Calculus II
Sample Syllabus

Instructor: Sr. Barbara Reynolds, Ph.D., Cardinal Stritch University

[***Editor's note:*** This detailed syllabus is a sample only, not a model for every possible course that can be taught from this text. It includes many features of Sr. Barbara's own teaching philosophy and practice that are consistent with the spirit of the text but not a requirement from teaching a successful course. Please feel free to pick and choose (and modify) elements that you think will work for you. In particular, several items marked in **red** must be replaced with your local information.]

Course Description

(Substitute your own catalog description.) Calculus is a transition course from lower-division courses to upper-division mathematics and computer science courses. Students will extend their experience with functions as they study the fundamental concepts of calculus: limits, difference quotients and the derivative, Riemann sums and the definite integral, antiderivatives and indefinite integrals and the Fundamental Theorem of Calculus. Students review and extend their knowledge of trigonometry and basic analytic geometry. Important objectives of the calculus sequence are to develop and strengthen the students' problem-solving skills and to teach them to read, write, speak and think in the language of mathematics. In particular, students learn how to apply the tools of calculus to a variety of problem situations.

Texts and Required Materials

- *Calculus: Modeling & Application*, 2nd Edition, by David A. Smith and Lawrence C. Moore. (Note: we need to update this URL.) This text can accessed on-line at http://www.math.duke.edu/education/calculustext/index.html. I've adopted this text because the authors have a teaching philosophy that supports the department's goals of helping students to develop skills in problem solving, oral and written communication, and appropriate use of computing technology.
- *Getting Started with Maple,* 3rd Edition, by Douglas B. Meade, Michael May, S.J., C-K. Cheung, G.E. Keough; John Wiley & Sons, 2009. This book is recommended but not required. We will be doing a lot of work with Maple, and students in last year's class specifically requested that I find a resource to support the use of this software.
- We will be using Maple 13, a computer algebra system (CAS), in this course. Maple is available on the computers in BH 056 where this course meets as well as in the open-access computer labs on campus. This course has been registered with the Maple Adoption Program. If you wish, you can purchase a personal copy of Maple for your own computer at a discounted rate. For more information, see Maple Adoption Program details at http://www.webstore.maplesoft.com Promotion Code: XXXXXXX. [Note: Each instructor must register her/his course with the Maple Adoption Program.]
- A *memory stick* or *computer disk* to keep back-up copies of your computer lab assignments.
- A *three-ring binder* to keep and organize your notes for this class. There will be weekly assignments, class notes, computer printouts, and homework assignments. Many of the lab assignments and exercises build on previous work, so you will need to organize your work so that you can easily find it as the semester progresses. In past semesters, students who attempted to just keep everything in a folder found that their notes were hopelessly confused.
- Loose-leaf paper, which is hole-punched to fit into your ring binder.
  When you turn in an assignment, please do not give me pages which have been torn out of a spiral-bound notebook (unless you first trim the edges with scissors).

Course Content

Arithmetic and algebra make use of three basic computational tools and their inverses (addition and subtraction, multiplication and division, and exponentiation and taking roots). Calculus provides two fundamentally new computational strategies – *differentiation* and *integration*. The focus of Calculus I is differential calculus, and the focus of Calculus II is integral calculus. This semester, we will cover material in Chapters 6 through 10 of the text.

One goal this course is to engage students in thinking deeply about some problems which can be studied using strategies of calculus. The authors of our text have very deliberately chosen to include topics that allow us to investigate important and interesting problems. For this reason, the order of topics in this course is a bit different than the order of topics in other calculus courses; in particular, if you have taken calculus at another school, you may notice that we cover some topics in this first semester that are often covered in a second or third semester of calculus.

Calculus is essentially a year-long course; that is, Calculus II is a direct continuation of Calculus I. We continue this semester from where we left off last semester, building on and extending the work that was begun in Calculus I. Our goal this semester is to cover Chapters 6 through 10.

