1. Let \( n \) be a prime. Is \((\mathbb{Z}_n - \{0\}, \odot)\) a group? Why?

2. What is the smallest non-abelian group? Why?

3. Is the collection of all infinite sets of natural numbers a countable set? Why?

4. A graph has \( q \) edges, where \( q \geq 2 \). What is the smallest number of vertices that the graph can have? Why?

5. Let \( g: A \to B \), and \( f: B \to C \) be functions. Prove that if \( f \circ g: A \to C \) is one-to-one, then \( g: A \to B \) is also one-to-one. Is the converse true? Why?

6. What is the solution to the system of congruences: \( x \equiv 1 \mod 3 \), \( x \equiv 2 \mod 5 \), and \( x \equiv 3 \mod 7 \)? Why?

7. Is the sum of any three consecutive positive cubes a multiple of 9? Why?

8. Is a rectangle with unequal sides less symmetric than a square? Why?

9. How many pairs of prime numbers \( p \) and \( q \) are there such that \( q - p = 3 \)? Why?

10. Is the set of prime numbers finite? Why?

Each problem is worth 10 pts.