

MATH 215
Great Ideas in Mathematics
Winter 2015

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Office Hours: By appointment and before and after the class.

Objectives: Math 215 introduces you to the world of mathematical ideas and mathematical thinking. The course is organized around five main themes: time, space, motion, size, and truth. We will discuss how mathematicians have thought about these topics and what frameworks and techniques they have developed for making the underlying concepts precise and accessible by logic and computation. The goal of the course is not only to make mathematics relevant, enjoyable, accessible, and learnable, but to guide you academically in directions that strengthen your ability to understand, appreciate, and use some of the learned material in your career disciplines.

Location & Laptops: Math 215 is taught in H-443, one of the computer labs in the Arts and Science Learning Centre. In order to follow the course, you must bring to class a laptop running *Mathematica*. If you do not have your own laptop, you can borrow one from the Webster Library.

Mathematica: The course requires Mathematica 10. Earlier versions of *Mathematica* will not have some of the features used. Concordia University has a site license for *Mathematica* and all registered students are entitled to install *Mathematica* on their personal computers free of charge. The process of installing the software is described on your MyConcordia web portal.

Activation of Mathematica requires a Concordia University e-mail address. Please consult your MyConcordia portal for details.

Mathematica is a computational software program used in many scientific, engineering, mathematical and computing fields, based on symbolic mathematics. It was conceived by Stephen Wolfram and is developed by Wolfram Research of Champaign, Illinois. The Wolfram Language is the programming language used in *Mathematica*.

Thousands of users have used *Mathematica* to create so-called "demonstrations" that solve a wide range of problems and prove

illustrations of topics ranging from mathematics to science, the arts, and entertainment. With my guidance, you will be able to access and use some of these demonstrations as a source of inspiration for working on your own course projects.

We will also use Wolfram/Alpha, a rich natural-language-based computing engine and front-end to a wide selection of data sets, covering many fields including those studied in this course. Users of *Mathematica* can access the Wolfram/Alpha without ever leaving *Mathematica*.

Moodle: MATH 215 is managed on a Moodle website. The site contains the course outline, lecture notes, quizzes, research material, student projects, announcements, feedback material and other items. Since only registered students have access to the website, all material on the site is confidential to the instructor, the teaching assistant and you. No material posted will be used elsewhere without your explicit written permission.

Communication: E-mail exchanges in this course are managed through the Moodle forum and use the Moodle e-mail system. They are monitored and facilitated by the teaching assistant.

Lectures: All lectures will be interactive.

Class activities

In Weeks 1, 3, 6, 9, and 12, I will be introducing the themes and discuss some of the mathematical ideas and techniques relevant to the theme.

In Weeks 2, 4, 7, 10, and 13, we will use *Mathematica* and Wolfram/Alpha to solve problems related to the themes of introduced and discussed the week before.

In Week 5, we will be working on creating *Mathematica* project reports.

In Week 7, we will be working on created *Mathematica* slideshow for presenting project reports.

In Week 11, we will be discussing what you have learned in your chosen topics. Each of you will present a 5-minute slideshow dealing with one of your chosen topics.

Lecture content

Week 1: What is time?

Week 2: Modular arithmetic and calendars

Week 3: What is space?

Week 4: Euclidean and non-Euclidean geometry

Week 5: (PROJECT DISCUSSION 1)

Week 6: What is motion?

Week 7: Derivatives and differentials
Week 8: {PROJECT DISCUSSION 2)
Week 9: What is size?
Week 10: Numbers, sets, and cardinality
Week 11: (PROJECT DISCUSSION 3)
Week 12: What is truth?
Week 13: Classical and non-classical logics

Evaluation: The MATH 215 grading scheme is based on four assignments.

Assignment 1 (10 marks)

Assignment 2 (20 marks)

Assignment 3 (30 marks)

Assignment 4 (40 marks)

The assignments increase in value as your familiarity with the process and the use of *Mathematica* and Wolfram/Alpha grows. The format of the expected slideshows and reports will be discussed in class, based on examples and illustrations. We will also discuss the problem of providing references and current conventions for cutting and pasting from existing sources.

Evaluation Criteria: Each assignment should consist of the following:

A description of the general theme and individual aspects of theme you have chosen for your study (10%)

A short account of the creation and/or invention of the relevant mathematics (30%)

A list of at least five references And/or sources from on which your project material is based (10%)

The solution of five mathematical problems relevant to the chosen topic (50%)

Disclaimer: As the course proceeds, it may be necessary to make minor changes to the course outline and to the content of the course to accommodate your special interests and needs. However, every effort will be made to minimize such changes. The course website is the official repository of the course material and you should consult the site for all information relevant to the conduct of the course.