APPM 1350 **Exam 3** **Spring 2014**

INSTRUCTIONS: Books, notes, and electronic devices are **not** permitted. Write (1) **your name**, (2) **1350/EXAM 3**, (3) **lecture number/instructor name** and (4) **SPRING 2014** on the front of your bluebook. Also make a **grading table** with room for 5 problems and a total score. **Start each problem on a new page.** **Box** **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. **SHOW ALL WORK**

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1. (5 points each) Evaluate each of the following integrals

$$\text{(a)} \int_{-3}^{3} \frac{t|t|}{t^4+2}\,dt \qquad \text{(b)} \int t^3\sqrt{t-4}\,dt \qquad \text{(c)} \int_{0}^{3\pi/2} |\sin x|\,dx \qquad \text{(d)} \int \cos^3\theta \sin\theta\,d\theta$$

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2. (20 points) The profit P (in thousands of dollars) for a company spending an amount s (in thousands of dollars) on advertising is $P = -\frac{1}{10}s^3 + 6s^2 + 400$. Find the amount of money the company should spend on advertising in order to yield a maximum profit.

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3. (a) (6 points) Write the integral which gives the area of the region between $x = 0$ and $x = 1$, above the x-axis, and below the curve $y = x - x^2$.
   (b) (8 points) Evaluate your integral exactly to find the area.
   (c) (6 points) Find all c between $x = 0$ and $x = 1$ so that $f(c) = f_{avg}$.

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4. (20 points) Using the definition for area using right hand endpoints,

$$A = \lim_{n\to\infty} R_n = \lim_{n\to\infty} [f(x_1)\Delta x + f(x_2)\Delta x + f(x_3)\Delta x + \ldots + f(x_n)\Delta x]$$

find an expression for the area under the curve $y = x^3$ from 0 to 1 as a limit.

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5. (5 points each) Let the function f be defined by $f(x) = \int_1^x \frac{1}{t}\,dt$ for $x > 0$.
   (a) What is f(1)? What is $f'(x)$? What is $f'(1)$?
   (b) f is differentiable. Why?
   (c) Show that $\frac{d}{dx}\left(f\left(\frac{1}{x}\right)\right) = -f'(x)$.
   (d) Using the definition of f, show that $f(x+h) - f(x) = \int_x^{x+h} \frac{1}{t}dt$.

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