Chapter 6: Antidifferentiation

Anti-differentiation is the inverse of the process of taking a derivative; in other words, it is the process of un-doing the derivative. We have been doing this informally since Chapter 2, and in this chapter we will begin to calculate antiderivatives formally. We also expand our computational tool kit by introducing the method of partial fractions. In Chapter 2 we considered an exponential model for population growth, and in this chapter we will see that a logistic model is better for modeling constrained population growth.

Chapter 7: The Fundamental Theorem of Calculus

While taking the derivative has to do with calculating rates of change, taking the definite integral has to do with accumulating the total quantity over some interval. The Fundamental Theorem of Calculus (FTC) tells us that these two operations are related in a fundamental way. In this chapter the definite integral is introduced as an averaging process. We find the average temperature over a day and the average speed over an interval of time, and relate this to the area under the curve of the associated function. The authors of our text approach the FTC by exploring the linkage between speedometer and odometer, and then deriving the FTC by solving a differential equation – given the derivative, what's the function? – a question for which we already know one kind of answer. The partial sums of the left-hand rectangular approximations of area are the Euler approximations to the solution of the differential equation, thus establishing the connection between antidifferentiation and area. Given this connection, it makes sense to use the integral symbol as a notation for antidifferentiation.

Chapter 8: Integral Calculus and its Uses

This chapter focuses on using integration as a problem solving tool in a variety of disciplines. As we use the integral to solve problems, we will grow in our understanding of what the process of integration means conceptually. We begin by exploring some problems in physics – finding moments and centers of mass – to reinforce the idea of integration as averaging. Our authors develop several numerical methods (the trapezoidal and midpoint rules, and Simpson's Rule), so that no definite integral need remain unevaluated when one has access to computer tools. By the end of this chapter we will have learned the basic rules for integration by hand: algebraic and trigonometric substitutions, and integration by parts.

Chapter 9: Probability and Integration

How long can a light bulb be expected to last? This important application in marketing makes possible the offering of product warranties on manufactured goods. For example, integration is used to calculate the expected lifetime (i.e., the mean time to failure) for light bulbs. These same strategies can also be used to calculate one's expected winnings at games of chance. The simplest model is the exponential distribution, which leads naturally to improper integrals which are calculated using limits. The standard notation for limits is introduced in this chapter.

If time permits, we will investigate other probability distributions (e.g., the normal distribution) for which finding a mean or a standard deviation may involve proper or improper integrals that cannot be evaluated in closed form. This leads to defining some functions (for example, the error function) by their integral representations.

Chapter 10: Polynomial and Series Representations of Functions

By this point in the course you will have noticed that polynomials are easier to work with than some other kinds of functions; for instance, it is relatively easy to calculate derivatives and integrals of polynomials. The focus of this chapter is to find ways to approximate any given function with a polynomial representation. In particular we will learn to set up Taylor polynomials. These polynomials are important tools for problem solving in other disciplines, such as biology, chemistry, and economics.

We will find polynomial representations of exponential and trigonometric functions, and work up to a polynomial representation of the error function. The primary tools for testing convergence of these polynomial approximations to other functions are the alternating series test (AST) and the ratio test (RT).

Course Objectives

A primary objective of a course in calculus is to provide a bridge from high-school or lower-division mathematics courses to upper-division mathematics. The student will be challenged to grow in mathematical maturity, and to develop and strengthen problem-solving skills. Beyond the content of individual courses, the major in mathematics is designed to prepare students for the 21st century by helping them to become problem solvers, effective communicators, users of appropriate technology, and team players. In this course, students will be engaged in a variety of activities which will help them to move toward achieving these goals. By the end of this course, students should be able to

- Understand concepts rather than merely mimic techniques
- Demonstrate understanding by explaining in written or oral form the meanings and important applications of concepts
- Construct and analyze mathematical models of real-world phenomena, including both discrete and continuous models
- Distinguish between discrete and continuous models, and make judgments about the appropriateness of the choice for a given problem
- Understand the relationship between a process and the corresponding inverse process
- Select between formal and approximate methods for solution of a problem, and make judgments about the appropriateness of the choice
- Select the proper computational tool or tools for the task at hand

In a calculus course taught using traditional pedagogy, students learn to use calculus to formulate problems, to solve problems, and to communicate their solutions to others. In addition to these skills, students who successfully complete this course will learn to

- Use mathematics to structure their understanding of the world around them, and investigate interesting questions in this world
- Use technology as an integral part of the process of formulation and solution of problems, and the communication of their solutions to others
- Work together productively, and learn cooperatively

Prerequisites

To be successful in this course, a student should have successfully completed Mt 210 Calculus I (or an equivalent course at another institution). Concepts and skills in this course build directly on the material covered in Calculus I. We will continue to use algebra, trigonometry, and differentiation as problem-solving tools. Please see the instructor if you have questions about your preparation for this course.

