Math 171
Course Description and Suggested Weekly Schedule

Math 171 is the first of a three semester beginning calculus sequence, which is taken, for the most part, by math, chemistry, and physics majors. The department expects that students passing Math 171 be able to handle routine computations, i.e., limits, derivatives, max-min problems, and calculation of definite integrals using the fundamental theorem of calculus. We expect students to be able to state (write) and apply basic definitions and major theorems. These include, but are not limited to, definitions of limit, continuous function, derivative, definite and indefinite integrals, the intermediate value theorem for continuous functions, the mean value theorem, and the fundamental theorem of calculus. Students are also expected to be able supply simple proofs, e.g., some of the limit theorems, some of the rules of differentiation, and applications of the intermediate and mean value theorems. The list is of course endless, but keep in mind the phrase 'simple proofs'.

Students should become familiar with the standard notations of logic, set theory, and functions.

Students should be required to demonstrate that they have learned the appropriate definitions and theorems. Keep these facts in mind when assigning homework, constructing quizzes or writing exams.

The priorities of this course are:

1. Ability to correctly solve problems, and write the solutions in a coherent fashion.
2. Conceptual understanding of material.
3. Ability to state and apply definitions and theorems and provide simple proofs.

The syllabus for this course does not leave much time for anything else. Instructors will have to take pains to stay on schedule. In order to ensure that conceptual ideas are covered and thoroughly discussed, the amount of time spent on Maple has to be carefully controlled. There are at least 13 class periods spent in a computer lab. It is suggested that at most 4 of these days be used for Maple. This is not to say that Maple should not be used in the lecture. If the instructor feels that a Maple demo has pedagogical value, then he/she should feel free to present the demo. Students should learn how to do a particular computation with pencil and paper before being shown how to solve these problems with technology. It is expected that students learn enough Maple in order to be able to

- Plot functions,
- Solve algebraic equations,
- Compute limits,
- Compute derivatives.

Plotting functions and solving equations can be done the first week or two of class, limits sometime after the material in chapter 2 has been covered, and derivatives after chapter 4. The topic of integration in Maple should be left to 172.

The instructor needs to keep in mind that the department offers a sister sequence, which is taken by engineering majors. It is very common for students to start in one of these sequences and finish in the other. Because of this, it is imperative that ALL of the topics in the syllabus be covered.

Weekly Syllabus for Math 171

Week 1: Introduction to two-dimensional vectors, dot products. Sections 1.1, 1.2. Instructors may want to introduce the definitions of dot product in $\mathcal{R}^n$ for $n > 2$, but this is not necessary, nor should much time be spent on vectors in dimensions higher than two. One nice application of these ideas is proofs of geometric facts (these are not in the text so handouts should be prepared) via vector techniques. Be sure to cover the subject of work in section 1.2

Week 2: Sections 1.3, 2.1, 2.2, and 2.4. Sections 1.3 and 2.2 should be covered together. The main purpose of 1.3 is the discussion of parametric curves. Section 2.1 should be done quickly as it is there just to explain why the ideas of limits are needed. Note that section 2.3 is not covered before section 2.4.

Week 3: Sections 2.3, 2.6, 2.5. When proving limit theorems use epsilons and deltas. We suggest doing 2.6 before 2.5. It is a good idea to ask students to prove simple limit statements. For example, prove from the definition of a limit that

$$\lim_{x \to 4}(2x - 6) = 2$$

This is relatively simple, and at the level we want our students to be able to handle.

Week 4: Sections 2.7, 3.1, 3.2. Sections 2.7 and 3.1 contain intuitive descriptions of the derivative. Be sure to discuss velocity and speed of a particle in $\mathcal{R}^2$. Most of the differentiation formulas should be proved. Note that the text has these proofs in an appendix. Section 3.3 should be assigned as reading material for the student. If you can, cover some of the simple anti differentiation formulas. This is a request from the physics' department.

Week 5: Sections 3.4, and 3.5. Somewhere around here exam 1 should be given. This exam should cover through 3.3.

Week 6: Sections 3.6, 3.7, 3.8, and 3.9. Section 3.8, Higher Derivatives, is a 10 minute discussion.

Week 7: Sections 3.9, 3.10, and 3.11. Section 3.11 discusses linear and quadratic approximation. The material on quadratic approximation does not have to be covered. Section 3.12, Newton's method, can be covered if the instructor wishes to do so, but it is not a required part of the syllabus.

Week 8: Sections 4.1, 4.2, 4.3, and 4.4.

Week 9: Sections 4.6 and 4.8. In section 4.6, Inverse Trig Functions, there is no need to talk about the inverse functions of secant, co-secant, and co-tangent.

Week 10: Sections 5.2, 5.3, and have the class read 5.1. Problems from section 5.5 in which the function has a bounded domain can be included in section 5.2. Exam 2 should be given about now, and should cover through Chapter 4.

Week 11: Sections 5.5 and 5.7. The material in section 5.4 should not be covered, and 5.6 may be given as a reading assignment if the instructor wishes.

Week 12: Sections 6.1, 6.2, and 6.3. A few of the summation formulas should be proven. Preferably with an induction argument. Don't feel you have to spend a lot of time on induction, but students should see this type of reasoning, and this is a good place for it.

Week 13: Sections 6.4 and 6.5. In the Fall semester, Thanksgiving break falls in this week.

Week 14: Exam 3 and review.