

# Presentation of the Major in Mathematical Sciences

FALL 2021



# What do Mathematicians Do?

“The universe cannot be read until we have learned the language and become familiar with the characters in which it is written. It is written in mathematical language, and the letters are triangles, circles and other geometrical figures, without which means it is humanly impossible to comprehend a single word. Without these, one is wandering about in a dark labyrinth”

Galileo Galilei (1564-1642)

Mathematics is a profoundly human Endeavor. It reflects a need we have as a species. Through their work, Mathematicians build a language that allows us to experience in a quantitative and self consistent fashion the complexity of nature. The language is used by Physicists, Engineers, Economists,...

# Why study Mathematics?

- Because you are drawn to logical analysis, patterns and structure.
- Because it is a powerful and beautiful language that can be used to model and predict systems from biology, physics, engineering, ...
- Because it opens up a wide range of appealing job opportunities...

# Where do Smith Math Major graduates work

evolve24

Twilio Inc.

Google

City Year (Americorps)

Hospice of the Fisher Home (nursing)

Aetna / CVS Health

World Bank Group

Xerox

Spotify

Public Financial Management

Liberty Mutual Insurance

MassMutual

Morgan Stanley

Center for Computing Sciences/IDA

# Where do Smith Math Majors have gone for graduate school

- Brown
- University of Washington
- Rice
- Brandeis
- Emory
- Cornell
- Dartmouth
- Duke
- Minnesota
- North Carolina State

# Wall Street Journal Article

## 2014 Ranking of the Best and Worst Jobs

### 1. MATHEMATICIAN

Applies mathematical theories and formulas to teach or solve problems in a business, educational, or industrial climate.

### 3. STATISTICIAN

Tabulates, analyzes, and interprets the numeric results of experiments and surveys.

### 4. ACTUARY

Interprets statistics to determine probabilities of accidents, sickness, death, & property loss from theft & natural disasters.

# Where do Mathematicians Work?

- Arts, entertainment, and recreation
- Education
- Finance and insurance
- Government
- Health care and social assistance
- Information technology
- Legal services
- Management of companies & enterprises
- Manufacturing
- Nonprofit
- Other science and technology
- Retail trade
- Transportation & warehousing
- Utilities

