APPM 1350 **Midterm 3** **Spring 2013**

On the front of your bluebook, please write: a grading key, your name, and instructor's name (Chang or Rubio). This exam is worth 100 points and has 7 questions. **Show all work! Simplify all answers.** Answers with no justification will receive no points. Please begin each problem on a new page. No notes, calculators, or electronic devices are permitted.

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1. (32 points) Evaluate the following expressions.

   (a) $\dfrac{d}{dx}\displaystyle\int_0^{1/x} \left(2t^3 - t^2\right) dt$

   (b) $\displaystyle\int \frac{\cos x}{(1+2\sin x)^2}\, dx$

   (c) $\displaystyle\int_{-6}^{0} \sqrt{36 - x^2}\, dx$

   (d) $\displaystyle\int_2^{16} \frac{5}{3x}\, dx$

2. (14 points) Let $p(x) = x^3 + 2x^2$.

   (a) Estimate the area under the curve on the interval $[0, 2]$ using n evenly spaced subintervals and right endpoints. (Find R_n.) Leave your answer unsimplified.

   (b) Find the exact area under the curve by evaluating the limit as $n \to \infty$ of the expression you found in part (a).

   (c) Check your answer by calculating $\displaystyle\int_0^2 p(x)\, dx$ using the Evaluation Theorem.

3. (12 points) A particle is moving along a straight line with velocity $v(t) = t^2 - t$ (in m/s).

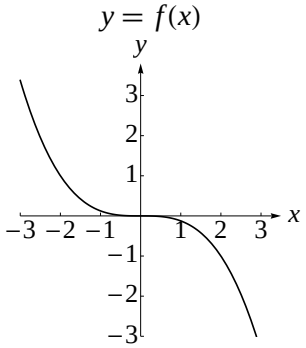
   (a) What is the total displacement of the particle over the interval $0 \le t \le 4$?

   (b) What is the total distance traveled over the same interval?

4. (10 points) Use one iteration of Newton's Method to approximate $\sqrt[5]{3}$ starting with an initial guess of $x_1 = 1$.

5. (10 points) Given that $f(x)$ is odd, $\displaystyle\int_0^1 f(2x)dx = 1$, and $\displaystyle\int_7^2 f(x)dx = 14$, find $\displaystyle\int_{-7}^0 f(x)dx$.

6. (12 points) Let f be a differentiable, one-to-one function, shown at right.



   (a) Copy the graph of f and add a sketch of the inverse function f^{-1}.

   (b) Given

$$f(1) = -\tfrac{1}{8} \qquad f'(2) = -\tfrac{3}{2}$$
$$f(2) = -1 \qquad \left(f^{-1}\right)'\left(-\tfrac{1}{8}\right) = -\tfrac{8}{3}$$

   find the following values.

   i. $f^{-1}(-1)$
   ii. $f\left(f^{-1}(8)\right)$
   iii. $\left(f^{-1}\right)'(-1)$

7. (10 points) Suppose that the function $f(x)$ has a positive derivative for all x and that $f(1) = 0$. Let

$$g(x) = \int_0^x f(t)\,dt.$$

   Answer TRUE (if always true) or FALSE (if not always true) for the following statements. No explanation is necessary.

   (a) $g(1)$ is negative.
   (b) g is increasing on $(0, 1)$.
   (c) g has a local maximum at $x = 1$.
   (d) g has an inflection point at $x = 1$.
   (e) The average value of g on $[0, 1]$ is negative.