Calculus I
MATH 251—CRN CRN
Fall 2012

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Course webpage: `http://uoregon.edu/~csinclai/`

Class Meetings: **room:** CLASSROOM
lecture: TIME

Text: ***Single Variable Calculus: Concepts and Contexts***, 4th edition. By James Stewart, Brooks/Cole

Calculators: Calculators can be helpful for homework and actually may be needed for some of the problems, however, to even the field for everybody, *they are not allowed during exams.*

Prerequisite: MATH 112 or satisfactory placement test score

Work Load: This course will require *between eight and twelve hours of work per week* outside class and recitation attendance, depending on your preparation.

Homework: Homework is assigned weekly ...

Tests:

▷ Midterm dates will be announced at least a week before.
▷ The final exam will be given on the date and time assigned by the registrar (http://registrar.uoregon.edu/calendars/final_exam). Final exam week is part of the regular quarter, and you are expected to be present. If you cannot attend the final exam due to a conflicting obligation, do not take the course.
▷ The final exam will be held jointly and concurrently with all other sections of Math 251. (Instructors: questions regarding this policy should be directed to the faculty coordinator for Math 251).
▷ Bring your UO student-ID to all your exams.
▷ The use of cellular phones, or any type of headset during tests is strictly forbidden.

Documented Disabilities: Students who have a documented disability and anticipate needing accommodations in this course should make arrangements to see the instructor as soon as possible. They should also bring a letter to the instructor from the Counselor for Students with Disabilities verifying the disability.

Academic Misconduct: You are expected at all times to do your own work. Copying content from other students and submitting it as your own work is grounds for failing the class. The University Student Conduct Code (available at http://conduct.uoregon.edu) defines academic misconduct. Students are prohibited from committing or attempting to commit any act that constitutes academic misconduct. By way of example, students should not give or receive (or attempt to give or receive) unauthorized help on assignments or examinations without prior permission from the instructor.

Learning Objectives: The successful student will be able to apply the basic precepts of differentiation and derivatives in order to investigate the quantitative and qualitative behavior of mathematical functions. This will include finding local and global extrema, sketching graphs (interpreting derivatives as rates of change and calculating limits to resolve questions about behavior at infinity and points of discontinuity).
A significant proportion of the graded effort for the course will encompass the ability to use mathematical methods, in particular differentiation, to model phenomena that arise in the natural and social sciences (this means lots of word problems). This includes optimization, related rates of change, linear approximation and applications of exponential growth and decay.

More specifically, by the end of the quarter the successful student will be able to differentiate combinations of common mathematical functions, produce linear approximation for these functions, and apply these mathematical tools to solve problems of the type which may arise in real world situations.

Community Standards: The University of Oregon community is dedicated to the advancement of knowledge and the development of integrity. In order to thrive and excel, this community must preserve the freedom of thought and expression of all its members. The University of Oregon has a long and illustrious history in the area of academic freedom and freedom of speech. A culture of respect that honors the rights, safety, dignity and worth of every individual is essential to preserve such freedom. We affirm our respect for the rights and well-being of all members.

Syllabus:
Included are typical problems that I would expect the students to be able to do. This list is not meant to be exhaustive! This is not meant to necessarily be used as a list of problems to be assigned for homework, especially since many instructors will use webwork homework assignments. Nor is it necessarily meant to be a list of problems to be done in class. Merely the problems should (perhaps) be used to guide what topics you emphasize during lecture.
The schedule below is for one midterm in week 6. More typical is two midterms in weeks 4 or 8. This gives students earlier feedback if they are doing poorly in the course, but it also means two midterms for them to take and two midterms for you to grade. Either scenario is reasonable.

Week 1: Chapter 1 should be read by the students, and it would not be a bad idea to assign homework on the first day covering basic mathematical concepts, even though (most) of Chapter 1 will not be covered in class. On the first day I would cover some portion of §1.2 Mathematical Models: A Catalog of Essential Functions. In particular, I would emphasize the material outlined by Figure 1. You might also cover Example 3, and some subset of Problems 1, 8, 13 and relevant background material. §2.1 The Tangent and Velocity Problems. §2.2 The Limit of a Function.
Problems: 1.1: 1, 14, 41, 59. 1.2: 12, 13, 19, 20. 1.3: 26, 29, 33, 51, 54. 1.5: 1, 2, 19, 23, 24, 29. 1.6: 9, 14, 18, 23, 35, 38, 49, 60. 2.1: 5, 9. 2.2: 3, 8, 12, 30.