Cooperative Learning Groups

Much of the work of this course will require students to work in cooperative learning groups. For mathematical problem solving, group sizes of about three students seem to work best. Students will be expected to work in groups in the lab on in-class activities, and are encouraged to work together on homework problems. While some students enjoy group work more than others, working well in a group is an important skill for life beyond the mathematics classroom. Our graduates tell us that skills developed while working in cooperative learning groups in our classes have been very helpful in the workplace.

Problem-solving is a social activity. One of the primary objectives of any mathematics course is to help students learn to think about problems mathematically and to solve problems independently. Working in small groups, doing the lab activities, and talking about problems with other students are all strategies to assist the student in achieving these objectives. Students will need to work regularly in the computer lab on homework assignments, and are strongly encouraged to meet with their group at least twice each week in addition to class time.

Calculators and Computers

Calculators and computers are tools for doing mathematics. In this course, the computer will be used primarily as a learning tool, giving the students the opportunity to investigate a concept by solving many more problems than is practical when all the calculations must be done by hand. Visualization is an important problem-solving tool. Computer graphing software has made visualization more accessible than it has been in the past. Students will be using a computer algebra system (Maple) to explore important concepts of calculus.

Throughout the semester, students will be expected to use *electronic communication tools* (such as email and a graphical web browser). Class assignments will be regularly posted on Educator. Students will be expected to get course assignments and materials from the web, and to communicate with the instructor and each other using email. The instructor will send a message via Educator whenever a new assignment has been posted. Homework hints may also be sent by email between class sessions. Students are expected to check their Stritch Educator email regularly, or to set parameters in this email account to forward messages to their preferred e-address.

In this course students will often be asked to experiment with an idea before it has been discussed formally in class. This teaching strategy provides students with multiple opportunities to think critically about problems, and to learn problem solving by solving problems. Research into how people learn has shown that students who learn mathematics using these methods have both deeper understanding and longer retention of what they have studied, and are better able to think about new problems than those taught using traditional methods. If this is your first course in which you are being challenged to work this way, it may take several weeks to adjust to these methods. The payoff in increased understanding is well worth the investment of time and energy it takes to adapt to this style of learning. Your instructor is committed to helping you to make this adjustment.

The overall objective is to learn mathematics and to develop effective problem-solving and critical-thinking strategies. Even though students are expected to use the computer regularly in their study, there are certain calculations which they will be expected to learn to do by hand. These will be clearly identified as we go through the course.

Ordinarily, in-class tests will focus on mathematical concepts; students may use a scientific calculator during in-class tests. On the benchmark portion of tests, which focus on more routine computations and conceptual understanding, students will not be allowed to use a calculator.

Requirements

Regular attendance, active class participation, and participation in class and lab activities: 5%

You are expected to come to class regularly, and to be on time. The material in this course has a well-deserved reputation for being difficult. If you miss a class, you are expected to find out what happened. The computer lab activities are designed to help you learn important mathematical concepts. You are expected to work with your group, and to seriously attempt the lab activities. *You will need to meet with your group outside of class, probably once or twice each week.* Sometimes you will be asked to turn in individual work; other times you will be asked to turn in your group's response to some questions.

At the end of each class period, I will ask you to fill out a Class Participation Form. I use these forms to check attendance, respond to your self evaluation and to any questions you write on this form, and give you a score for class participation. There may be occasional (unannounced) quizzes which you will be able to do in your small groups; it is not possible to make-up a quiz.

