Math S166: Analytic Geometry and Calculus II
(Class No: 27124)

Meets: MWF 9:00–10:15a in LD 002
Final Exam: Wednesday, May 6, 8:00a – 10:00a

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Office Hours: MWF 10:30 – 11:30a, MF 1:30 – 2:30p, or by appointment
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General Information and Goals

Calculus is one of the outstanding intellectual achievements of the human mind, in addition to being the foundation of many applications of mathematics to physics, chemistry, biology, statistics, economics, and many other natural and social sciences. The roots of calculus go back to Eudoxus, Archimedes, and other Greek thinkers more than 2000 years ago, but the calculus as we know it began with the work of Isaac Newton, Gottfried Leibnitz, and other mathematicians of the 17th century with many improvements in understanding, development of applications, and refinements and extensions of the theory in the 18th and 19th century. Much more recently, beginning in the second half of the 20th century, machines have been developed that, with human guidance, can solve calculus problems. In this course, we will keep all of these threads in mind as we learn about calculus and try to connect it to areas that are of interest to each of you.

Math 166 here at IUPUI forms the mathematical foundation for many majors in Science and Engineering but is taken by many other students as well. The course is open to all students who have the appropriate mathematical background in first semester calculus, equivalent to a grade of "C" or better in Math 165.

This course, Math S166, is a special 'Honors' version of Math 166 designed for students in the Honors Program or for students with a desire for a better understanding of the background for the material and a deeper understanding of why the mathematics presented in the course is correct. While this course is open to all students with the appropriate first semester calculus, it will require more independence and is intended to build on and to develop stronger mathematical skills than the standard course in Math 166. If you have interest in the course but have questions or concerns about it, please contact the instructor by email or in person as soon as possible. This course meets at the same time as a section of Math 166, so students can easily more from one course to the other, but the text used in the two courses is different.

The text for Math S166 is

Text: *Calculus, Volume I*, 2nd edition(1967), by Tom M. Apostol (Wiley)

and we expect to cover Chapters 6 and 7 as well as the material in earlier chapters not usually covered in Math 165 (e.g. 2.9, 2.10, 3.12, 3.13, 3.14, 5.9) that are part of Math 166. This is comparable to the coverage of the usual Math 166, so after finishing this course, students will be ready to continue in Math 261.

There will be two principal focusses of the class. First, there will be the development of the transcendental functions: logarithm, exponential, trigonometric, and inverse trigonometric functions and their relationships to other functions in common use. The other is on the properties of sequences and infinite series which form the foundation both for important applications (e.g., via Fourier series) to the sciences and engineering as well as for analysis, one of the central areas of advanced mathematics.

In addition to these mathematical topics, this course will include use of mathematical applications on a computer to facilitate some of the computations involving the mathematics in the course. Such tools, for the most part developed in the past 30 years, are becoming increasingly important both in industry as well as in more theoretical science, engineering, and mathematics.

My goals for you in this course are

Short term goal: That you master the ideas and computations of the course, both theoretical and applied.

Short term goal: That you become proficient in the language of calculus, as it is used both formally and informally in theoretical discussions and in applications to problems from other disciplines.

Short term goal: That you develop your ability to read mathematics and learn from what you read.

Short term goal: That you develop your ability to write mathematics, and begin to develop your skill in creating and writing proofs, which are the explanations of why things in mathematics are true.

Long term goal: That you recognize the uses or ideas of calculus as you see them in your professional or your personal life and that you know or can quickly relearn the computations that are important to you throughout your life.

Long term goal: That you develop and sustain an excitement about mathematics and its connections to problems in the 'real world' generally, especially the mathematics you need in your professional and personal life, and that you can and do communicate that excitement to others.

Class Participation, Attendance, and Homework

Class participation will be an integral part of this course, we can say with a fair degree of certainty, that you will not do well in the course if you do not come to class regularly. Learning mathematics requires steady and persistent effort. Coming to class and making an effort to focus on the material being discussed is critical for success. The homework and the projects are aimed at facilitating your practice of the concepts from the course and leading you to see other concepts that you might not have encountered.

