1. (4 points) Find the derivatives of the following functions:
   i) \( f(x) = \sin^2 x + \log x^3 - \ln x^2 \)
   ii) \( g(x) = \alpha \cot x + \sqrt{x} + \sqrt[3]{x^{x+1}}, \) where \( \alpha \neq 0 \)

2. (3 points) Evaluate the following integral:
   \[
   \int_{0}^{\infty} e^{x^2} \, dx \quad \text{or} \quad \int_{0}^{\infty} \exp(x^2) \, dx
   \]

3. (3 points) Prove that \( \sin x \leq x - \frac{x^3}{3!} \) for all real numbers \( x \).