CALCULUS I
Math 1010
http://www.rpi.edu/~mclauh/classes/calculusI/

SYLLABUS
Fall, 2003

RESOURCES

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Text


- The Terms of Calculus, by Harry McLaughlin, available in the RPI bookstore, 2003, and

- Calculus I Exam Reference Problems, available at

GOALS

Develop:

- symbol manipulation skills,

- mathematical modeling skills,

- skills at the math-machine interface,

- a thorough understanding of the structure of the language, calculus,

- an appreciation for the calculus benefits to humankind.

Symbol Manipulation Skills

For most participants this requires repeated pencil-and-paper practice on a regular basis. It also requires repeated practice with the Maple software. Almost no formal classroom time is provided for developing paper-and-pencil skills, but guidance and opportunities for self evaluation are available. A limited amount of formal classroom time is provided for Maple-skill building, but, necessarily, most of it will be done through many hours of independent work. (Becoming skillful with Maple is time intensive.)

Evaluation.
Each of the four scheduled “hour-exams” will contain a section dealing exclusively with pencil-and-paper symbol manipulation skills. In addition, there
are scheduled 10 short quizzes focused on these skills. And, Rensselaer’s Department of Mathematical Sciences offers gateway exams that deal with pencil-and-paper symbol manipulation skills. (The gateway exams are discussed below.)

Mathematical Modeling Skills

Participants are asked to investigate phenomena, described in the spoken language, and for each of them develop a mathematical model. Modeling problems from the Calculus I Exam Reference Problems and from the text offer a variety of experiences.

Evaluation.
Each of the “hour exams” provide opportunities for participants to demonstrate mathematical modeling skills.

Skills At The Math-Machine Interface

Three computer projects are scheduled. Each project has goals and take-aways defined. There participants work to build appropriate mathematical models after which they analyze the models, at the computer interface. Of particular importance are correctness assessment techniques. Work on the computer projects is frequently done in a collaborative mode with other participants and with the course instructors. All projects are brought to completion with formal write-ups, prepared individually (not in a collaborative mode). The write-ups reflect skills developed for working effectively at the math-machine interface as well as skills in technical writing. Some formal laboratory time is provided but most of the learning is done off-line with the aid of written documentation, peer collaboration and trial and error.

Evaluation.
Participants’ skill levels are assessed through submitted write-ups, interviews and demonstrations.

A Thorough Understanding of the Structure of the Language, Calculus

Understanding of the structure of the language, calculus will be aided by formal lectures, given from time to time, from informal conversations, and
from classroom discussions. Participants will be challenged to answer ques-
tions such as “Why has history filtered out the definition of derivative, as
studied in this course?” “In the definition of the definite integral, why is the
\( x - axis \) partitioned and not the \( y - axis \)?” “In what sense does the symbol
\( \infty \) represent a number?”

Evaluation.
Participants’ understandings will be assessed through written examinations
and quizzes.

*An Appreciation for the Calculus Benefits to Humankind*
Participants reflect on the questions related to the title. They report on their
insights through classroom discussions.

Evaluation.
There is no formal assessment procedure for this goal.

*Course Takeaways.*
The principle takeaway will be newly developed skills in careful and critical
thought.

The five goals listed above identify additional takeaways.

**THE LEARNING ENVIRONMENT**

**Philosophy**
The instructors subscribe to the belief that

assessment drives performance.

Participants are frequently reminded of criteria used to assess their work. It
is realized that there exist many learning styles that are equally effective.
In that regard, techniques for assessing an individual’s performance are de-
signed to “see” areas of strength.

Participants are urged to

come to practice everyday.
All participants are welcome to three “lectures” and two recitations/computer labs each week. To the extent possible classroom time will be structured for hands-on activity in lieu of (boring) lectures. Participants are not required to come to any of the scheduled classes; it is the responsibility of the participants to develop their own learning styles and respond to the methods of evaluation discussed in the section, below, called Assignment of Grades.

Assignment of Grades
The procedure for assigning grades is described below. It has three features: (1) For participants whose performance starts slowly but accelerates dramatically as the term progresses there is little penalty. (2) For participants who have one or two “bad” days writing quizzes, there is little penalty. (3) For participants who have well developed strengths in one area, e.g. math modeling, and yet-to-be-developed strengths in another area, e.g. work at the math-machine interface, the system “sees” the developed strengths and partially discounts the yet-to-be-developed strengths.

