Mathematics 180
Spring, 2007

Textbook: Priestley, W.M, *Calculus: A Liberal Art,* Springer-Verlag.

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HOURS: **MWF 9:00–11:00a, Th 2:00–5:00, or after class**
Drop-ins welcome. An appt. is encouraged.

Course Content: Mathematics 180 is a one-semester introduction to the concepts of single-variable calculus with particular attention to the principles of mathematical analysis that underlie fields of business. The main topics are the limits, differentiation, and integration of functions and the applications of these processes; they include the analysis of algebraic, natural logarithmic, and natural exponential functions. The applications include marginal analysis, utility, compound interest as well as the fundamental ones of velocity, acceleration, curve sketching, area, and volume. A calendar of topics is attached to this syllabus.

Course Goals: After this course, the student should be able to do the following: to find the limit, derivative, antiderivative, and definite integral of a function; to understand the basic theoretical underpinnings of these processes; to understand the relationships between these processes, rates of change and the graph of a function; and to apply these processes in solving problems on rates, extrema, area, volume, and approximation.

This course also seeks to develop the following capacities of the student: to reason logically; to use intuition and creativity in solving problems; to appreciate the cogency of a sound argument; to understand numbers, especially the continuous and infinite nature of the system of real numbers.

Classes: The student is responsible for work covered in class. In addition to the regular class meetings, there will be optional SI sessions and help sessions. There will also be three tests scheduled on Tuesday or Thursday mornings. (See below).

Homework: A homework is assigned almost every day of class at the end of class. These exercises will not be collected but are for the benefit of the student.

Case Studies: (200 points.) Eight case studies (worth 25 points each) will be assigned to groups. Part of the assignment will be a presentation to the class by one of the group members chosen more or less at random. Calculators may be used in these assignments. Every group member is responsible for each member of the group learning the material covered in the assignment. Problems will be handled according to the individual circumstances.

Quizzes: (100 points.) All quizzes are unannounced and in-class. The student must be present in class to take each quiz. Up to one quarter of the quizzes will be dropped. Each quiz will count the same amount, the average per cent being used to calculate the number of points. For example, a 94% quiz average at the end of the course will result in 94 points out of the 100. Normally an excused absence during which a student misses a quiz may not be made up; it will be dropped.

Gateway Exam: (100 points.) In order to pass this course the student must pass an examination on derivatives at a rate of 100%. The exam will first be offered at

8:00 a.m., Thursday, March 22

Each re-test will be different but very similar to the original test. The exam must be passed by the last day of classes. The student will be allowed at least three opportunities to pass it.

Tests: (300 points.) In general, calculators will not be allowed on tests. Three tests (100 pts. each) will be given on the following days:

8:00 a.m., Tuesday, February 13
8:00 a.m., Thursday, March 8
8:00 a.m., Thursday, April 12

Final Exam: (200 points.) A cumulative final exam will be given at the time scheduled by the Registrar.

Excuses: Excuses deemed legitimate by the instructor will be handled according to the individual circumstances and college policies.

The student is expected to take all tests and exams at the scheduled times. For legitimate excuses arrangements will be made to take a test **prior to** the testing time. There will be no make-up tests given after the testing time.

Written Style: Thoughts are expressed by sentences: just so in mathematics. Pay attention to your textbook: it is written in sentences. **Your written work must be in complete sentences.** Note "$1+1=2$" is a complete sentence (it has a subject "1+1", verb "=" and predicate "2"). Use mathematical symbols wherever appropriate. Your work also needs to be neat and orderly to be intelligible. See Appendix 4, "Clean Writing in Mathematics," in your textbook *Calculus: A Liberal Art* and the "Calculus Style Guide."

Grading: Evaluation will be based on the following written work:

Gateway Exam	100 points
Tests (3 @ 100 pts)	300 points
Case Studies (8 @ 25 pts)	200 points
Quizzes	100 points
Final	200 points
Total	900 points

The plus/minus system will be used with the following rough guide to letter grades:

A	810 points and up	D	540–629 points
B	720–809 points	F	below 540
C	630–719 points		

Tips for Success: Calculus is hard, but it can be made easier by intelligent and efficient study habits.

Gauss said the purpose of calculation is insight. Insight is an understanding into why things work the way they do. This should be the goal of working out problems. Know **why** each step is correct and **why** each step was the right step to take. This is more than knowing **that** each step is correct.

Although the homework exercises are not graded, it is important for the success of the student that they be completed as soon after covering the material as possible. Calculators may be used when appropriate, but the student should keep in mind that they are not permitted on the tests. While collaboration is encouraged, each student should be sure that he or she ultimately can **solve problems unaided by notes, the textbook, a calculator, or other people**.

Practice good style on homework. A clean style helps to clean up messy thinking.

In general the student will need to study at least six good hours per week exclusive of the time spent on case studies and review for tests.

