

DU Mathsoc Problem Solving: Set 3

Date: 29/09/2026

~Beginners Paper~

For any assistance or inquiries about the problem sets, please email me at: quizmaster.maths@csc.tcd.ie.

Problem 1. You need to put n items into k boxes. How many ways are there to do that?

Problem 2. Let ABC be an acute triangle and let D be the foot of the altitude from A to BC . Let M and N be the midpoints of AB and AC , respectively. Prove that $\angle MDN \equiv \angle BAC$.

Problem 3. Prove that for any positive integer n and positive real numbers $a_1, a_2, \dots, a_n$,
$$\frac{(a_1 + a_2 + \dots + a_n)^2}{n} \leq a_1^2 + a_2^2 + \dots + a_n^2.$$

Problem 4. Let ABC be a triangle and let D be a point on BC such that $\angle BAD \equiv \angle ACB$. Suppose also that $AB \equiv BD$. Prove that $AD \equiv DC$.

Problem 5. ABC is an equilateral triangle and P is a point inside it such that $PA = 3$, $PB = 4$, $PC = 5$. Find the side length of triangle ABC .