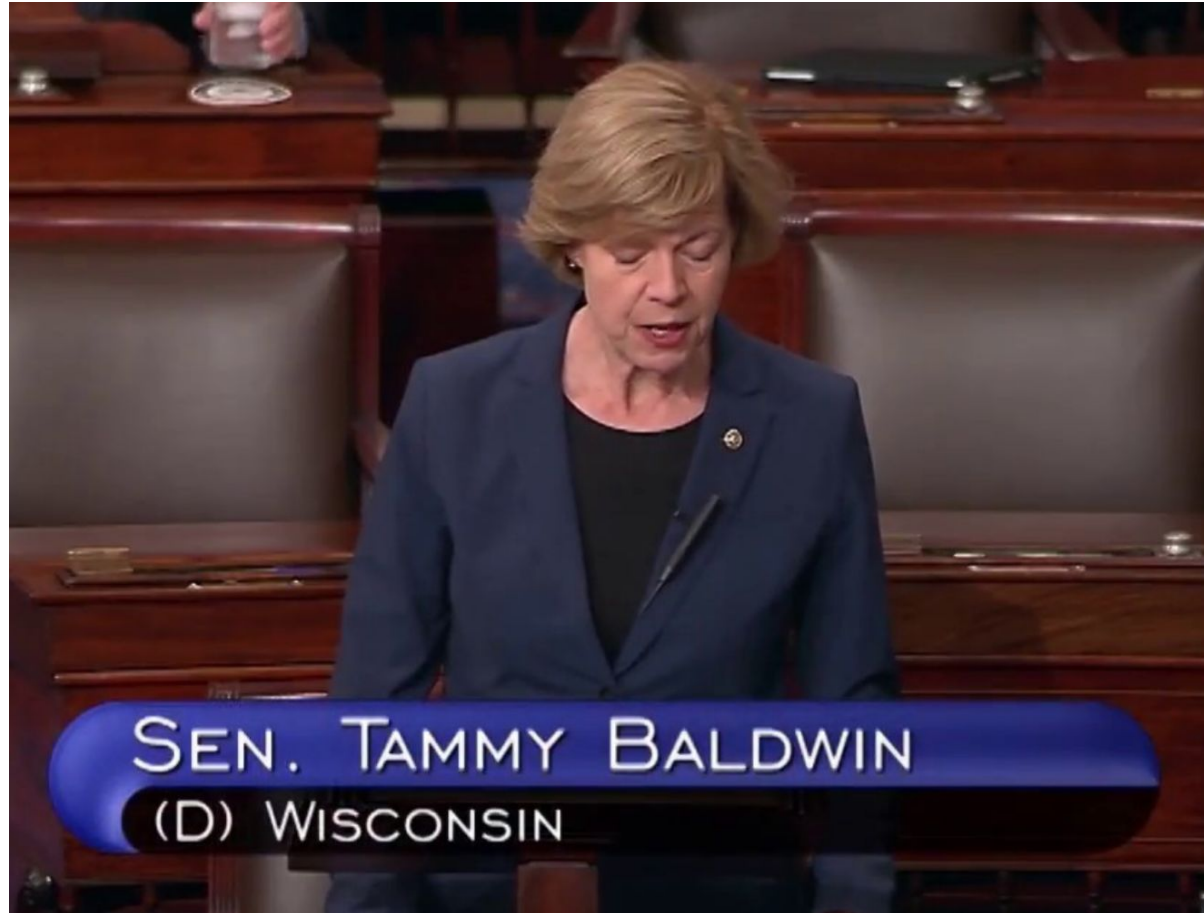
<http://www.ams.org/early-careers/>



AMS

American Mathematical Society

# Careers in government!



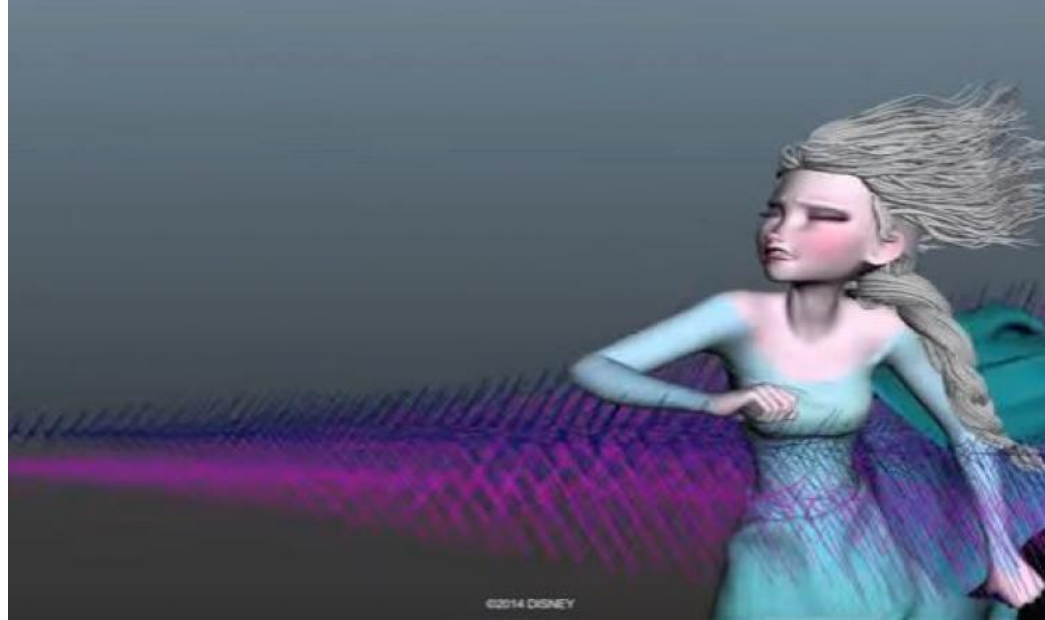
Tammy Baldwin, Math Major, Smith class of 1984



# Mathematical Models for Global Warming



# Mathematics in Entertainment



Alex McAdams, a mathematician working at Disney Studios used math modeling and computational physics to do realistic hair simulations in the movies Tangled and Frozen

# A History of Inclusion and Excellence...

## Euphemia Haynes

Was the first African-American woman to receive a doctoral degree in mathematics (PhD Catholic University of the Americas, 1943).

Se was a Math Major at Smith, class of 1914.



## Evelyn Boyd Granville

Was the second [African-American](#) woman to receive a [Ph.D.](#) in [mathematics](#) from a US University (PhD 1949 Yale).

She was a Math Major at Smith, class of 1945.

