

# YouTube University: Shared upper level math courses across schools

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`http://web.williams.edu/Mathematics/sjmler/  
public\_html/`

AMS-MAA Special Session: Novel Methods of Enhancing  
Success in Mathematics Classes

Joint Mathematics Meeting, San Diego, January 2018

## Description

**Motivation:** Share classes to supplement and keep small liberal arts flavor.

**Implementation:** Math 331: Problem Solving: Taught at Williams in Spring '17 with 3 students taking it remotely at Swarthmore and 2 auditing from Amherst.

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### Goals for the talk:

- Discuss mechanics of course.
- Discuss administrative issues.
- Report on class and next steps.

## Mechanics

## Course Mechanics

- Met MWF 9-9:50am in Williams, posted lectures by noon.
- Homework submitted in person or emailed to grader.
- One class at Swarthmore, 3 live classes using a Surface and GLOW.
- Class participation key component: for remote students extensive emailing and phone calls.

Webpage: [http://web.williams.edu/Mathematics/sjmiller/public\\_html/331Sp17/](http://web.williams.edu/Mathematics/sjmiller/public_html/331Sp17/)

## Snapshot of webpage

### Math 331: The little Questions: MWF 9-9:50am, Bronfinan 103

Professor Steven Miller (sjm1 AT williams.edu), 202 Bronfinan Science Center (413-597-3293)

My office hours: TBD and whenever I'm in my office ([click here for my schedule](#)). TA Sessions: Mon 7-8 B34, Thurs 7-8:30 Bronfinan B34

#### Useful links:

- [additional comments](#)
- [articles/videos](#)
- [handouts](#)
- [homework](#)
- [links \(contests, books\)](#)
- [Mathematica programs](#)
- [objectives](#)
- [syllabus/general](#)
- [takeaways \(all classes\)](#)
- [welcome letter](#)

**GENERAL INFO:** This is a pre-core 300 level course; no advanced classes are assumed, but if you have not taken linear algebra please contact me. Using math competitions such as the Putnam Exam as a springboard, in this class we follow the dictum of the Ross Program and "think deeply of simple things". The two main goals of this course are to prepare students for competitive math competitions, and to get a sense of the mathematical landscape encompassing elementary number theory, combinatorics, graph theory, and group theory (among others). While elementary frequently is not synonymous with easy, we will see many beautiful proofs and 'a-ha' moments in the course of our investigations. Students will be encouraged to explore these topics at levels compatible with their backgrounds. The textbook for the class is Famous Puzzles of Great Mathematics by Miodrag S Petkovic (published by the AMS. Language: ISBN-10: 0821848143, available <http://www.amazon.com/Famous-Puzzles-Mathematicians-Miodrag-Petkovic/dp/0821848143> and <http://www.ams.org/bookstore-getitem/item=mbk-63>; see the [links page](#) for other recommended books (especially Polya's classic text).

**OBJECTIVES:** The goal is to use interesting problems, puzzles and riddles as springboards to great mathematics, as well as to uphold Williams' honor in several math competitions (Green Chicken, Putnam, Virginia Tech) in future years.

**GRADING POLICY:** Homework (typically due Fri): 15%, Midterm 30%, Final 30%, Class Participation: 10%, Project Euler: 15%.

#### Week 13: May 8-12, 2017

- Video: Mon: Dominoes and the Harmonic Series: <https://youtu.be/LG-pPUYFhnE>
- Video: Wed: Egg Drop Recurrence: <https://youtu.be/z9tYmZXDe6Y>
- Video: Fri: Harmonic Sums, Teller Problem, Grid Game: <https://youtu.be/uYrSpolXE-M>
- Some takeaways from all classes: [https://web.williams.edu/Mathematics/sjmiller/public\\_html/takeaways/TakeAwaysAllClasses.pdf](https://web.williams.edu/Mathematics/sjmiller/public_html/takeaways/TakeAwaysAllClasses.pdf)

## Equipment

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- iPad mini and swivel system with tripod.



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**Figure:** Video (go to 4:16): <https://youtu.be/TGJtH7K-mXs>.

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- iPad mini and swivel system with tripod.
- Microsoft Surface.



**Figure:** Surface: pen and touch screen huge asset; programs such as Snagit, Powerpoint, ....

## Using technology to help with challenges

Two very different options: straight recording, OIT-production.  
Function of money and time what can do.

- Calc III: Taylor Series in a Day: Sony Flip Cam: <https://www.youtube.com/watch?v=yr01SLw9t4c>.
- Calc III: Green's Theorem in a Day: OIT Camera Crew: <https://www.youtube.com/watch?v=Iq-Og1GAtOQ>.
- Problem Solving: iPad (go to 4:16): <https://youtu.be/TGJtH7K-mXs>.
- Double plus ungood: OIT: <https://www.youtube.com/watch?v=Esa2TYwDmwA>.

## Integrating recorded lectures

What is the purpose of recorded lectures?

- More material (both at home and in class).
- Aids absent students / students who want to review.
- Use material as review / supplement in other classes.
- Easier to travel.
- Obviously essential for remote students!

## Unexpected bonus: I was fine during a gas evacuation!



## Implementation Issues

## Implementation issues

- Will students watch it?
- What will they get from it?
- How effective is it?
- Difference b/w upper level and lower level courses.
- Strength liberal arts colleges knowing each other, lose greatly online.
- Technology failures (recording, wireless, uploading).



