Review For Exam 3

The directions for the exam are as follows:

"WRITE YOUR NAME CLEARLY. Do as many problems as you can for a maximal score of 100. SHOW YOUR WORK!"

1. The exam consists of 10 core problems and 3 extra-credit problems. If you wish, you can do all the 13 problems, but your score will only add up to 100 points. Partial credit will be given.
2. This exam will also feature 3 problems targeting the trouble topics on exam 1.
3. You are allowed to use a scientific calculator. Don't forget to bring it
4. When you are studying for this exam, be sure to work through sections that you know least of all first.
5. Odd exercises have solutions at the back of your textbook.

Warning! Be sure to work on ALL exercises below that are marked in red. 100% of regular exam questions will consist of a subset of the red problems. Do ALL the problems on the review list to insure a perfect mastery of the topic.

Section 4.9

- **Possible Extra-Credit:** Suppose F(x) is the antiderivative of f(x). Explain why every other antiderivative of f(x) must be of the form F(x) + C, where C is any constant.
- Be able to efficiently and hastily compute antiderivatives of elementary functions. (P. 275, Exercises **1-43** [odd])
- Be able to compute the function from information about its derivative (P. 275, Exercises **45-61** [odd])
- Be able to find the position of the particle from information about the particle's velocity or acceleration (P. 275, Exercises **63-67** [odd]). No need to graph!
- Know how to apply antiderivatives to solve basic physics problems (P. 276, Exercises **75, 77**).

Section 5.1

- Know how to represent sums using sigma notation (P. 292, Exercises **40, 41**).
- **Possible Extra-Credit:** Express the sums $\sum_{k=1}^{n} k$, $\sum_{k=1}^{n} k^2$, and $\sum_{k=1}^{n} k^3$ in closed form (i.e. find the sums in terms of n). Of course, show that you didn't merely memorized the formulas. Exhibit how these sums are found.

Section 5.2

- Be able to express a given Riemann sum as a definite integral (P. 306, Exercises **19-20**).
- Know how to compute definite integrals by evaluating limits of Riemann sums (P. 307, Exercises **45-50**)
- Be able to evaluate a definite integral by recognizing instances when the area is known from basic geometry (P. 306, Exercises **25, 27**).

Section 5.3

- Use the Fundamental Theorem of Calculus to compute derivatives (P. 321, Exercises **59-66** [all]).
- **Possible Extra-Credit:** Let $G(x) = \int_0^{\int_0^x \cos(s^2)ds} \cos(t^2)dt$. Find the derivative of $G(x)$.
- Use the Fundamental Theorem of Calculus to evaluate definite integrals (P. 321, Exercises **29-47** [odd]).
- Calculate the following limits:

  (1) $\lim_{n\to\infty} \frac{1}{n}\left(1\frac{1}{n} + 2\frac{1}{n} + \cdots + n\frac{1}{n}\right)$

  (2) $\lim_{n\to\infty} \frac{2}{n}\left(\sqrt{1\frac{2}{n}} + \sqrt{2\frac{1}{n}} + \cdots + \sqrt{n\frac{1}{n}}\right)$

  (3) $\lim_{n\to\infty} \frac{\pi}{2n}\left(\sin\left(\frac{\pi}{2} + 1\frac{\pi}{2n}\right) + \sin\left(\frac{\pi}{2} + 2\frac{\pi}{2n}\right) + \cdots + \sin\left(\frac{\pi}{2} + n\frac{\pi}{2n}\right)\right)$
- **Possible Extra-Credit:** Prove the Fundamental Theorems of Calculus.

Section 5.4

- Be able to use symmetry to evaluate integrals (P. 328-329, Exercises **7-15** [odd], **40-43** [all])
- Calculate the average value of a function (P. 328, Exercises **21-27** [odd])
- Suppose that $\lim_{h\to 0} \frac{1}{h}\int_x^{x+h} f(t)dt = 5$. Compute

  (1) $\lim_{h\to 0} \frac{1}{h}\int_x^{x+3h} f(t)dt$

  (2) $\lim_{h\to 0} \frac{1}{h}\int_x^{x-h} f(t)dt$

  (3) $\lim_{h\to 0} \frac{1}{h}\int_x^{x+h^2} f(t)dt$

  (4) $\lim_{h\to 0} \frac{1}{h}\int_x^{x+\sin h} f(t)dt$

  (5) $\lim_{h\to 0} \frac{1}{h}\int_x^{x+\sin 3h} f(t)dt$

  Explain your reasoning.

Section 5.5

- Be able to apply the substitution rule to find antiderivatives and definite integrals. (P. 338-339, Exercises **17-51** [odd]).
- **Possible Extra-Credit:** P. 339, Exercises **82, 83**