Math 2890: Reasoning with Infinitesimals and Infinities (Honors)

Professor: Paul Fili
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Lecture: M 1:30-2:20 in HCI 330
Office: 532 Mathematical Sciences Building
Office Hours: TBD
Online Classroom (D2L) site: https://online.okstate.edu (then log in and find our course)
Prerequisite: Grade of C or better in Math 2144 or equivalent.
Textbook: Calculus (Early Transcendentals, Third Edition), by Jon Rogawski

Many famous problems in physics and engineering are difficult to solve in general but can be easily solved when one assumes certain quantities are much smaller, or much larger, than others. For example, it is much easier to determine the motion of a swinging pendulum if one assumes the angle is very small, that is, if the angle is "infinitesimally small."

In this Honors add-on to Calculus II, we will explore the art and science of reasoning with both infinitesimal and infinitely large quantities and study how you can make the reasoning that goes into these problems more precise. We will also explore the history of such reasoning, from the "ghosts of departed quantities" which Bishop Berkeley criticized in Newton's work in 1734, to Cauchy's notion of a limit, to Landau's big-O error notation, and to the invention of the hyperreal numbers by Abraham Robinson in 1966 and Internal Set theory by Edward Nelson in 1977, which finally gave the study of infinitesimal quantities a rigorous footing.

The main goal of this course is to appreciate both the technical issues which arise in the study of infinitesimal quantities, as well as the art of using them to arrive at solutions to interesting mathematical problems.

Homework: Homework for this course will be available on the Online Classroom website under the "Content" section. I will send out notifications when homework is posted, but it is your responsibility to keep up to date on the assignments.

Grading: Your grade in this course will be determined by your score on the homework assignments.

Attendance: Attendance is required and a penalty may be assessed for repeated absences. If you are unable to attend a lecture, please let me know.

Conflicts: I will offer reasonable accommodation in the event that you miss a major assessment activity for a valid and documented reason, assuming documentation is provided **in advance**, unless absolutely impossible. For a quiz or exam, you need to tell me as soon as you know you have a conflict and will be ineligible for a make-up if you do not. I require proof of the reason for your absence (e.g., a doctor's note, proof of involvement in an OSU-sponsored activity, etc.), and you should not assume you will be eligible for a make-up exam or quiz unless I have explicitly approved your request.

Academic Honesty: You are expected to follow the academic integrity policy. Do not copy work directly from other students, allow other students to copy your work, or present work you find in printed or electronic sources as your own. You may get help on homework from other people or sources, but should write your solutions independently, without looking at anything someone else has produced. **In this class, copying on quizzes or exams or allowing someone to copy off of you may result in an F! for the course. Copying or allowing someone to copy your work on homework carries a penalty of up to 10 percentage points off your**

semester homework grade in the first instance and an F! in the class in a second instance. Fraudulently signing an attendance sheet for someone else or having someone sign for you may result in an F! in the class at my discretion. For questions, contact the Office of Academic Affairs, 101 Whitehurst, (405) 744-5627, http://academicintegrity.okstate.edu. I deal with cheating very harshly; don't take any chances.

What if I need help? First and foremost, come see me and ask questions! Office hours are usually the best time to come and ask me questions, but they are equally useful as a common time to meet and work together with your classmates. There is also free tutoring available in the MLSC, which is the same area where I will hold some of my office hours. See http://www.math.okstate.edu/mlsc for details. **Above all, get in touch with me if you are having any difficulties.** Good luck!

Syllabus Attachment: Please read the OSU syllabus attachment which follows this document, as it has a lot of important information, including instructions about disability accommodations. If you require accommodations as the result of a disability, you must contact the Office of Student Disability Services and they will inform me as to what accommodations should be provided.