1. Let n, m be coprime and $d \mid nm$. Prove that there are coprime a, b such that $a \mid n, b \mid m$ and $ab = d$.

2. Prove that $n! + 1$ and $(n+1)! + 1$ are coprime for any n.

3. Find $\gcd(2 \cdot 3^{13} + 1, 2 \cdot 3^7 - 5)$.

4. Find all prime p such that $8p^2 + 1$ is also prime.

5. Solve the system

$$\begin{cases} 65x + 37y - 27z = 23 \\ 55x + 13y + 31z = 27 \end{cases}$$

6. Solve the equation $x^2 + \overline{5}x - \overline{2} = \overline{0}$ in $\mathbb{Z}/121\mathbb{Z}$.

7. Find the remainder of $18! \pmod{437}$. Hint: Wilson's theorem

8. Find the remainder $77^{70^{28^{133}}} \pmod{880}$.

9. Is the equation $\overline{9}x^2 - \overline{14}x = \overline{117}$ solvable in $\mathbb{Z}/959\mathbb{Z}$?

10. For any prime $p > 5$, prove that there are consecutive quadratic residues modulo p and consecutive quadratic non-residues modulo p.