Ideas in Mathematics

University of Pennsylvania
Math 170, Spring 2016
Syllabus

> *Mathematics is a vast adventure of ideas; its history reflects some of the noblest thoughts of countless generations.*
>
> – Dirk K. Struik,
> *A Concise History of Mathematics*

Learning to calculate is to mathematics what learning to read is to literature – necessary, though not especially interesting. In school, most of us took math classes in which we learned to do something (i.e., multiply numbers, solve for x, take derivatives), and then spent months improving our technique. At the end of the day, though, performing these calculations is neither thought-provoking nor particularly useful, as your smartphone can perform them many times faster than even the fastest mathematician.

Instead of focusing on calculation, this course will take us on a guided adventure through some of the most beautiful ideas in classical and contemporary mathematics. These ideas have intrigued many of history's most creative minds, inspired them to think deeply about what might appear trivial, and ultimately contributed towards our collective understanding of the world. Despite requiring no prerequisites beyond an elementary-school education, this course will cover some of the most central topics in modern mathematics, including cardinality, prime numbers, geometry, and symmetry groups. In the end, it is the capacity for careful thought, not the ability to precisely and quickly calculate, that is the primary concern, and lasting contribution, of mathematical thinking.

Course

Lecture:	M,W,F 12:00–12:50pm, DRL A4
Recitations:	T,Th 8:30–9:20 / 9:30–10:20am, DRL 4C8

Lecturer: Emanuel Lazar

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Office Hours:	M,W 1:00–2:00pm, and by appointment

Teaching Assistant: Dominick Villano

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Office Hours:	W 10–11:00am, Th 5:30–6:30pm

Topics: Cardinality of sets, rationals and reals, prime numbers, methods of proof, modular arithmetic, graphs, coloring theorems, Euler and Hamiltonian circuits, polyhedra and the Platonic solids, groups and symmetries, other topics as time and interest permit.

Book: *The Language of Mathematics: Making the Invisible Visible*, by Keith Devlin.

Homework. A problem set will be assigned most weeks. The first part of each assignment is designed to ensure your comprehension of the basic material covered in class; the second part will require more thinking and is designed to facilitate your own mathematical development beyond basic comprehension. In general, assignments will be due at least one week after they are assigned. Late submissions cannot be accepted, though I will drop your two lowest scores. Solutions must be clearly written; if you need to, first work out all solutions on scrap paper, and then carefully rewrite your work on the paper you eventually hand in. Assignments must be turned in on paper.

Working Together. At its best, learning is a collaborative effort, and so students are strongly encouraged to work together on assignments. That said, merely copying another person's work does not involve working – or learning – and is not allowed. Each student must turn in a separate copy of the solutions.

Quizzes and Exams. Ten-minute quizzes will be administered every Wednesday; studying for these is not necessary. There will be two mid-term exams (dates TBA) and one final exam. If you are unable to take an exam as scheduled, please notify me in advance.

Writing Assignments. There will be one or two writing assignments during the semester; more details will be provided later.

Grading. Your final grade will be determined based on the following:

Homework:	200 points (10 assignments, 20 points each)
Quizzes:	100 points (10 quizzes, 10 points each)
Exams:	150 points (3 exams, 50 points each)
Writing Assignments:	50 points

Expectations. Watching movies will not land you a job in Hollywood, nor will sitting and watching workout videos get you in shape. Likewise, merely watching me and Dominick explain material and solve problems will not make you into a good mathematician. The most important element in your own learning is the time you spend thinking. Don't forget this.

Help. Learning mathematics is hard. Don't feel bashful to ask for help when you do not understand something or feel that you are falling behind. If you cannot make it to scheduled office hours, please be in touch to set up an alternate time to meet. In addition to meeting with me and Dominick, please avail yourselves of the many Penn help resources, including the Math Centers, the Tutoring Center, and the Weingarten Learning Resources Center. Additional information can be found at https://www.math.upenn.edu/ugrad/.

Extra Credit. I will occasionally mention particularly challenging problems, and will post these to the course webpage. A solution for such a problem will be rewarded with extra credit towards the final grade; these points will not affect any curve for the class. In addition, I will also periodically describe special problems, the solution to any of which will be rewarded with an A in the course.