There are two methods for the assignment of grades to participants’ efforts. In each of the methods a number between 0 and 100 is assigned to the work of the semester. A course letter grade is assigned according to the scheme:

- A 100 − 90 plus one perfectly written gateway exam
- B 89 − 80 plus one gateway exam written at the 80% level or above
- C 79 − 70 plus one gateway exam written at the 60% level or above
- D 69 − 60
- F 59 − 0.

The grade entered on the transcript is the maximum of the grades computed using the two methods.

The two methods are, in part, governed by performance on the gateway exam. Participants are given opportunities to write the gateway exam (multiple times), electronically, between the hours of 5:00 P.M. and 9:00 P.M. on Monday-Thursday, during most weeks of the term. (Opening day is September 11, 2000.) Each version of the exam consists of 10 questions. In order to earn an A grade for the course a participant needs to write at least one version without error and earn an A grade by one of the methods described.
below. In order to earn at least a B grade for the course a participant needs to write at least one version at the 80% level or above, and earn a B grade by one of the methods described below. In order to earn a C grade for the course a participant needs to write at least one version at the 60% level or above, and earn at least a C grade by one of the methods described below. (Note that, for example, writing the gateway exam perfectly, or at the 80% level, does not guarantee a course grade of A or B.) In order to earn a D grade for the course a participant need not write any of the versions of the gateway exam.

Method I.
Using this method the grade is determined by two components: (1) a grade on the final exam and (2) an assessment of skill level at the math-machine interface: determined by an average score earned on the three scheduled Maple projects (which may be completed at any time prior to the scheduled due dates). The relative weighing of these two components is 80% and 20% respectively.

Example. A participant earns 78 points on the final exam and an average of 90 points on the three Maple projects. In addition the participant scores at the 80% level on the gateway exam. The transcript grade is computed as \((.80)(78)+(.20)(90)=80.4\). If this is the maximum of the grade computed using Method I and Method II, the grade entered on the transcript is B. (Note: if the participant had a maximum score of 70% on the gateway exam, the grade entered on the transcript would have been C.)

Method II.
Using this method the grade is determined by two components (one of which has two subcomponents): (1) the final exam score and (2) an average score of the two subcomponents (i) “hour” exams and (ii) computer projects. The relative weighing of the two components is 10% and 90% respectively.

Example. A participant earns 70 points on the final exam and a total of 82 points for the two subcomponents. In addition the participant scores at the 80% level on the gateway exam. The transcript grade is computed as \((.10)(70)+(.90)(82)=80.8\). If this is
the maximum of the grade computed using Method I and Method II, the grade entered on the transcript is B.

The computation of the two subcomponent scores used to determine the course grade is done as follows.

1. The maximum score that can be earned on each of the four hour exams is 100 points. To the sum of the scores earned on the four hour exams is added the total number of points earned on quizzes during the term.\(^1\) The final total is divided by 400 to determine the “hour” exam component of the course grade. The “hour” exam component of the course grade cannot exceed 100.

2. The maximum score that can be earned on each of the three computer projects is 100 points. The sum of the scores earned on the three computer projects is divided by 300 to determine the computer projects component of the course grade.

Finally the two components above are weighed 80% and 20% respectively.

Example. A participant earns scores of 65, 78, 85 and 90 on the hour exams number #1-4. In addition, the participant earns a total of 23 quiz points during the term. The hour exam component of the course grade is computed by

\[
\frac{65 + 78 + 85 + 90 + 23}{4} = 85.25.
\]

The participant earns a total of 220 points on the three computer projects. The computer projects component of the course grade is computed by

\[
\frac{220}{3} = 73.3.
\]

\(^1\)There are 60 quiz points available. However, at, most 50 quiz points can be added to the sum of the “hour exam” scores. The extra 10 points are provided in case some participants need to miss a quiz due to ill health or other circumstances. Outside of extended participant absence excused by the Dean of Students’ Office, there will be no make-up quizzes provided. The quizzes scheduled toward the end of the term may, in general, have more available points than those scheduled at the beginning of the term.
The participant earns a total of 85 points on the final exam.

The course grade determined by Method II is:

\[ (.9) [( .8)(85.25) + (.20)(73.3)] + (.1)(85) = 83.1. \]

If the participant was able to write one gateway exam at the 80% level or above, the course grade determined by the above is B.

**Submission Dates**

Included in this document are scheduled submission dates for exams, quizzes and computer projects. These dates are firm and late submissions, without a convincing argument from the Dean of Students or a medical doctor, will be assessed as “stiff” penalty. In particular, failure to have a working laptop computer at the time of a quiz is not reason for a make-up quiz.

