APPM 1350 Midterm #3 Spring 2010

On the front of your bluebook, please write: a grading key, your name, student ID, and section and instructor. This exam is worth 100 points and has 5 questions. **Show all work!** Answers with no justification will receive no points. Please begin each problem on a new page. No notes, calculators, or electronic devices are permitted.

1. (30 points) Find the requested information.

   (a) Find $\int \left(\frac{t^2}{2} + 4t^3\right) dt$

   (b) Find $\int \left(1 + \tan^2 x\right) dx$ (Hint: use a trig identity.)

   (c) Find $\int \frac{e^{-\sqrt{x}}}{\sqrt{x}} dx$

   (d) Find $\int_{-1}^{-1/2} t^{-2} \sin^2\left(1 + \frac{1}{t}\right) dt$

   (e) Find $\frac{dy}{dr}$ when $y = e^{\sin r}(\ln r^3)$

2. (20 points) Suppose the acceleration of a particle moving along a straight line is given by $a(t) = -4\sin 2t$ with initial velocity $v(0) = 2$ and initial position $s(0) = -3$.

   (a) Find the position function of the particle at time t.

   (b) For what values of $0 \le t \le \pi$ is the particle at rest?

   (c) For what values of $0 \le t \le \pi$ is the particle moving forward? Backward?

3. (24 points)

   (a) State the Fundamental Theorem of Calculus parts 1 and 2. Include both the hypotheses and conclusion for both parts.

   (b) Find the linearization of

   $$f(x) = 2 - \int_2^{x+1} \frac{9}{1+t} dt \qquad \text{at } x = 1.$$

   (c) Express the following limit as a definite integral.

   $$\lim_{\|P\| \to 0} \sum_{k=1}^{n} \frac{1}{1 - c_k} \Delta x_k, \qquad \text{where } P \text{ is a partition of } [2, 3].$$

4. (16 points)

   (a) Given that $\int_0^1 \frac{4}{1+x^2} dx = \pi$, what estimate of π do you get if you numerically evaluate the definite integral using the Trapezoidal Rule with 2 intervals?

   (b) What is the approximation error E_T that you get in part a? (Leave your answer in fraction form, do not attempt to find the decimal value of E_T.)

5. (10 points) Use Logarithmic Differentiation to find $\frac{dy}{dx}$ for the following function:

   $$y = \frac{x\sqrt{x^2+1}}{(x+1)^{2/3}}$$