Thriving in University-level Mathematics

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Why we are here....

- Most likely you are already signed up for your first mathematics course here.
- We have found that what you think a math course is like at the university level is quite different from what you find.

Fact

University-level mathematics $\neq$ *Secondary-level mathematics* $+ \quad 1$

- In other words, freshman year is NOT 13th grade!
- This leads to a lot of initial struggling and floundering in an unfamiliar environment.
- In this orientation talk, I will try to explain our philosophy, the structure of a mathematics course at the freshman level, the roles of the various players in the experience, some common misconceptions, how we evaluate your performance and some tips of how to max your performance.

Mathematics here at Hopkins

- Pre-college view: Math is a set of service courses providing useful tools for the calculation of certain ideas present in the natural or social sciences.
- Higher ed view: Math is a process of how to think analytically and reason deductively and logically.
- Thus, instead of a tool box set of techniques one would gain from a mathematics class, we provide you the raw materials,the imagination and the know-how to make the tools you need as you need them.

Mathematics here at Hopkins

Mathematics at the university level is more than simply a set of techniques useful in solving problems. It is **the development of your ability to analyze the structure of any complicated situation, and abuse the nature of that structure to gain useful information from (or to say something meaningful about) that situation.**

Mathematics at the university level is less a study of how things work and more a study of why things work the way they do. This is why theory is an integral facet of mathematics at the university level even in the basic courses.

- This is the fundamental reason why pretty much everyone needs to take some math at the university level; to develop better their analytic prowess.

Structure of a Math course

The service-level courses (100-200 level courses, and 302 service pretty much the entire university) meet for 4 hours a week (academic hour; 50 minutes)

- **3 hours of lecture time:** You meet in a (usually large) lecture hall with the professor. This is where the base of the course is developed. The professor lays out the theoretical framework of the course, and develops the material.
- **1 hour of recitation:** You meet in a smaller classroom with 25 or so students, and discuss current material from the lectures from the standpoint of applications and calculations. The TA is usually a graduate student in mathematics. Focus is more on discussion, homework problems, applications, and secondary developments outside of the lecture.

Note: A course lasts 13 weeks, for a total of 39 lecture hours and 13 recitation hours.

Structure of a Math course

Hours inside/outside the class Notice how much material there is to cover in the lectures and so few lectures to cover it.

Question

How much time outside of class do I need to study for each hour in class?

There is no good answer. Rather, think about this:

- So much of your learning in a mathematics class comes from outside of the classroom (reading, interpreting and reinterpreting the lecture notes, working out homework problems, talking with classmates, asking questions, etc), that...

...it is more the role of the professor to guide you through the material than it is to present every aspect of the material to you.

Hence, you will see an emphasis in lecture on the more difficult material, and a relegation of the easier, more straightforward stuff to your OWN exploration OUTSIDE of the classroom (with classmates, the text, etc.)

Role Playing

Professor

- To run the course.
- Determine the proper content necessary for the course.
- To guide a student's learning.
- To partially digest difficult material
- To prepare the student's base for the more advanced material
- Theoretical and conceptual development

TA

- To interpret/reinterpret theory in terms of application
- To more closely follow (monitor) a student's progress
- To provide a possible different perspective on material
- Practical application

Role Playing

Student

- To engage in the course actively
- To learn and question
- To work steadily and effectively
- To monitor your progress accurately

Lectures

- To comprehensibly lay out the framework of the course.
- Theoretical development.
- Text and concept highlighting.
- Material planning.

Recitations (Sections)

- Practical application.
- Theory to problem solving development.
- Rehash/pre-hash of relevant material.

Role Playing

Text

- Base structural framework for the course.
- Organizational guideline for concept development.
- Professor/TA may deviate/reinterpret/eliminate portions
- Contextual aid for problem work

Homework

- Practical application / Concept exploration.
- Concept to calculation practice.
- Alternate to lecture conceptual development.

Quizzes

- To incrementally evaluate understanding and monitor progress
- Scrimmaging for exams

Exams

- To gauge general understanding and evaluate performance.

Mathematics Misconceptions (SZ)

- With a math problem, you either know how to do it or you don't.
- In a calculus course, theory is irrelevant, for what's really at stake is doing the problems. The lectures should just show the student how to do the problems.
- The purpose of the classes and assignments is to prepare the student for the exams.
- Students learn best when everything they have to know is presented slowly in the classroom.
- It is the teacher's job to cover the material.
- A good teacher is one who can eliminate most of the struggle for the student, making the material easy to learn.
- Grades are curved so I only need do better than the other students.

Approaching the course

The best was to view a mathematics course here at Hopkins is an an individual contract between each student and the professor:

the Student/Professor Contract

The professor agrees to provide you with a well-designed set of material and instruction so that the educational experience is well-founded, fulfilling, and comprehensive. The student agrees to follow the course closely and carefully, adhering to the course aims, structured exercises and other requirements, and to respect the environment relevant to the course.

Approaching the course

Lectures

- Prepare for them:
  - Review recent material from lectures; note unclear stuff
  - Read ahead to familiarize yourself with the upcoming material
  - Take notes to outline the upcoming material
  - Identify the easy stuff and the incomprehensible stuff
- In them:
  - Take notes more on the stuff you need to work out rather than the easy stuff
  - Do not neglect the lecture nor the board for the other
  - Leave margins in notes for later annotations
  - Leave room for unfinished problems to finish later

Approaching the course

Lectures

- Afterwards:
  - Read over your notes soon after a lecture and fill in missing details
  - After the lecture, annotate notes
    - Immediately with things you remember from the lecture
    - Later, after reflection and talking to other students
    - After recitation or studying
    - Upon consulting other texts
  - Work out unfinished board problems in detail
  - Compare notes with other students
  - Place question marks at places where you have lost the idea. Take notes to professor/TA for clarification at any unsure point.

Approaching the course

Text

- READ the text; not like a novel, but like a crossword puzzle
- Use the margins in the text for notes.
- Use the examples as guides.
- Consult other texts on similar material.

Homework

- Talk math to your peers, but write math alone
- Use problem types as a guide
- Save unassigned problems as more practice
- Do new problems under a clock

Quizzes/exams

- Not milestones
- Scrimmage
- Don't cram

Take an active role in your education

More Tips and Advice

Visit these online resources for more tips and advice:

- The Math Department website: www.mathematics.jhu.edu
- My Blog: The Chalkboard (www.jhuchalkboard.blogspot.com)
- Facebook: JHU Undergraduate Mathematics (www.facebook.com/JHUUndergradMath)
- Twitter: @ JHU_Math_DUS
- Professor Steven Zucker's website: www.math.jhu.edu/~sz/