

## YouTube University II: Shared upper level math courses across schools.

Steven J. Miller, Williams College

`sjm1@williams.edu`

`http:`

`//web.williams.edu/Mathematics/sjmillers/public_html/`

AMS Special Session on Pedagogical Innovations That  
Lead to Successful Mathematics  
Joint Mathematics Meeting, Denver, January 16, 2020

## Description

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

**Third Implementation:** Math 317: Operations Research: Taught at Williams in Fall '19 with 6 from Vassar and three from other schools; doing again in Spring with *only* remote students!

## Goals for the talk:

- Discuss mechanics of courses.
- Discuss administrative issues.
- Report on class and next steps.
- Hear what others are doing!

## Mechanics

## Course Mechanics (Typical General Course)

- Met MWF in the morning Williams, posted lectures by noon: *asynchronous*.
- Homework submitted in person or emailed to grader.
- Try to do a live class at any school with 3+ students, and some live joint classes.
- 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, Bronfman 103

Professor Steven Miller (sjml AT williams.edu), 202 Bronfman 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 Bronfman 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, VirginiaTech) 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-pUYFhnE>
- Video: Wed: Egg Drop Recurrence: <https://youtu.be/z9YmZXDe6Y>
- 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)

Bypasses permission issues....

## Implementation issues

- Will students watch it? Will the lectures be effective?
- Difference b/w upper level and lower level courses.
- Strength liberal arts colleges knowing each other, lose greatly online.
- Technology failures (recording, wireless, uploading).
- *Course credit*: faculty/registrar issues.
- *Offerings*: Will other schools offer classes?

## Equipment

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- iPad mini and swivl system with tripod.



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**Figure:** Video (go to 4:16):

<https://youtu.be/TGJtH7K-mXs>.

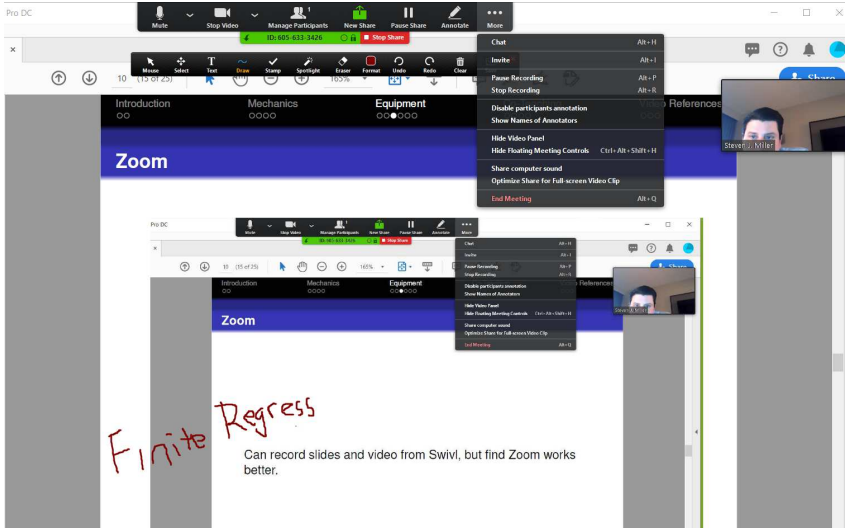
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- iPad mini and swivl system with tripod.
- Microsoft Surface.



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

# Zoom



## 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!

## Technology issues

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

## Co-Teaching

## Data Science Class: <https://lacol.net/critical-ds/>

Huge need for statistics / programming.

Co-taught summer Data Science Class.

Multiple teachers at several institutions.

- Jingchen (Monika) Hu (Vassar)
- Moataz Khalifa (Washington and Lee University)
- Steven J. Miller (Williams)
- Ella Foster-Molina (Swarthmore)
- Natalia Toporikova (Washington and Lee University)

## Pros

Only have to do part of the class, can focus on what you love.

Had a great administrative coordinator, Liz Evans.

Cheaper as do not need a full FTE.

Can expand each year.

In summer, so some freedom in when you are “on”.

Can target different sectors (some schools opened to all, some to students with course deficiencies).

Don't reinvent the wheel - lot of great resources exist.

## Cons

Do not get to know students as well.

Asynchronous cuts down on interactions, but had common online office hours.

Some schools only let certain students take.

Fear of replacing FTE's with online courses...?

## 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: Discussess 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=aMorr1h4Egs>.
  - ◇ 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).