Mathematics 110B
Fall, 2004

Textbook: Larson, Hostetler and Edwards, Calculus of a Single Variable: Early Transcendental Functions, D.C. Heath and Company, 3rd edition

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Course Content: A two-semester course, Mathematics 110A, B provides students with an integrative approach to calculus that includes the necessary precalculus topics. Course content includes limits; continuity; the derivative; differentiation of algebraic, trigonometric, and the natural logarithmic and exponential functions; applications of derivatives; anti-derivatives; the definite integral; integration by substitution; and applications of the definite integral. Algebraic and transcendental functions are included. Math 110A does not count for a GER mathematics course. Math 110B does count for a GER mathematics course.

Content for Math 110A

Review of algebra, functions, trigonometric functions, logarithms and exponents. Calculus topics include limits, continuity, definition of derivative, differentiation, extrema, Intermediate Value Theorem, Mean Value Theorem, graphing polynomial and rational functions, optimization problems.

Content for Math 110B

Review of inverse trigonometric functions, differentiation, and graphing. New topics include implicit differentiation, logarithmic differentiation, related rates, graphing vertical tangents, sums and sigma notation, induction, antiderivatives, Fundamental Theorem of Calculus, definite integral, area, volume, separable differential equations, substitution method of integration.

Goals: By the completion of the sequence Math110A and 110B, the student should have a basic conceptual understanding of the following: (1) limits and their relationship to the graph of a function, (2) the derivative and its relationship to the graph of a function and to the concept of "rate of change," and (3) the definite integral and its relationship to area and volume. The student should be able to calculate derivatives and to evaluate limits and integrals (both definite and indefinite). The sequential course for Math 110B is Math 112, Calculus II.

Class Attendance: The student is responsible for the course material discussed in class, therefore the student is expected to attend all classes. An inordinate number of absences will be handled in accordance with the College's policies. In addition, after two absences (excused or unexcused), any unexcused absence will result in a deduction of 5 points from your grade total. Entering class late by ten or more minutes is considered an absence.

Homework: Homework assignments are for the student's benefit and will not be collected. It is important; however, that the student thoughtfully complete most of the problems assigned. The student will need to spend at least 10 good hours of study each week, not counting time spent taking quizzes, reviewing for tests, and preparing the graphing portfolio.

Calculators: Calculators will **not** be allowed on tests or quizzes.

Gateway Exam: In order to pass this course, the student must pass an examination on differentiation. All 100 points will be given for a perfect paper. If the student has only ONE mistake, the student may choose to get a score of 80 points and not retest. More than ONE mistake is **not** considered a passing

grade. The Gateway Tests are scheduled in the class calendar. Attached is an outline of the Gateway Exam.

Major Tests: Five major tests will be given. Students are expected to take tests at the scheduled times. Conflicts, problems and emergencies will be handled on an individual basis. For reasons deemed legitimate by your professor, arrangements may be made for a student to take a test prior to the testing time. Any student who needs special accommodations must provide documentation several days in advance of the needed accommodation so that appropriate arrangements may be made.

Graphing Portfolio: Students are to use software (GRAPHMATICA) to prepare a portfolio of computer-generated graphs. The portfolio is to contain at least 15 distinctly different displays of graphs. Each function is to be clearly identified by the formula. Use only algebraic, trigonometric (including inverse trigonometric), logarithmic and exponential functions or combinations of them. The student must have at least three graphical displays where the important features of the graphs are clearly labeled (maximum, minimum, inflection points, etc). The Curve Sketching Checklist (provided during the graphing section of this course) should be used to determine what graphing aspects should be labeled. These are the technical graphs. In addition to the required or technical graphs, the student should compose functions to produce pictures illustrating a theme or a story for a second set of graphs, the thematic graphs. Each portfolio should include a variety of functions (algebraic and transcendental). Evaluation of the portfolio will be based on the selection of graphs, the documentation associated with the graphs, the completeness of the technical graphs, the creativity of the thematic graphs, and the oral presentation of the portfolio. Accuracy, clarity, organization, and originality are important in your portfolio. Oral presentations will be given on the due date. Students should not wait until the week before the due date to do this project. Use your time wisely throughout the semester. Examples of previous portfolios can be reviewed in your professor's office during office hours.

Grading: The student's final course grade will be determined as follows:

Gateway Exam @ 100 pts	100 points
Major tests (5 @ 100 points)	500 points
Graphing Portfolio	150 points
Final Exam (Comprehensive)	250 points
	1000 points

In general, letter grades will be determined as follows:

A: 900 or more points
B: 800 – 899
C: 700 – 799
D: 600 – 699
F: fewer than 600 points

Grades of A-, B+, B-, C+, C-, D+ may be assigned for sums of points near the above cut-off scores in total points.