It is important to develop your ability to read mathematics and other technical material. It will be helpful to read material from the text both before and after coming to class. Reading before will prepare you for the discussion in class and reading after will help solidify your understanding. Reading mathematics books is a skill that will take time to master, but will pay off in your later study both in other math classes, but also in any classes that depend on reading detail. One of the biggest differences between reading mathematics and other kinds of reading is that to be successful in reading mathematics, you must read slowly and pay attention to the details you are reading. If you have trouble with material from the textbook, please ask me about it in class or in office hours. Occasionally, there will be homework problems based on material that we have not discussed in class, but that you will have been assigned to read.

Homework will be assigned regularly and will be collected sporadically with grading mostly to check that you are doing the work. Make-up/late homework will **not** be graded for credit.

Maple is a 'computer algebra system' (well-known competitors are Derive and Mathematica) that is available on many UITS machines on the IUPUI campus, including the lab on the second floor of LD. A computer algebra system is a computer program that recognizes algebraic and other mathematical symbols and can do computations with them in their *symbolic form!* At this time, there are also some hand-held devices that can do symbolic calculations, and there will certainly be many more to follow. These systems contrast with numeric engines, such as Matlab, also available on many UITS machines, which can only do numerical computations, giving answers as numbers and accurate to a fixed accuracy. The computer projects will be done using Maple, Matlab, or possibly both. You may use electronic tools to help you in your homework and study, but pursuant to the Mathematics Department's policy, you will not be using these tools on tests.

The developing schedule for the course will be announced in class, but will also be on the website for the class (see the URL above), updated regularly.

Test, Exam, and Grading Policies

In addition to the Final Exam on May 6, there will be 3 tests during the semester, of which one, Test 2, will be a "mastery test" (see below). Each of Test 1 and Test 3 will contribute about 20% of the grade, Test 2 about 15% of the grade, the homework and computer projects about 20% of the grade, and the Final Exam about 25%.

Test 1 (late February), Test 3 (early April) and the Final Exam will be ordinary tests covering the theoretical and applied parts of the course material and with partial credit granted for answers that are mostly, but not completely correct.

Test 2, on computation of derivatives and integrals, covers the most basic and fundamental skills in calculus and will be a mastery test. By "mastery test" I mean that the test will cover material that must be mastered for success in the course and will be graded accordingly. For this test, no partial credit will be given – each answer is completely correct, or it will receive no credit. BUT, the test may be repeated at arranged times until 3pm on May 7 or until a score of more than 90 is achieved. The test will have 20 questions. A perfect score is 110 points, but for each incorrect answer, 10 points will be deducted. That is, on the first day the test is given, you will receive 110 points if you get all 20 questions correct, 100 points if you miss 1 question, 90 points if you miss 2 questions, 80 points if you get only 17 correct, and -30 points if you get only 6 correct. After the first day, 100 points will be the maximum score, given for no wrong or 1 wrong, and otherwise the scoring will be the same. I expect everyone will get more than 90 points on Test 3 after taking the test no more than three or four times because the test will contain no "hard" questions.

The Department of Mathematical Sciences enforces course-wide policies for the Final Exam in Math 166. These same policies will apply for all tests in this course. The most important of these policies is:

- No calculators, cell phones, pagers, ipods, or other electronic devices are permitted to be on during the tests.

General Academic Policies

The work you submit for homework, tests, and the final exam must be your own. For homework you will probably find it beneficial to consult with other students about the

material and this kind of conversation and collaboration is encouraged. At the end of the consultation, however, each participant is expected to prepare their own summary of the discussion and their own solutions to the problems. The policies for this class will be those derived from IUPUI's policies on academic conduct and adaptive services. More information about student conduct can be found at `http://registrar.iupui.edu/misconduct.html` More information concerning adaptive services for learning or other disabilities at IUPUI can be found at `http://life.iupui.edu/aes/`

Some Important Dates

January 12	First day of classes
January 19	Martin Luther King Day, no classes
March 6	Last day to withdraw with automatic 'W' (w/ permission of advisor)
March 14 – 22	Spring Break!! no classes
April 3	Last day to withdraw (requires permission of advisor and instructor)
May 4	Last day of classes
May 6	Final Exam, 8:00a–10:00a
May 7	Last day to take Test 2 (by 3:00p)