**Math 126** **Review for Final Exam** **Spring 2013**

As you may recall from reading the syllabus, the goals for this course are

- to develop quantitative reasoning skills;
- to learn how to read technical material;
- to learn to write technical information correctly and clearly;
- to take pride in your work and to avoid errors;
- to learn how to solve non-routine problems;
- to appreciate/understand how mathematicians view mathematics;
- to comprehend some aspects of calculus.

It is with these goals in mind that the final exam will be written. The exam is comprehensive and covers all of the sections that we have discussed this semester, with a slight emphasis on the more recent material. The final exam will require the skills and concepts that you have been practicing and pondering this semester. It is your responsibility to go back over the sections and make certain that you know how to do the types of problems we have encountered. One or two problems on the final exam will be more involved than the sorts of problems that have appeared on the other exams that we have had. This should not be that much of a surprise because most of the test questions have been easier and shorter than homework problems due to the time period of the in-class exams. It is now time for you to put all your knowledge together and show me what you have learned this semester.

Here is the (most likely) introduction to the final exam that you will be taking.

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Write neat, concise, and accurate solutions to each of the problems in the space provided—I will not give any credit for steps I cannot follow. Your solutions should be written in the style expected for collected homework problems. Pay particular attention to correct use of notation and use sentences when appropriate. Each of the ten problems is worth eight points. No electronic devices or calculators are allowed for this exam.

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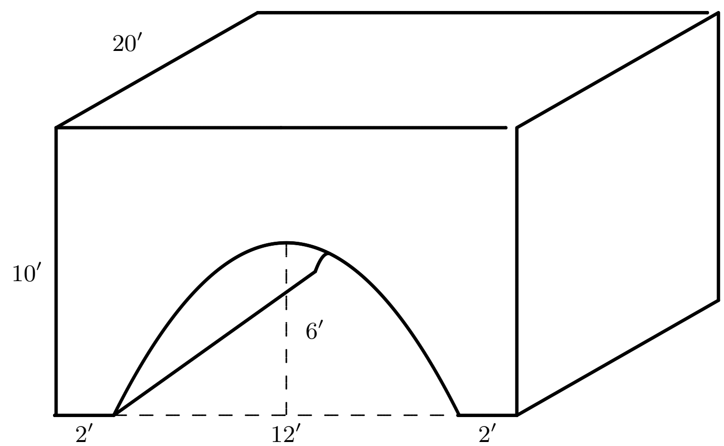
The problems will be graded as indicated in the heading so it is important that you work toward avoiding computational errors and that you pay attention to your writing and notation. The best advice is to review for the exam by looking over the sections in the text that we have covered, thinking carefully about the ideas we have discussed, and understanding the types of problems that have appeared on previous exams. You can redo problems from the sections in the textbook, you can look over your previous exams, and you can work on some of the review problems (there are 112 of them) at the link "Review Problems for Math 126" on the course website. It is important that you arrive at the exam with a refreshed mind and body, and be prepared to stay positive and work hard for up to three hours. As just indicated, although the exam is written for a two hour period, you may have three hours for the exam.

As should come as no surprise, it is expected that you can state the definition of the derivative, the definition of the integral, and both versions of the Fundamental Theorem of Calculus. Do not lose points by ignoring this fact. You should also be familiar with basic integration formulas and techniques of integration, be able to solve problems involving applications of the integral, understand the main ideas behind sequences, series, and power series, and know the Maclaurin series for $e^x$, $\sin x$, and $\cos x$. This is just a sampling of the things that you need to know for the exam; if you have been keeping up during the semester, it should not be too difficult to remember the common formulas and ideas that we have been using.

The following problems are not representative of the final exam. They are simply intended to give you some indication of the nature of a more difficult or novel problem that may appear on the final exam. Having said that, I do recommend that you give them some thought. However, keep in mind that most of the problems on the final exam will be (or at least should be) quite familiar to you (see the final exam from Spring 2011 that is located on the course website).

1. Consider two different solids. The base of each solid is a triangle with vertices $(0, 0)$, $(2, 4)$, and $(6, 0)$. For solid $A$, each cross-section perpendicular to the $y$-axis is an equilateral triangle. For solid $B$, each cross-section perpendicular to the $x$-axis is a square. Find the ratio of the volume of solid $A$ to the volume of solid $B$.

2. Find the number of cubic yards of concrete necessary to construct the culvert shown below. Assume that the arch of the culvert (which is empty space) has a parabolic shape.




3. Let $a_1 = 2$ and $a_{n+1} = 3 - (1/a_n)$ for each positive integer $n \geq 1$. Prove that $a_n = \dfrac{f_{2n+1}}{f_{2n-1}}$ for each positive integer $n$. Here $f_n$ refers to the $n$th Fibonacci number.

4. For each positive integer $n$, let

$$y_n = \frac{1}{3n+2} + \frac{1}{3n+4} + \frac{1}{3n+6} + \cdots + \frac{1}{5n}.$$

Find the limit of the sequence $\{y_n\}$. (Try writing $y_n$ in summation notation and think about integrals.)

5. Determine (using familiar calculus functions) the function represented by $\displaystyle\sum_{k=0}^{\infty} \frac{(-1)^k(2k+1)}{4^k k!}\, x^{2k}$.

For the record, the problems at the link "Review Problems for Math 126" on the course website are more elementary. These problems are given in the order of the sections in the textbook, which (for better or worse) gives you a clue about how to start the problem. Answers are given underneath each problem (don't read them until you have tried the problem) but they have not all been checked for accuracy so some errors may still exist in the file; let me know if you find such errors.