If you must miss a class for any reason (excused or unexcused absence), your participation score for that day will be recorded as 0. Missing more than two class periods without submitting written work to make up the absence will bring down your grade for this course. If you wish to make up an absence, you may turn in written evidence that you have done some work to make up missed lab/class activities. This make-up work must be turned in within two class periods of the missed class. In general, such make-up work will earn 7 points to replace the 0 for missing class.

Participation Score	**Meaning**
10 (A)	Student arrived on time, stayed to the end of class, and presented work at the board and/or gave a helpful explanation to the class about a problem.
9 (A-)	Student arrived on time, stayed to the end of class, worked well with her/his small group on class activities, and made appropriate contributions throughout the class session. Student asked and/or answered questions in small group and whole class discussion.
8 (B-)	Student arrived a few minutes late or left a few minutes early, yet still made a good contribution to the class discussion and group work.
7 (C)	Student was quiet and polite, but made minimal contribution to class discussion. Student was inattentive or distracted throughout the class session. Student turned in carefully written work which was mostly correct to make up a missed class; this make up work must be submitted within two class periods of the missed class. Student arrived more than five minutes late and/or left class more than five minutes early.
Less than 7 (D or F)	Student's contribution to the class was disruptive or in some ways less than expected from college students; an indication of why participation was less than acceptable will be indicated in written comments. Student turned in written work to make up a missed class, but this work was carelessly done and/or had many errors.
Subtract 5 points	Student's cell phone rang audibly during class: 5 points will be subtracted from class participation score.

Web Work problems, graded homework, quizzes: 5%

Some homework exercises will be assigned using Web Work, an on-line homework management system. It is important that you attempt these Web Work assignments, which will be Web Work assignments will be announced almost every week and ordinarily will be open for about two weeks. You may work together on these Web Work assignments, but each student will have her/his own problems. To get credit for doing the Web Work problems, you will have to submit your solutions into your own Web Work space. When you submit your solutions online, you will receive immediate feedback about whether your solutions are correct. During the two-week window, you may submit your solutions an unlimited number of times. Your score on these Web Work assignments will be based primarily on whether you have attempted these problems and submitted solutions into your own Web Work space.

Occasionally, other homework problems will be assigned, collected, and graded. As we are learning new strategies for calculating antiderivatives, I will give some quizzes. Graded homework and

quiz grades will be recorded. Attempting Web Work problems, graded homework and quizzes will contribute 5% to your overall course grade.

Tests: 30%
There will be three tests, each weighted 10%. A detailed study guide for each test will be posted about a week before the scheduled test date. Tests are tentatively scheduled for the following dates:

Test 1: [Week 5, Day 13]
Test 2: [Week 8, Day 21]
Test 3: [Week 10, Day 28]

Mathematics is a discipline in which new material naturally builds on previous material. All tests in this class are cumulative. You are expected to know and continue to use skills that you learned in the prerequisite courses (particularly Calculus I). You must understand and continue to use concepts from the early part of the course as we progress through later topics. Ordinarily, I do not give make-up tests; exceptions to this policy will be considered on a case-by-case basis.

Benchmark Tests: 15%
Benchmark testing is the department's way of assuring that students have achieved minimum levels of computational competency. It is generally expected that students who have successfully taken Calculus can do certain calculations by hand. Although we will be using computers and calculators throughout this course, you will be expected to become proficient with these hand calculations. Throughout the semester, these calculations will be indicated, and you will be expected to do whatever practice you need to do to master these calculations.

Instead of having separate Benchmark tests, this semester there will be a Benchmark part with each test. Thus your will receive two scores on each test, a Benchmark score and a Test score. You may not use a calculator until you have turned in your work on the Benchmark portion of the test. To pass the Benchmark portion of each test, you must score at least 88% (B+) on the Benchmark portion. If you do not score at least 88% on the Benchmark, your grade for that portion will be recorded as 0% until you have retaken and scored at least 88% on the Benchmark.

If you do not pass the Benchmark, you may retake it once or twice. If you pass the Benchmark on a re-take, the score of 0% that was originally recorded will be changed to the average of your scores on your two or three attempts. If you do not pass the Benchmark on three attempts, your score will be recorded as the average of 0% plus your scores on the three attempts. Each Benchmark grade will contribute 5% to your overall grade for the course.

