Department of Mathematics

May 16, 2022

UNDERGRADUATE MATH SEMINAR

Professor Lucy Oremland

The next math seminar on the term will be

DATE: **THURSDAY, May 19**

Time & **12:30 –** Pizza lunch in **Bailey 204**

Location: **12:55 – 1:45** Seminar in **Bailey 207**

Professors Lucy Oremland and **Csilla Szabo** from the Department of Mathematics at **Skidmore College** will present the following talk.

Design – 3D Print – Calculate: Student Created 3D Printed Solids of Revolution

Professor Csilla Szabo

Abstract: In mathematics, it is often necessary to build, visualize, and manipulate complex multi-dimensional structures. Instructors and students must become makers - through drawing, simulating, and crafting - in order to engage deeply with key concepts. In this talk we present a solids of revolution making activity for Calculus II (Integral Calculus). As part of the activity, students designed and 3D printed volumes of solids of revolution using our college's maker space.

We will demonstrate the steps required to create a digital solid of revolution using free online tools, Desmos and Fusion360. If you would like to follow along with the demonstration, please bring a laptop and complete the steps below to get free access to Fusion360.

- Create an Autodesk account (Free for one year) https://www.autodesk.com/education/edu-software/overview?sorting=featured&filters=individual
- Access Fusion360 online at https://fusion.online.autodesk.com/ or download to your computer.

Fall Term Job Opportunities: Calculus Help Center Tutor; Math Coach for MTH 105

CALCULUS HELP CENTER TUTOR

The Math Department is now accepting applications for vacant **Calculus Help Center (CHC) tutoring positions**. Tutors in the fall work in the CHC one fixed night per week, Sunday through Thursday, from 7:30-10:00pm.

Qualifications: Calculus through Math 115 with grades of no less than A-. Preference will be given to students who

- have also completed Math 117 (with a grade ≥ A-),
- are declared math majors,
- are considering becoming a math teacher or pursuing graduate work in mathematics, and
- have other tutoring experience (not necessary, though).

To apply for a position, send an email to Professor Paul Friedman (friedmap@union.edu) expressing your interest, listing your mathematical background, including coursework (term, professor, and grade) and tutoring experience (if any), and discussing why you think you would be a good tutor.

Application deadline: Friday, May 27 at NOON

MATH COACH for MATH 105

Math Coaches will attend and work with a section of MTH 105 in the fall to assist students with their understanding of course content.

For more information and to apply, use the QR code below. If you have questions, contact **Lesly Clay** at clayl@union.edu.

Apply

TURN THE PAGE – THE NEWSLETTER CONTINUES

My Senior Writing Experience – by Colin Langton

Colin *participated in the Senior Writing Seminar with Professor Kim Plofker*

This past winter, I participated in the Senior Math Writing Seminar with Professor Plofker. In this class, I explored various topics on the History of Math, of which I focused on the work of Daniel Bernoulli. As a physics and math double major, it became apparent that many of the topics and applications of math that I use from day to day are taught with no insight into their historical background. What's intriguing about this is that mathematics is purposely built this way so that the newest and simplest ideas can be applied without devoting a lifetime to rigorous study. This is why derivatives can be taught in introductory calculus without being formally defined until much later in real analysis. However, examining these developments can provide intuition about how the ideas are used today and how they can be applied to further the advancement of science.

As I mentioned already, I studied the work of Daniel Bernoulli and his many contributions to math and physics. Daniel Bernoulli was a French mathematician born in 1700 who worked on topics ranging from probability theory and differential equations to early calculus and mechanics. The most interesting contributions that of Daniel Bernoulli were his treatise on energy and his overlooked impact on Lagrangian Mechanics. After Isaac Newton's formulation of mechanics in the late 17th century, there was wide debate over the idea of "live force" or force in motion. This debate centered around the quantities of mv and mv2; the first was the modern quantity of momentum championed by the followers of Isaac Newton and the second was an early equation for kinetic energy pushed forward by Gottfried Wilhelm Leibniz. Unfortunately for Leibniz, his quantity of kinetic energy was only conserved in the event of an elastic collision, something that rarely occurred in the real world. For that reason, the study of energy was pushed to the side and hardly ever considered. However, this did not deter Daniel Bernoulli who believed that the idea was simply incomplete. He thought energy could be used to completely describe motion by accounting for a term that he would call the "potential ascent." As modern academics, this is a clear description of the law of the conservation of energy as we know it today. Furthermore, in Daniel Bernoulli's papers, he properly defines equations for kinetic energy and potential gravitational energy. Both of these equations show up in his work years before any other mathematicians of the time including those that are historically given credit for their modern development.

From these equations, we can see a clear influence on the creation of Lagrangian Mechanics. If you don't know, Lagrangian Mechanics was the first reformulation of Newtonian Mechanics that allowed for the description of more complex physical systems using the kinetic and potential energies. Right away, it is clear that Bernoulli was a large influence as he was the one who proposed the idea of potential energy. However, I believe that this influence is even more impactful and argue that Daniel Bernoulli is the bridge that connects Newtonian Mechanics and Lagrangian Mechanics and without his work, the field would not have developed as quickly as it did.

The main thing I took away from this work was a better conceptual understanding of the ideas behind Lagrangian Mechanics. In addition to this, I gained a greater appreciation for the contributions that lead to the simple ideas that I apply without a second thought as an undergraduate scientist. Just like the case of a derivative, you never really need to know how it historically developed. Yet the conceptual insights provide a better understanding of how it's properly applied. For me, this experience in the senior writing seminar has led to a deeper understanding of mathematics and physics that will prepare me for my future studies in pursuing a Ph.D. in physics next year at Georgetown University.