1. **SHOW ALL WORK. NO CREDITS FOR ANSWERS NOT SUPPORTED BY WORK.**

2. **CALCULATORS ARE NOT ALLOWED.**

1. (15 Points) A rectangular box has a square base with edges at least 1 in. long. It has no top, and the total area of its five sides is 300 in.$^2$. What is the maximum possible volume of such a box?

2. (15 Points) The demand equation of a certain product in a company is $p = 400 - 2q$ and the average cost per unit of producing $q$ units is $\bar{c} = q + 160 + \frac{2000}{q}$ where $p$ and $\bar{c}$ are in dollars per unit. Find the maximum profit that the company can achieve.

3. (15 Points) Use differentials to approximate $\sqrt{16.8}$

4. (60 Points: 10 points each) Evaluate each of the following integrals.
   
   a) $\int \frac{x^2 - \sqrt{x}}{x^3} \, dx$

   b) $\int \sqrt{\frac{1}{e^x}} \, dx$

   c) $\int \frac{x}{\sqrt[3]{2x^2 + 9}} \, dx$

   d) $\int \frac{\ln xe^x}{x} \, dx$

   e) $\int_1^2 \left( \frac{d}{dx} \int_1^2 e^{x^2} \, dx \right) \, dx$

   f) $\int_5^5 \frac{(x + 2)}{x + \ln \sqrt{3x + 3}} \, dx$

5. (15 Points) Given that $y^* = x + e^{2x}$, $y'(0) = 2$, and $y(0) = 3$. Find $y$.

6. (15 Points) Find the area between the graph of $y = x^2 - x - 2$ and the $x$-axis from $x = -2$ to $x = 2$. 
7. (15 Points) Find the area bounded by the curves of \( y = 2x + 2 \) and \( y = x^2 - 1 \).