Problem A1. Find all positive integers $x, y$ such that $4^x + 5 = 9^y$. 
Problem A2. Prove that from any point inside an equilateral triangle, the sum of the measures of the distances to the sides of the triangle is constant.
Problem A3. Let $a, b, c, d > 0$. Prove that

$$\frac{1}{a} + \frac{1}{b} + \frac{4}{c} + \frac{16}{d} \geq \frac{64}{a + b + c + d}.$$
Problem A4. Find $\lim_{n \to \infty} \prod_{k=0}^{n} \left(1 + \frac{1}{3^{2k}}\right)$. 
Problem A5. Prove that if $a, b$ are two positive integers and $\sqrt{a}$ is irrational then $\sqrt{a} + \sqrt{b}$ is irrational.
Problem A6. Prove that in the following product
\[ P = (1 - x + x^2 - x^3 + \cdots - x^{99} + x^{100})(1 + x + x^2 + x^3 + \cdots + x^{99} + x^{100}) \]
after multiplying and collecting terms, there does not appear a term in \( x \) of odd degree.