Scheduled Help Outside Class: The Supplementary Instructors (SI leaders) will schedule outside of class study sessions for students.

In addition, student tutors are available to help with homework problems. A schedule of tutoring hours will be provided early in the semester.

e-Reserves/WebSite: The student is responsible for obtaining the handouts on library e-Reserves. Handouts include information and exercises to supplement the textbook. In addition, there is a Graphing Tutorial at the following web site (also accessible through e-Reserve):
http://www.oxford.emory.edu/OXFORD/RESTRICTED/UNIVERSITY/Classes/Chen/Calculus/Index.htm

Learnlink: There is a class conference on Learnlink, **Math110B Fall2004**. Announcements from your SI leaders and from your instructors will be posted. Students may ask questions and make requests of a general nature on this conference. Individual concerns should be sent directly to your professor.

Written Style: Neatness is one way of showing courtesy toward your instructor and pride in your work. Thoughts in mathematics are expressed in sentences, such as "1 + 1 = 2". There is a subject "1 + 1", a verb "=", and a predicate "2". The student should strive to be neat and to use mathematical symbols appropriately.

THE HONOR CODE OF OXFORD COLLEGE APPLIES TO ALL WORK SUBMITTED FOR CREDIT IN THIS COURSE. BY YOUR SIGNATURE ON SUCH WORK YOU PLEDGE THAT WORK WAS DONE IN ACCORDANCE WITH THE RULES STIPULATED ON THE WORK OR IN THIS SYLLABUS.

Tentative Calendar of Topics and Homework Assignments (Subject to Adjustments)

Wednesday, August 25 — Introduction and Gateway Pre-Test

Friday, August 27 — Review Differentiation
(e-Reserve: Review Differentiation and Limits)
Textbook: p. 143 37-54 (odd); p. 156 9-36(odd), 55-92(odd)

Monday, August 30 — Implicit Differentiation
Textbook: p. 166 1-20(odd); 25-38; 41-46(odd); 49-50
(e-Reserve: Implicit Differentiation)

Wednesday, September 1 — Logarithmic Differentiation
Textbook: p. 167 55-64

Friday, September 3 — Inverse Trigonometric Functions
(e-Reserve: Notes on Transcendental Functions Section E)

Monday, September 6 Labor Day

Wednesday, September 8 — Limits and Derivatives of Transcendental Functions
Textbook: p. 173 13-38(odd)
(e-Reserve: More on Transcendental Functions)

Thursday, September 9 — **Gateway Test 1 at 8:30 a.m.**

Friday, September 10 — Review for Test 1
(e-Reserve: Review Differentiation #2)
(e-Reserve: Review for Test 1)

Monday, September 13 — Review for Test 1

Tuesday, September 14 — **Test 1 at 7:45 a.m.**

Wednesday, September 15 — Discuss Graphing Portfolios

Friday, September 17 — Review Graphing
(e-Reserve: Graphing Handout – Vertical Tangents)
(e-Reserve: Calculus Page – Graphing Tutorial)

Tuesday, September 21 — **Gateway Test 2 at 8:30 a.m.**

Monday, September 20 — Graphs with Vertical Tangents
Wednesday, September 22 (e-Reserve: Graphing Handout – Vertical Tangents)
Textbook: p. 270 51-64 (e-Reserve: Calculus Page – Graphing Tutorial – Vertical Tangent)

Friday, September 24 — Review Graphing

Monday, September 27 — Review for Test 2
(e-Reserve: Review for Test 2)

Tuesday, September 28 — **Test 2 at 7:45 a.m.**

Wednesday, September 29 — Sums and Sigma Notation
Textbook: p. 295 1-6, 7-14(odd), 15-20

Friday, October 1 — Mathematical Induction
(e-Reserve: Mathematical Induction)

Monday, October 4 — Antiderivatives, Definite Integrals
(e-Reserve: Introduction to Integration)

Thursday, October 7 — **Gateway Test 3 at 8:30 a.m.**

Wednesday, October 6 — Fundamental Theorem of Calculus,
Friday, October 8 — Area under the Curve
(e-Reserve: Area and Fundamental Theorem of Calculus)
Textbook: p. 283 15-44; p. 306 15-22, 23-44(odd), 45; p. 318 5-38(odd), 41-50(odd)

