Problem 1. Determine all prime numbers in the sequence 101, 10101, 1010101, \ldots.

Problem 2. Let \( b \) be a positive real number such that
\[
1 + 2b + 3b^2 + \cdots + nb^{n-1} + \cdots = 2002.
\]
Which number is larger: \( 4004b \) or \( 2002b^2 + 2001 \)?

Problem 3. Find a polynomial \( f(x) \) with real coefficients, of degree \( \leq 2 \), which best approximates \( \sin x \) on the interval \([-\frac{\pi}{2}, \frac{\pi}{2}]\), in the sense that the integral
\[
I = \int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} (f(x) - \sin x)^2 \, dx
\]
is as small as possible.

Problem 4. Let \( a_1, a_2, \ldots, a_{2n+1} \) be integers with the property that if we remove any one of these numbers, we can divide the remaining \( 2n \) numbers into two groups of \( n \) numbers each, having the same sum. Show that \( a_1 = a_2 = \cdots = a_{2n+1} \).