1. Write the truth table for the if-then operation, $p \rightarrow q$. Define vacuous truth. Why do we define the if-then operator the way that we do? Give a concrete mathematical example.

2. Give complete examples (including the proof or disproof) for the following proof techniques:
   a. Direct proof
   b. Proof by exhaustion
   c. Disproof by example
   d. Proof by contradiction

3. Write Epp pseudo-code for the Euclidean algorithm. (Just describe the Euclidean algorithm for partial credit.)

4. Give examples from mathematics of the following. Be sure to specify the domain and the co-domain.
   a. A function on a finite domain
   b. A function on an infinite domain
   c. A mapping that is not a function because of contradictory specification
   d. A mapping that is not a function because of non-unique specification

5. Use mathematical induction to demonstrate

$$\sum_{k=1}^{n} k = \frac{n(n + 1)}{2}$$