

APPM 1350 - Exam 3  
Wednesday 28 November 2007 A.D.

**INSTRUCTIONS:** Books, notes, flying monkeys and electronic devices are not permitted. Write your (1) name, (2) student number, (3) instructor's name, and (3) when your lecture meets on the front of your bluebook. Also make a scoring table, with places for 6 problems, plus a total score. This exam has 6 problems, on both sides of this sheet. Work all 6 problems. Start each problem on a new page. Show your work. **BOX** in your answers. A correct answer with incorrect or no supporting work may receive no credit, while an incorrect answer with relevant work may receive partial credit.

Problem 1 (10 points)

Given

$$\int_{-1}^5 1 - 2f(x) dx = -6 \quad \text{and} \quad \int_2^5 f(x) + 3 dx = 13$$

find

$$\int_{-1}^2 f(x) dx.$$

Problem 2 (20 points)

Let  $f(x) = x^2 - 1$ . Consider

$$\int_1^3 f(x) dx. \tag{1}$$

(a) Partition  $[1, 3]$  into  $n = 4$  equal subintervals. Graph the function  $f(x)$  together with the rectangles associated with the Riemann sum with left-endpoints and the trapezoids associated with the Trapezoidal Rule used to approximate the integral in (1).

(b) With  $n = 4$  equal subintervals, use the Riemann sum with left endpoints and the Trapezoidal Rule to approximate the integral in (1). The formula for the Trapezoidal Rule  $T_n$  is

$$T_n = \frac{h}{2}(y_0 + 2y_1 + 2y_2 + \cdots + 2y_{n-1} + y_n)$$

(c) Compute the error and error estimate for the Trapezoidal Rule. The formula for the error estimate  $E_T$  is

$$E_T = \frac{b-a}{12} h^2 M.$$

**Problem 3 (25 points)**

Evaluate the following integrals.

$$(a) \int x^{-3}(x+1) dx \quad (b) \int \frac{dx}{\sqrt{5x+8}} \quad (c) \int_0^{\pi/4} \tan x dx$$

**Problem 4 (15 points)**

(a) State the Fundamental Theorem of Calculus including hypotheses.

(b) Let

$$g(x) = 3 - \int_2^{\sqrt{x}} \sin(\pi t^2) dt$$

Compute the linearization of  $g(x)$  at  $x = 4$ .

**Problem 5 (20 points)**

(a) Using logarithmic differentiation, calculate the derivative of:

$$y = \sqrt{\frac{(x+1)^{10}}{(2x+1)^5}}$$

(b) Evaluate  $dy/dx$  at  $x = 0$ .

**Problem 6 (10 points)**

(a) Which of the functions  $f(x) = x^3 - 1$  or  $g(x) = x^4 + 2$  has an inverse? Justify your answer. Find a formula for the inverse of this function.

(b) Graph this function and its inverse.