October 11 – 12 — **Mid Semester Break**

Wednesday, October 13 — Acceleration, Velocity, Speed
(e-Reserve: Acceleration, Velocity, Speed)
Textbook: p. 285 73-87(odd)

Friday, October 15 — Review for Test 3
(e-Reserve: Review for Test 3)

Monday, October 18 — Review for Test 3

Tuesday, October 19 — **Test 3 at 7:45 a.m.**

Wednesday, October 20 — Related Rates
Friday, October 22 (e-Reserve: Application: Related Rates)
Textbook: p. 180 15-36, 51

Tuesday, October 26 — **Gateway Test 4 at 8:30 a.m.**

Monday, October 25 Substitution Method
Wednesday, October 27 (e-Reserve: Further Exercises on Substitution)
(e-Reserve: Reference Sheet)
Textbook: p. 331 7-34(odd), 45-76(odd), 85-92, 93-110(odd); p. 348 1-32; p. 355 1-30(odd)

Friday, October 29 Mean Value Theorem for Integrals
First Order Separable Differential Equations
(e-Reserve: Mean Value Theorem for Integrals and First Order Separable Differential Equations)
Textbook: p. 318 51-62; p. 392 33-58(odd)

Monday, November 1 Review for Test 4
(e-Reserve: Review for Test 4)

Wednesday, November 3 Review for Test 4

Thursday, November 4 Test 4 at 7:45 a.m.

Friday, November 5 Area Between Curves
Monday, November 8 (e-Reserve: Area and Volume Examples)
Textbook: p. 418 7-12(odd), 15-30

Wednesday, November 10 Volume of Solid Revolutions
Friday, November 12 (e-Reserve: Area and Volume Examples)
Monday, November 15 (e-Reserve: Calculus Page – Graphing Tutorial – Volume Section)
Textbook: p. 429 11-32; p. 437 5-21

Wednesday, November 17 Review Area and Volume

Friday, November 19 Review for Test 5
(e-Reserve: Review for Test 5)
Monday, November 22 Review for Test 5

Tuesday, November 23 Test 5 at 7:45 a.m.

November 24 – 26 Thanksgiving Break

Monday, November 29 Review for Final
(e-Reserve: Review for Final)

Wednesday, December 1 **Graphing Portfolios Due – Oral Presentations**
Friday, December 3

Thursday, December 2 Gateway Test 5 – Last Chance!

Monday, December 6 Review for Final
(e-Reserve: Review for Final)

The Final Exam will be given according to the exam schedule.

Outline of the Gateway Test

The test will consist of finding the derivative of the following kinds of functions:

- a linear combination of simple functions (e.g. $3x^7 - 4x + \frac{2}{x^3} - \frac{\sqrt{x}}{3} + \sqrt{2}$, etc.)
- a simple product (e.g. $x \sec x$, $e^x \cos x$, etc.)
- a simple quotient (e.g. $\frac{\sin x}{x}$, $\frac{\tan x}{x^2 + 1}$, etc.)
- a simple composition (e.g. e^{x^2}, $\sin\sqrt{x}$, $\cot 2x^3$, etc.)
- a rational function (e.g. $\frac{x^2 - 4}{x^2 + 4}$, $\frac{x}{(3x - 1)^3}$, etc.)
- an algebraic function (e.g. $x(2 - x)^{1/3}$, $(4 - x^2)^{2/3}$, $x/\sqrt{x^2 + 1}$, etc.)
- a multiple composition (e.g. $\cos\left(\sin^2\left(x^2\right)\right)$, $\sqrt{\csc e^{2x}}$, etc.)
- a combination of product, quotient, and/or composition (e.g. $e^{x^2}\sin\sqrt{x}$, $\frac{x\tan x}{1 + x^2}$, $\frac{1 + \sin^2 2x}{1 + \cos^2 2x}$, $\sqrt{\frac{1 + \sqrt{x}}{1 - \sqrt{x}}}$, etc.)

One problem will ask you to find the first and the second derivatives of either a rational or an algebraic function.

- One or two of the functions will contain literal constants (e.g. $\frac{x}{x^2 + a^2}$, $\sin kx$, $e^{x^2 - c^2}$, etc.).

Most or all of the basic functions will appear in the test.

Some derivative will have to be simplified, but not most. The simplified form is not to contain negative exponents.

Calculus Survival Guide

1. **How much to study:** Calculus is a hard subject. It is likely that it will be your most challenging course this semester. You should be spending **10** to **15** hours a week studying calculus. If you need to make adjustments in your academic or work schedules, do so now. If you cannot make this level of time commitment this semester you will likely be better off taking calculus at another time.

