Instructions:
1. Do NOT open your exam until you are told to.
2. You have 50 minutes for this exam.
3. Before start the exam, PRINT your name and student ID in the space above.
4. NO notes or books are allowed.
5. Calculators may NOT be used for this exam. Do not replace precise quantities such as $\sqrt{3}, e^2, \ln 2$, with decimal approximations unless a question specifically requests an approximate answer.
6. Show all your work clearly on the pages provided.
7. Please raise your hand if you have any questions during the exam.
1 (12 pts.) Determine whether each statement is true (T) or false (F). Then CIRCLE the appropriate answer. Assume that $x$ and $y$ are positive numbers.

(a) $\ln(x + y) = \ln x + \ln y$ T F
(b) $e^xe^y = e^{xy}$ T F
(c) $\int \ln x \, dx = \frac{1}{x} + C$ T F

2 (10 pts.) Find the derivative of the function $f(x) = (x^2 + 2x - 1)^{\ln x}$. 
A company produces a product for which the marginal cost of producing $x$ units is modeled by \( \frac{dC}{dx} = 2x - 12 \) and the fixed cost (the cost when $x = 0$) is $125$.

(a) Find the total cost function and the average cost function.

(b) Find the total cost of producing 50 units.

You deposit $500$ in account AA paying 6% nominal interest rate compounded monthly, and deposit $400$ in account BB paying 7% nominal interest rate compounded continuously. (You may use a calculator for this problem.)

(a) What is the approximate effective rate of each account?

(b) What is the approximate balance in each account after 5 years?

(c) When will the balance in account BB be doubled?
5 (18 pts.) Analyze the function $f(x) = (x + 3)^2 e^{-x}$ to determine extrema, points of inflection, axes intercepts and asymptotes. (Hint: $\lim_{y \to \infty} \frac{y^2}{e^y} = 0$.)
Evaluate the following indefinite integrals. Simplify your answers as much as possible. Show your work.

(a) \( \int \frac{x^3 + 10}{x + 3} \, dx \)

(b) \( \int \frac{e^{-x}}{1-e^{-x}} \, dx \)

(c) \( \int x(x^2 - 1)^5 \, dx \)

(d) \( \int x^2 e^{x^3} \, dx \)

(e) \( \int \frac{\ln x}{x} \, dx \)