Tests are performances, similar to those by athletes, musicians, and dancers. Prepare for them in similar ways. Begin practicing for them weeks in advance.

SI/Help Sessions/Tutoring: The SI program is a program of optional, organized study sessions. The sessions are not meant to be tutoring sessions. The supplemental instructor (SI) is a student who has taken the course (or a similar course) before, has a good understanding of the material (but probably not as complete as the instructor!), and knows how to be a successful student.

Help sessions will be scheduled as there is demand for them. Attendance is optional.

The schedule for tutoring in the Math Center will be announced when available.

Honor Code: The Honor Code of Oxford College applies to all work submitted for credit in this course. To receive credit for work submitted you must place your name on it. By placing your name on such work, you pledge that the work has been done in accordance with the given instructions and that you have witnessed no Honor Code violations in the conduct of the assignment.

You may always ask the instructor any question about an assignment. He will answer at his discretion.

Proposed Calendar

Date	Topic	Section
Wed 17 Jan	Inequalities	(Handout)
Fri 19 Jan	Two Calculus Problems; Functions I	Ch. 1, §§1–5
Mon 22 Jan	Functions II Extension/restriction. Composition. Algebraic analysis: resolution in powers of $x-a$.	(Handout)
Wed 24 Jan	Optimization	Ch. 1, §6
Fri 26 Jan	Limits & Continuity	Ch. 1, §§7–9
Mon 29 Jan	Limits: Growth & Vanishing	(Handout)
Wed 31 Jan	Binomial Theorem and Compound Interest * Case Study 1	(Handout)
Fri 2 Feb	Functions III Piecewise functions. Composition. Limits.	(Handout)
Mon 5 Feb	Chapter 2	Ch. 2, §§1–5
Wed 7 Feb	Chapter 3	Ch. 3, §§1–5
Fri 9 Feb	Lines & Rates. * Case Study 2	Ch. 4, §1
Mon 12 Feb	Review	
Tue 13 Feb	**TEST 1 — 8:00 AM**	
Wed 14 Feb	Derivatives	Ch. 4, §§2–5
Fri 16 Feb	Functions IV Exponential and logarithmic functions.	(Handout)
Mon 19 Feb	Functions V Inverse functions. Limits and derivatives of exponential and logarithmic functions. Continuously compounded interest.	(Handout)
Wed 21 Feb	Estimation * Case Study 3	(Handout)
Fri 23 Feb	Monotonicity; L'Hopital's Rule	Ch. 4, §§6–8
Mon 26 Feb	Quadratic functions	Ch. 4, §§9, 11
Wed 28 Feb	Derivative rules I; Concavity * Case Study 4	Ch. 5, §§1–5
Fri 2 Mar	Derivative rules II; Optimization II	Ch. 5, §§6–9
Mon 5 Mar	Velocity & Acceleration; Chain Rule	Ch. 6, §§1–5
Wed 7 Mar	Review	

Thu 8 Mar	**TEST 2 — 8:00 AM**	
Fri 9 Mar	Rate equations: $y' = f(x)$ and $y' = f(y)$	(Handout)
Mon 12 Mar Wed 14 Mar Fri 16 Mar	*Spring Break*	
Mon 19 Mar	Marginal Rates	(Handout)
Wed 21 Mar	Graphing I	(Handout)
Thu 22 Mar	**GATEWAY TEST (First Try) — 8:00 AM**	
Fri 23 Mar	Graphing II	(Handout)
Mon 26 Mar	Implicit Differentiation; Related Rates * Case Study 5	Ch. 6, §6
Wed 28 Mar	Mean Value Theorem; Antiderivatives	Ch. 6, §7
Fri 30 Mar	Applications of Antiderivatives	Ch. 6, §§8–11
Mon 2 Apr	Multivariable Optimization	(Handout)
Wed 4 Apr	Areas and Antiderivatives I * Case Study 6	Ch. 7, §§1–3
Thu 5 Apr	**GATEWAY TEST (Second Try) — 8:00 AM**	
Fri 6 Apr	Areas and Antiderivatives II	Ch. 7, §§4–5
Mon 9 Apr	The Definite Integral	Ch. 7, §§6–7; App. 2
Wed 11 Apr	Review	
Thu 12 Apr	**TEST 3 — 8:00 AM**	
Fri 13 Apr	Fundamental Theorem of Calculus	Ch. 7, §8
Mon 16 Apr	Substitution in Definite Integrals	(Handout)
Wed 18 Apr	Volume * Case Study 7	Ch. 7, §§9–11
Fri 20 Apr	Improper Integrals	(Handout)
Mon 23 Apr	Integration by Parts	(Handout)
Wed 25 Apr	Integration Review * Case Study 8	
Fri 27 Apr	Review	
Mon 30 Apr	Review	