# Calculus Assignment

Q1. A cybersecurity system uses two encryption algorithms in sequence. Algorithm f applies a transformation on the encrypted data, and Algorithm g performs a secondary encryption. Find the overall encryption function when both are applied:  
1. One after the other, i.e. (f ∘ g)(x)  
2. In reverse order, i.e. (g ∘ f)(x)  
Given:  
 f(x) = 2x - 5, g(x) = e^(sin x)

Q2. a) Select the domain for the function f: R → R where  
 f(x) = √(x + 2) / (x - 1)  
  
b) Solve the inequality  
 √(x + 2) / (x - 1) > 1

Q3. During a network scan, a relation is established between each IP address and the number of open ports. Determine whether this relation represents a valid function. If one IP corresponds to multiple port responses, explain whether it violates the definition of a function and what kind it could represent.

Q4. In a cyber defense simulation, the function  
 f(n) = (n² + n + 1) / (3n + 3)  
models the rate of incoming data packets per second as the system nears maximum load. Evaluate the limit of f(n) as n → -1. Does it stabilize (limit exists) or spike (limit does not exist)? Determine system stability under heavy load.

Q5. Discuss the continuity and differentiability of the function  
 f(x) = { sin x, x ≤ π ; 0, x > π }  
at x = π.