2. **How to study:** Calculus texts are odd books. They are not meant to be read like a novel, or even like a history or biology text. Your calculus should be read in a series of passes. On the first pass through a section, which should be done **before** the lecturer covers it, the student should skim through it lightly, reading definitions and theorems, and trying to **work** through some of the examples. But, and this is the key, you won't fully understand much of what you've read until you start working on the exercises. In fact, you should spend most, perhaps **80%**, of your study time working problems. As you get stuck, you go back, rereading the section, studying the examples and derivations, on a "need-to-know" basis.

3. **Homework:** Work lots and lots of problems, not just the ones assigned as homework. If you are done with the current section, go back and work review problems. Furthermore, you are not done with a problem just because you got the right answer. You are only done when you understand **why** the methods you used had to have worked. If all you are doing is blindly applying formulas and mimicking examples, get extra help. The problems should make *sense* to you.

4. **Studying for tests:** If you were an athlete preparing for track meet, and you slacked off during the weeks before the meet, doing just what you needed so the coach wouldn't get on your case, and then stayed up running the whole night before you meet, you'd lose. Yet this is just how many students prepare for exams. The right way to study for a test, is to do your work at a steady pace throughout the semester. The point is, that while there are a few facts and formulas you'll need to remember for a test, the real way to do well is to think well. That is, you want your brain to be in top shape. You cannot achieve that by cramming. It is now known that as you learn the brain slowly rewires itself. As you study, you *gradually* get smarter. That is the whole point of college!

5. **Come to class:** Many college students treat class attendance as optional. This may be fine for some classes. However, for calculus you can get way behind very fast. You should come to class every period unless you are seriously ill.

Tips for doing well in your mathematics class

Attitude. First of all, a positive attitude is one of the most important elements needed to be successful in mathematics. You won't do well if you think you can't or if you don't give mathematics a chance. It doesn't matter at what level you begin, Math 100C or Math 112, if you don't have a positive attitude, you won't do well.

Study time. Make a plan to use your time wisely for all courses. In this plan have time to work at least a couple of math problems daily, even if only for 30 minutes. Keep your mind open to math on a regular basis. Don't try to do a marathon study. Work at a steady pace. Cramming doesn't work in mathematics classes!

While studying, take a break at least every two hours and do something physical like walk around the quad, run track, swim, jumping jacks, and jump rope. This activity gets the blood circulating and that includes blood to the brain cells.

Sleep. Get plenty of rest. Most college students don't because of poor organizational skills and because they procrastinate. When it is late at night and you are tired, the law of diminishing returns kicks in; i.e., you stuff information in but it falls out quicker than you stuff it in. If you've been studying and keeping up with your work, then restful sleep is the best preparation for a math test. We all do better with adequate rest.

Test Anxiety. Take deep breaths and focus on some stationary object (sort of like they teach in birthing classes). Think about what you know and review in your head what will be on the test. If you feel tense, walk around the quad or do some other mild exercise to take the edge off and help you relax.

Treat the test as a game. See how many points you can get. Think about the test as a performance to show how good you really are. Attitude is very important!

Careless mistakes. Sometimes careless mistakes are simply that, while other times there may be concept problems. To eliminate careless errors (and also show pride in your work), write clearly and carefully. This will slow you down and create neat papers so that both you and your instructor can see if there is a real problem or if, indeed, you were being careless. Careless errors occur when students rush. Paying attention to detail comes when you have slowed down. Neat handwriting tends to remove careless errors so that attention can be paid to true errors.

Resources. Use the office hours of your professor for specific questions, to work a problem, and/or to clarify concepts. Attend the SI sessions that are available. These sessions have proved to be beneficial. Tutors are available to help with problems. Study groups with fellow students, when done on a regular basis, will also help.

Use the class conferences, e-Reserves through the library; send e-mails to your professor to ask questions or make requests to review a particular problems or concepts you need.

Class time/note taking. You should attend all classes unless you are ill. Unlike high school, you will need to learn the material outside of class. There are not enough class meetings for you to absorb everything during the class time. Take good notes and review them carefully. Some students re-write notes from classes at the end of each day. That refreshes them and gives them an opportunity to review what was covered.

Homework. Each student should work an adequate number of problems for him or her to learn the concepts being covered. It is much more important to THINK about what you are doing on a few problems than to mechanically work a lot of problems that are incorrect and have to be fixed. How you use your time (mind in gear) is very important to retention of material. In mathematics, concepts build so that you can't simply study for the test and then forget. You'll fail that way. Your instructor usually gives guidelines as to what is most important to work, so pay attention.