Projects: 25%
There are many interesting problems which can be studied using the tools of calculus. You will have an opportunity to investigate some of these problems which you may find more challenging than typical textbook exercises. This semester you will be asked to work on two to four such projects in your groups, which will typically be extended assignments, requiring one or two weeks of work. This semester, I anticipate that these projects will come toward the ends of Chapters 6, 7, 8 and 10. The tentative schedule for these projects is as follows:

Project 1: Available about [Week 2, Day 5], due [Week 3, Day 8]
Project 2: Available about [Week 4, Day 9], due [Week 5, Day 12]
Project 3: Available about [Week 8, Day 22], due [Week 10, Day 26]
Project 4: Available about [Week 13, Day 36], due [Week 15, Day 41]

Note: Midterm is [date], and the last day to withdraw from fall semester courses is [date]. Each student's midterm grade will be based on two tests (including two benchmarks), one or two projects, and half the semester of participation, Web Work, other graded homework, and quizzes. This represents approximately [45%] of the graded work for the semester. If you have concerns about your progress or ability to keep up with course assignments should discuss these concerns with the instructor.

Final Exam: 20%
The *cumulative final exam* is scheduled for **[day, date, time of the Final Exam].**
All tests in this course are cumulative, including the final exam.

Administrative Policies
Academic Integrity Policy
Inherent in the mission of Cardinal Stritch University is the strong belief in the principle of academic integrity. Students who cheat violate their own integrity and the integrity of the University by claiming credit for work they have not done and knowledge they do not possess. All students are expected to recognize and to abide by the policy on academic integrity found in the Student Handbook which can be found at **URL for online Student Handbook, with link to information on Academic Integrity**. (Look for the Academic Integrity Policy in the Table of Contents.)

Since much of the work of this course is to be done in cooperative learning groups and I encourage you to work together on the class activities and on most homework assignments, I will clearly indicate those assignments on which I expect you to work on your own. Basically, I assume that you are collaborating on homework assignments and class activities unless I tell you not to do so.

Collaborating and/or sharing your work with another student during a test or other individual graded assignment is unacceptable, and will earn a grade of 0 for that test or assignment. If you consult other sources – whether print materials or internet resources – while working on a project or paper, keep track of all the sources you consult and include these in your bibliography for the project. Failure to cite your sources on a paper is a serious offense, which will affect your grade for that paper or assignment. I am required to report each violation of academic integrity to the Department Chair. Repeated violations of academic integrity will be reported to the Dean of the College and the Academic Vice President, and may result in dismissal from the university.

Letter Grade Equivalences:

Letter Grade	Percent range		Letter Grade	Percent range
A	93 or above		C+	78 – 79
A-	90 – 92		C	70 – 77
B+	88 – 89		C-	65 – 69
B	83 – 87		D	60 – 64
B-	80 – 82		F	Less than 60

Compliance with the Rehabilitation Act of 1973
If you have any special needs for alternative instruction and/or evaluation procedures, please feel free to discuss these needs with the instructor so that appropriate arrangements can be made.

Cell Phones and Pagers
As a matter of courtesy, students are expected to turn off cell phones and pagers during class. If extraordinary circumstances require an exception to this policy, the student is expected to discuss this with the instructor before class begins. If your cell phone rings audibly during class, five points will be deducted from your class participation score for that class period.

Appropriate Dress for Class
As a student, you are in training for your future professional career. You should give some thought to how you "dress for success." Wear comfortable casual clothing that reflects positive self-esteem.

Office Hours
My office is located at **XXX**. I am on campus regularly Monday through Friday, and welcome students who drop in with a question. I also make it a point to check and respond to email regularly throughout the

day. Although various responsibilities may require me to change my schedule from week to week, I try to reserve the following times as official office hours:

Mondays, Wednesdays, and Fridays	times
Tuesdays and Thursdays	times

If you need to reach me between classes:

- **Email address**
- **Campus phone number**