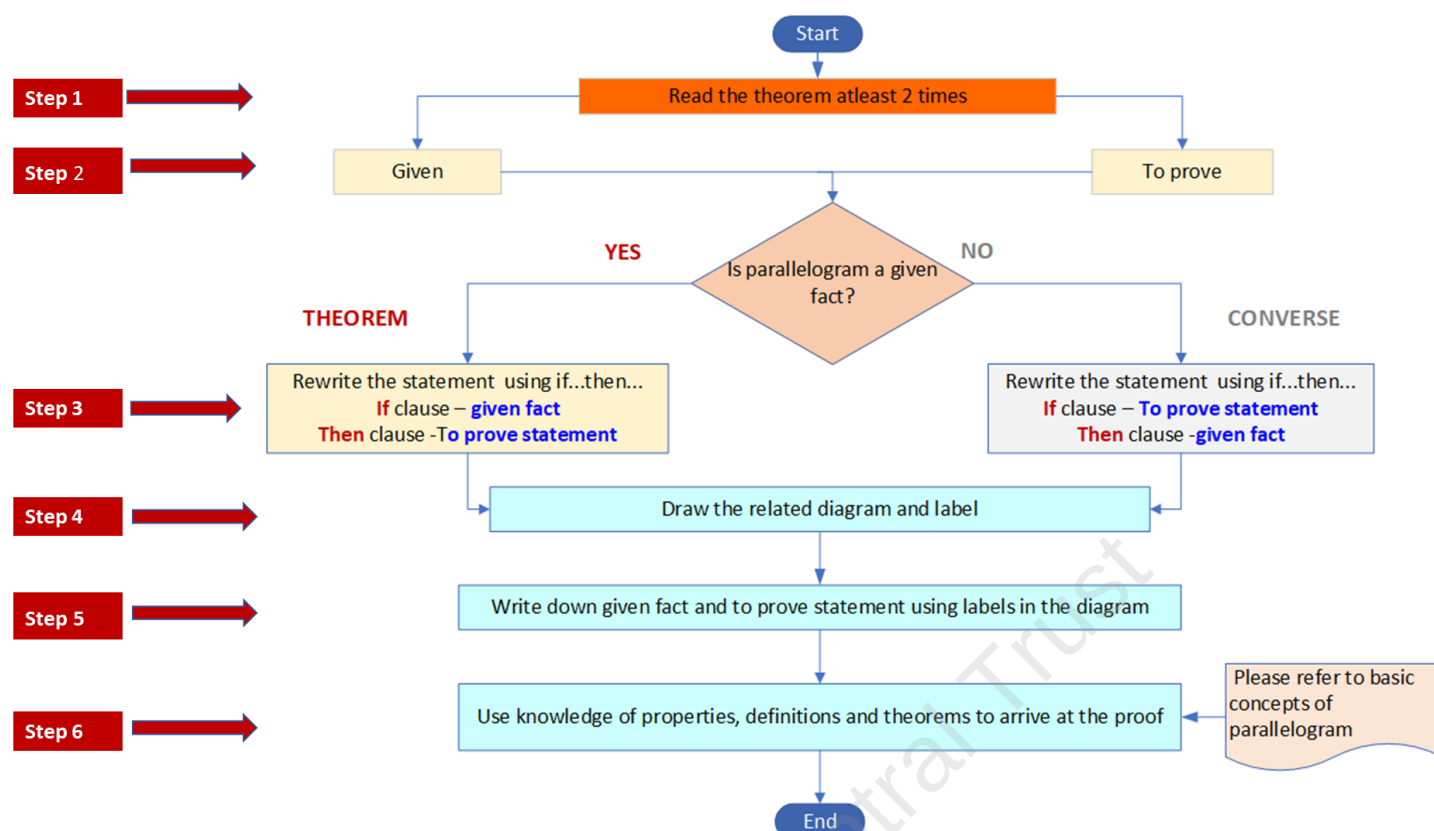
For example:

Theorem: If a quadrilateral is a **parallelogram**, then the opposite sides are equal.

Converse: If opposite sides of a quadrilateral are equal, then it is a **parallelogram**.

4. Draw a related figure. (Draw a parallelogram. Name it. Draw a diagonal or diagonals as necessary.)
5. Now write down what is given and what is to be proved using the names for sides, angles and the diagonal.
6. Use your knowledge of properties, definitions and theorems learnt earlier to arrive at the proof.

A graphical representation of these steps is given below



Annexure/Reference for Parallelogram theorems

To prove all the theorems in this chapter, you may need to use one or more of the following properties and theorems.

- Opposite sides of a parallelogram are parallel.
- Diagonal is a transversal. The sides of a parallelogram can also be a transversal
- Parallel line cut by a transversal : Alternate angle, corresponding angle theorem
- Congruence rules: SSS, ASA, SAS
- Diagonals of a parallelogram divides it into 2 congruent triangles.
- Angle sum property of a quadrilateral states that the sum of the angles of a quadrilateral = 360°

Example to Solve a theorem using the guidelines

Now let us see how to prove the following theorem using the above method:

Theorem: A diagonal of a parallelogram divides it into 2 congruent triangles.

Step 1: Read the theorem at least twice.

Step 2 :

Given: A parallelogram ABCD, and a diagonal AC divides ABCD into two triangles $\triangle ABC$ and $\triangle CDA$.

To Prove: $\triangle ABC \cong \triangle CDA$

Step 3: In the rough work column, rewrite the theorem using the 'if... then...' structure as follows:



Sri Sathya Sai
VIDYA VAHINI
श्री सत्यसाई विद्या वाहिनी

Sri Sathya Sai Central Trust

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.