## Remote Student: Post-core Complex Analysis

My overall experience taking a class online was very positive. This was an opportunity to take a class that I would have otherwise not have been able to take (except as an independent study). Without the structure, a fixed syllabus, and helpful lectures, I wouldn't have covered as much material in an independent study. Once we overcame the technical hurdles and were able to have videos for all lectures, I benefitted tremendously from the lectures. Despite watching with headphones in a quiet section of a library, I found it more challenging to focus on watching the videos than focus on a professor in a physical classroom. I got distracted more often than I would in a physical classroom and would have to watch some videos more than once. Further, I didn't have the option of clarifying things in the moment (with another student or the professor) and felt more compelled to figure things out myself before emailing a fellow student or the professor. While this meant that I had to work harder on watching videos multiple times or re-reading sections of the textbook, I would say that the overall experience was more challenging, but not less meaningful, than a course in a physical classroom.

## Local Student: Multivariable Calculus

The partial flipping was a successful, interesting twist to class (though I think it worked in large part b/c of Prof Miller's way of teaching). Your website with many different kinds of practice problems, lecture notes, and additional comments with various links played an influential role to my performance in this class. I watched all the videos you sent via email and on GLOW. I watched some of the optional videos on the webpage when I had time or something I wanted to learn more about. Most of the time, however, I watched the mandatory videos after class b/c I viewed the online videos as good reviews of the lecture for that day rather than as previews since I prefer learning new material in person. Also, I watched all of the lecture videos for that class day when I got back to my room and took more notes for things I missed or wanted to emphasize b/c I found them important. You don't know how helpful these recordings were since we cover so much material in such limited time. As a student, I really appreciated this partial flipping system and the available online resources – it really worked.

## YouTube and the World: Broader Impact

- Often don't know who watches, though some contact.
- Broader impact: posting general lectures, research talks, conferences.
- Standard tutorials: saves time.

## Data

## Technology issues

- OIT recording: higher quality:
  - ◇ Processing time.
  - ◇ Student workers.
- iPad recording: lower quality:
  - ◇ Big issue: blackboard real estate.
  - ◇ Simple: just upload to YouTube!

## Analytics from videos

- WHO watched WHAT and HOW MUCH?
- Does watching help students?
- Should lecture recording be broken into smaller segments?
- YouTube or not YouTube? (I.e., GLOW?)

Future

## Going forward....

- Hollywood level videos great, lot of time and effort but better understanding?
- How much to flip, and how to integrate?
- Split work among several institutions?



## Next classes....

### Course Description

Math 137: *Graduate Real Analysis*

Fall 2017

**Space-Time Coordinates:** Tu-Tr 9:35 - 10:50 (PST) / Millikan 2113

**Professor:** Stephan Garcia

**E-mail:** `Stephan.Garcia@pomona.edu`

**Office:** 2383 Millikan

**Description:** Math 137 focuses on foundations, measure theory, Lebesgue integration, and functional analysis. See the end of this document for an approximate syllabus.

**Prerequisites:** Students are assumed to have taken two semesters of undergraduate real analysis equivalent to Pomona's Math 131-2 sequence.

**Course Website:** Course materials will be available at:<sup>1</sup>

<http://pages.pomona.edu/~sg064747/teaching/17F-137/17F-137.html>

## Next classes....

# Project Update: Upper Level Stats shared course pilot added for Fall 2017

📅 March 8, 2017    👤 LACOL    📁 Pomona College, Projects, Vassar College

In connection with LACOL's [Upper Level Math](#) collaboration, [Assistant Professor Jingchen \(Monika\) Hu](#) at Vassar College is opening her Fall 2017 **Bayesian Statistics** course to students from across the consortium. As the course unfolds, Prof. Hu plans to share bi-weekly lectures and screencasts with the class and engage with remote students via video conferencing and online office hours. On each participating campus, a local faculty liaison will be on hand to guide students as needed. Technical support will be provided in partnership with instructional technology/academic computing groups on each campus. In exploring the opportunity for the pilot experiment, Hu said:

To me, this shared/hybrid model can be a great way to get students on our campuses the access to upper level statistics courses. After collecting some data, I am very amazed at how rich the upper level



Jingchen (Monika)  
Hu, Assist. Prof. of  
Statistics, Vassar  
College

## Video References

## Course homepages

My homepage: [https://web.williams.edu/Mathematics/sjmilller/public\\_html/](https://web.williams.edu/Mathematics/sjmilller/public_html/).

Problem Solving Course Homepage: Math 331 (Fall 2017):  
[http://web.williams.edu/Mathematics/sjmilller/public\\_html/331Sp17/](http://web.williams.edu/Mathematics/sjmilller/public_html/331Sp17/).

## Video References

- OIT videos:
  - ◇ Double plus ungood: Discuss applications of Fibonacci numbers to roulette, 6:43 minutes: <https://www.youtube.com/watch?v=Esa2TYwDmwA>.
  - ◇ Duality: Introduction to duality and linear programming, 3:30 minutes: <https://www.youtube.com/watch?v=aMorrlh4Egs>.
  - ◇ Tangent lines: Review of tangent lines, 3:33 minutes: <https://www.youtube.com/watch?v=1EJ06epMLEQ>.
- Course videos: Probability, Complex Analysis, Calculus III:  
[http://web.williams.edu/Mathematics/sjmiller/public\\_html/videoclasses/index.htm](http://web.williams.edu/Mathematics/sjmiller/public_html/videoclasses/index.htm).
- Tutorial videos:
  - ◇ LaTeX: <http://www.youtube.com/watch?v=dKUtJpG4Rt0>.
  - ◇ Mathematica: <http://www.youtube.com/watch?v=gloj7CIqGM8>.
- Calculus videos:
  - ◇ Calculus review: <https://www.youtube.com/watch?v=xYzQL0TUtBA>.
- Conferences / Talks:  
[http://web.williams.edu/Mathematics/sjmiller/public\\_html/math/talks/talks.html](http://web.williams.edu/Mathematics/sjmiller/public_html/math/talks/talks.html).