1-st Mediterranean Mathematical Competition 1998

1. A square $ABCD$ is inscribed in a circle. If M is a point on the shorter arc AB, prove that $MC \cdot MD > 3\sqrt{3} \cdot MA \cdot MB$. *(Greece)*

2. Prove that the polynomial $z^{2n} + z^n + 1$ ($n \in \mathbb{N}$) is divisible by the polynomial $z^2 + z + 1$ if and only if n is not a multiple of 3. *(Croatia)*

3. In a triangle ABC, I is the incenter and D, E, F are the points of tangency of the incircle with BC, CA, AB, respectively. The bisector of angle BIC meets BC at M, and the line AM intersects EF at P. Prove that DP bisects the angle FDE. *(Spain)*

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