APPM 1350 **EXAM #3** **SPRING 1998**

ON THE FRONT OF YOUR BLUEBOOK write: (1) your name, (2) your student ID number, and (3) a grading table. You must work all of the problems on the exam. Show ALL of your work in your bluebook and **BOX IN YOUR FINAL ANSWERS**. A correct answer with no relevant work may receive no credit, while an incorrect answer accompanied by some correct work may receive partial credit. Text books and class notes and calculators are NOT permitted. A one-page crib sheet is allowed. Please start each new problem on a new page of the bluebook.

1. (20 points) Evaluate the following derivatives, $\dfrac{df}{dx}$. Show all of your work.

   (a) $f(x) = (\sin x)^{\sin x}$

   (b) $f(x) = \displaystyle\int_0^{3x} e^{-(t^2)}\,dt$

   (c) $f(x) = x \log_8 \left(e^{(\ln x)(\ln 8)}\right)$

2. (20 points) Evaluate the following integrals. Show all of your work.

   (a) $\displaystyle\int \frac{\cos x}{\sin x}\,dx$

   (b) $\displaystyle\int_0^{\pi/2} e^{\sin t}\,\cos t\,dt$

   (c) $\displaystyle\int_0^1 \frac{x^4}{\sqrt{x^5+9}}\,dx$

3. (20 points) Consider the integral $\displaystyle\int_2^4 \sqrt{1+x^2}\,dx$. Explicitly write out the calculations necessary to approximate the value of the integral using the trapezoidal rule with four subintervals. You do not need to numerically evaluate the resulting expression.

4. (20 points) Consider the differentiable function $f(x)$ defined on $[0, \frac{\pi}{2}]$. You know the following information about the function: $f(0) = 1$; $f\left(\frac{\pi}{2}\right) = 0$; $f'(0) = 3$; $f'\left(\frac{\pi}{2}\right) = 4$; Determine the following:

   (a) $f^{-1}(0)$

   (b) $f^{-1}(1)$

   (c) $\dfrac{df^{-1}}{dx}$ at $x = 0$

   (d) $\dfrac{df^{-1}}{dx}$ at $x = 1$

5. (20 points) An aluminum beam was brought from the outside cold into a machine shop where the temperature was held at 65°F. After 20 minutes, the beam warmed to 25°F and after another 20 minutes it was 45°F. Use Newton's law of cooling to estimate the beam's initial temperature.