

**Instructions:** There are six problems. Some questions are easier than others so you are encouraged to read the entire exam before beginning your work. Make sure that you have a total of 10 pages with 6 problems.

1. (20 points.) Evaluate the following integrals.

(a)  $\int \frac{e^x - 1}{e^x + 1} dx$

(b)  $\int \frac{\ln x}{x^2} dx$

2. (20 points.) Evaluate the following integrals.

(a)  $\int_{-1}^1 x^3 e^{-x^2} dx$

(b)  $\int_0^1 \left(\frac{x}{x+1}\right)^2 dx$

3. (10 points.) Find a function  $f$  that satisfies

$$f''(x) = \frac{1}{x}, \quad x > 0; \quad f'(1) = 1; \quad f(1) = 1$$

4. (10 points.) Find the area between the graphs of  $y = 8 - x^2$  and  $y = x^2$ .
5. (10 points.) Alice deposits \$50 into a bank account with an annual interest rate of 10%, compounded continuously. Bob deposits \$100 into an account with an annual interest rate of 5%, compounded continuously. Give numerical answers to the following questions, using the approximation  $\ln 2 \approx 0.7$ .
- (a) How long does it take for Alice's money to double?
- (b) At what point do the two accounts have the same balance?
6. (10 points.) Use the trapezoidal rule with 4 subintervals to estimate  $\int_0^1 e^{x^3} dx$ . Do not simplify.