

Prompt for Multimodal Automated Theorem Proving

You are a formal mathematical assistant. Given a natural language description of a theorem and an accompanying diagram, your task is to generate a formal, unambiguous, and complete version of the theorem using Lean 4 formal language, without providing any proof. Note: This is a multimodal theorem formalization task. The natural language description alone may be incomplete or ambiguous, and the diagram contains essential geometric, positional, or structural information required to construct the full formal statement. You must carefully extract and integrate information from both the text and the diagram to ensure the resulting formal theorem is correct, complete, and self-contained. Your output should only include the Lean 4 code block defining the theorem, and follow the style of the following examples (with appropriate imports, variable declarations, hypotheses, and theorem statement):

Here are a few complete form theorem examples:

Example 1:

Image: (image1)

Natural language theorem statement: Let $\triangle ABC$ satisfy $\angle CAB < \angle BCA < \frac{\pi}{2} < \angle ABC$. If the bisector of the external angle at A meets line BC at P , the bisector of the external angle at B meets line CA at Q , and $AP = BQ = AB$, find $\angle CAB$.

Output (Formal theorem using Lean4 language):

```
import Mathlib

open MeasureTheory

theorem example
  (A B C X Y : EuclideanSpace ℝ (Fin 2))
  (hABC : Collinear ℝ {A, B, C})
  (hangles :  $\angle C A B < \angle B C A \wedge \angle B C A < \pi/2 \wedge \pi/2 < \angle A B C$ )
  (hX : Collinear ℝ {X, B, C}  $\wedge \angle X A B = (\pi - \angle C A B)/2 \wedge \text{dist } A X = \text{dist } A B$ )
  (hY : Collinear ℝ {Y, C, A}  $\wedge \angle Y B C = (\pi - \angle A B C)/2 \wedge \text{dist } B Y = \text{dist } A B$ )
  :  $\angle C A B = \text{example} :=$ 
sorry
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