

**Mediterranean Mathematics Olympiad 1998**

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by djb86

- 1 A square  $ABCD$  is inscribed in a circle. If  $M$  is a point on the shorter arc  $AB$ , prove that

$$MC \cdot MD > 3\sqrt{3} \cdot MA \cdot MB.$$

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- 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.
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- 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  $FDE$ .
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