Assignment 2

Classical Plane Geometries and their Transformations

Due: October 21, 2025.
Submit your solutions on Crowdmark by 5pm.

Answer all five problems. Give clear synthetic geometric proofs and identify the congruence criteria, midpoint results, or circle theorems you use. Results proved in the course notes through Week 5 may be quoted. Figures are schematic; measurements from a figure are not proofs.

Problem 1. The incircle and the excircle

Let ABC be a triangle with $AB \neq AC$, incenter I, and A-excenter I_A. The incircle and the A-excircle touch the segment BC at U and V, respectively. Let M be the midpoint of II_A, and let N be the midpoint of BC.

(a) Prove that $MN \perp BC$.

(b) Prove that N is also the midpoint of UV. Deduce that $BU = CV$.