The submission of computer projects will be formalized by putting the submitted projects (in the form of hard copy) into a box at the beginning of class on the dates indicated and closing the box five minutes after the scheduled beginning of the class. Human nature, being what it is, there is a tendency to put off to the last minute the task of completing computer projects. History has shown that these “last minutes” are the most likely time for computers and printers to fail or to be stolen. They are also times for physically exhausted participants to fall asleep and not hear an alarm clock. So, the course instructors urge all participants to finish their work several days early (and submit their work early).

**Appeals**

Grades may be appealed by conversation with the course instructors. All appeals are to occur within one week of the original assessment of work, or of the course grade. In the event of unreconcilable viewpoints, participants are encouraged to contact the Chairman of the Department of Mathematical Sciences.
ACADEMIC INTEGRITY

Collaboration
Participants are encouraged to work jointly on all phases of the learning process. However, it is expected that the final exam, tests and quizzes, will be written individually. Participants will benefit from collaboration on the projects but it is expected that write-ups be prepared individually. In particular, sharing of computer files either electronically or in hard copy is a dishonest act on the part of all individuals concerned. In this regard, from time to time, there will be personal interviews by the course instructors with the participants, for the purpose of assessing participant understanding of what has been submitted. (Submitting a document without complete understanding of what is asserted may be regarded as academic dishonesty.)

Provost Request
At the request of the Provost, memorandum to faculty, dated July 27, 2003, the following paragraph is included in this syllabus.

\[\text{Student-teacher relationships are built on trust. For example, students must trust that teachers have made appropriate decisions about the structure and content of the courses they teach, and teachers must trust that the assignments that students turn in are their own. Acts, which violate this trust, undermine the educational process. The Rensselaer Handbook of Student Rights and Responsibilities defines various forms of Academic Dishonesty and you should make yourself familiar with these. In this class, all assignments that are turned in for a grade must represent the student’s own work. In cases where help was received, or teamwork was allowed, a notation on the assignment should indicate your collaboration. Submission of any assignment that is in violation of this policy will result in a failing grade for the course.}\]

\[\text{2The specific penalty is set by the course instructor.}\]
SCHEDULE

Hour Exam dates.

<table>
<thead>
<tr>
<th>Exam #</th>
<th>Date &amp; Time</th>
<th>ref.</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>September 17, 2003 (Wednesday)</td>
<td></td>
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<tr>
<td>#2</td>
<td>October 14, 2003 (Tuesday)</td>
<td></td>
</tr>
<tr>
<td>#3</td>
<td>November 6, 2003 (Thursday)</td>
<td></td>
</tr>
<tr>
<td>#4</td>
<td>December 4, 2003 (Thursday)</td>
<td></td>
</tr>
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</table>

Computer Projects due dates.

<table>
<thead>
<tr>
<th>Project #</th>
<th>Date &amp; Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>September 24, 2003 (Wednesday)</td>
</tr>
<tr>
<td>#2</td>
<td>October 22, 2003 (Wednesday)</td>
</tr>
<tr>
<td>#3</td>
<td>November 17, 2003 (Monday)</td>
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Quiz dates.

<table>
<thead>
<tr>
<th>Quiz #</th>
<th>Date &amp; Time</th>
<th>ref.</th>
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</thead>
<tbody>
<tr>
<td>#1</td>
<td>Sept. 2, 2003 (Tuesday)</td>
<td></td>
</tr>
<tr>
<td>#2</td>
<td>Sept. 9, 2003 (Tuesday)</td>
<td></td>
</tr>
<tr>
<td>#3</td>
<td>Sept. 23, 2003 (Tuesday)</td>
<td></td>
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<tr>
<td>#4</td>
<td>Sept. 30, 2003 (Tuesday)</td>
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<td>#5</td>
<td>Oct. 7, 2003 (Tuesday)</td>
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<td>#6</td>
<td>Oct. 21, 2003 (Tuesday)</td>
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<td>#7</td>
<td>Oct. 28, 2003 (Tuesday)</td>
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<tr>
<td>#8</td>
<td>Nov. 4, 2003 (Tuesday)</td>
<td></td>
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<tr>
<td>#9</td>
<td>Nov. 11, 2003 (Tuesday)</td>
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</tr>
<tr>
<td>#10</td>
<td>Dec. 2, 2003 (Tuesday)</td>
<td></td>
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</tbody>
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Note: Classes are held on Tuesday, 10/14/03, according to Monday’s schedule.