1. (48 pts.) Evaluate the following. Remember to show your work!
   (a) \( \lim_{x \to 0} \frac{\cos x - 1}{e^x - 1} \).
   (b) \( F'(x) \) given that \( F(x) = \int_{\sqrt{2}}^{x^2} \cos(t^2) \, dt \).
   (c) \( \int e^t \sqrt{1 + e^t} \, dt \).
   (d) \( \int_0^2 |x - 1| \, dx \).

2. (20 pts.) (a) Verify that \( \ln |\sin u| \) is an antiderivative of \( \cot u \).
   (b) Compute \( \int_{\pi/4}^{\pi/2} \cot x \, dx \). Your final answer may contain logarithms, but it should NOT contain trig functions.

3. (12 pts.) Verify the inequality \( \int_0^1 \sqrt{2 + x^2} \, dx \leq \sqrt{3} \) without evaluating the integral.

4. (a) (15 pts.) Given the table of information below, use a linear approximation to estimate \( g(16) \).

   \[
   \begin{array}{c|c|c|c}
   x & 0 & 5 & 10 & 15 \\
   \hline
   g(x) & 0 & 20 & 35 & 45 \\
   \end{array}
   \]

   (b) (5 pts.) Do you think your prediction is an overestimate or underestimate? Why?
   You must give a reason to receive credit.

END OF EXAM