Problem 1. Let $a, b \in \mathbb{N}$ and $p$ be a prime. Show that $(a + b)^p = a^p + b^p \mod p$.

Problem 2. Let $d$ be a positive integer. Show that

$$\left| \left\{ x \in \mathbb{R} \mid \exists a_0, \ldots, a_d \in \{1, 2, 3\}, \sum_{i=0}^{d} a_ix^i = 0 \right\} \right| \leq d3^{d+1},$$

i.e., degree-$d$ polynomials with coefficients in $\{1, 2, 3\}$ have at most $d3^{d+1}$ distinct roots altogether.