Week 2: §2.3 Calculating Limits Using the Limit Laws. §2.4 Continuity. §2.5 Limits Involving Infinity.
Problems: 2.3: 6, 8, 17, 18, 28, 37, 42. 2.4: 10, 11, 34, 35, 37, 55. 2.5: 9, 11, 17, 23, 28, 51, 55, 56.

Week 3: §2.6 Derivatives and Rates of Change. §2.7 The Derivative as a Function. §2.8 What does f' say about f?
Problems: 2.6: 3, 8, 11, 12, 16, 21, 35, 37, 41, 45, 47, 50. 2.7: 3, 12, 13, 20, 25, 41, 53. 2.8: 4, 9, 12, 14, 22, 28, 31.

Week 4: §3.1 Derivatives of Polynomials and Exponential Functions. §3.2 The Product and Quotient Rules. §3.3 Derivatives of Trigonometric Functions.
Problems: 3.1: 2, 15, 20, 22, 28, 29, 42, 45, 60, 65. 3.2: 1, 2, 9, 15, 22, 25, 40, 41, 42, 49, 50, 60. 3.3: 1, 2, 13, 29, 35, 37.

Week 5: §3.4 The Chain Rule. §3.5 Implicit Differentiation. §3.7 Derivatives of Logarithmic Functions. (Here I would actually teach differentiation of inverse functions using the chain rule. More specifically, since

$$f(f^{-1}(x)) = x, \qquad f'(f^{-1}(x)) \cdot \frac{d}{dx} f^{-1}(x) = 1$$

means we can solve for $\frac{d}{dx} f^{-1}(x)$). Several applications of this can be given including derivatives of logs and inverse trignometric functions (§3.6).
Problems: 3.4: 1, 2, 4, 7, 34, 37, 52, 70, 71, 74, 94. 3.5: 15, 16, 47. 3.6: 10, 11, 23, 28. 3.7: 2, 10, 14, 29, 39, 40.

Week 6: Midterm. §3.8 Rates of Change in the Natural and Social Sciences. §3.9 Linear Approximation and Differentials. (I would deemphasize differentials and concentrate on linear approximations).
Problems: 3.8: 9, 11, 13, 15, 18, 20, 21, 24, 27, 29, 33. 3.9: 2, 15, 18, 22, 33, 34, 36.

Week 7: §4.1 Related Rates. (Spend two days, do lots of examples). §4.2 Maximum and Minimum Values.
Problems: 4.1: 2, 5, 6, 10, 11, 12, 13, 14, 18, 21, 23, 24, 25, 28, 29, 33, 34, 35, 40, 44. 4.2: 5, 8, 11, 23, 29, 28, 36, 41,43, 47, 51.

Week 8: §4.2 Maximum and Minimum Values (cont). §4.3 Derivatives and the Shapes of Curves. (Again, lots of examples).
Problems: 4.2: 61, 62, 63, 65. 4.3: 1, 7, 8, 13, 17, 20, 41, 49, 53, 54, 55, 56, 58, 63.

Week 9: §4.5 Indeterminate Forms and l'Hospitals's Rule. §4.6 Optimization Problems. (Lots of examples).
Problems: 4.5: 1, 2, 4, 6, 12, 16, 61, 64, 65, 66, 67, 75. 4.6: 2, 5, 8, 9, 10, 15, 19, 25, 27, 32, 33, 35, 43, 50, 51, 54, 56, 60.

Week 10: §4.7 Newton's Method. §4.8 Antiderivatives. Review of the quarter.
Problems: 4.7: 1, 4, 8, 23, 25, 33, 34. 4.8: 3, 9, 12, 25, 35, 41, 43, 56, 58.

Notice that the suggested syllabus covers fewer sections per week after the midterm. This is to allow for significant emphasis on mathematical modeling and applications of concepts of differentation to problems arising in various domains, and using this information to determine various features of mathematical functions.