Her research was in the field of computing

## ...Continuing to Today

- Center for Women in Mathematics
- Women in Math in New England
- Postbacc program@Smith
- Calculus Training Group program
- Inclusive Active Learning and Curriculum development
- Ongoing department conversations about DEI at Smith and beyond
- AEMES program
- STRIDE program
- McKinley fellowships
- Science Center Committee on Diversity (SCCD)

# Common double majors with Math

**Computer  
Science**

CSC 250, 252

**Economics**

Study Abroad

Grad School

**Statistics and  
Data Science**

Grad School  
Actuary

**Biology**

Math Bio Cert.  
Modeling Courses

**Neuroscience**

Stats + Modeling  
Research

# Requirements for the minors

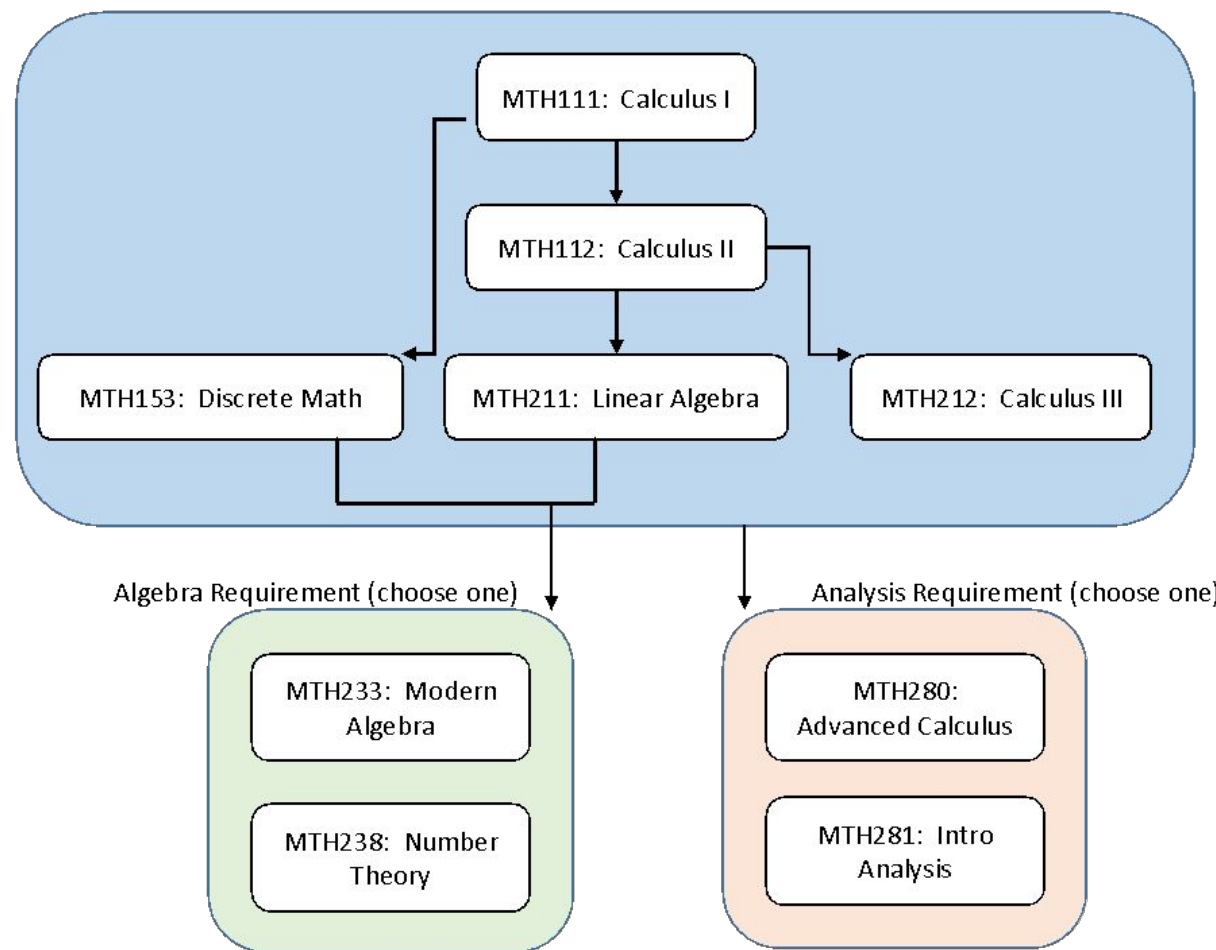
- Math Minor:  
MTH 211 (Linear Algebra) and 16 credits taken from among the following: MTH 153 (Discrete), MTH 205 (Modeling), and courses numbered above MTH 211, including two courses numbered at or above MTH/SDS 220 (Stats).
- Applied statistics minor in the Program of Statistics and Data Science
- Consists of five courses: introductory statistics (SDS220), plus two intermediate statistics classes two (or more) courses from an approved list.

# Menu of Math Majors

- Classic Mathematics Major
- New: joint SDS/MTH major in Mathematical Statistics (S '22)
- Spoiler: Applied Math Track in the Mathematics Major? (soon...)



Foundation Requirements (take all)



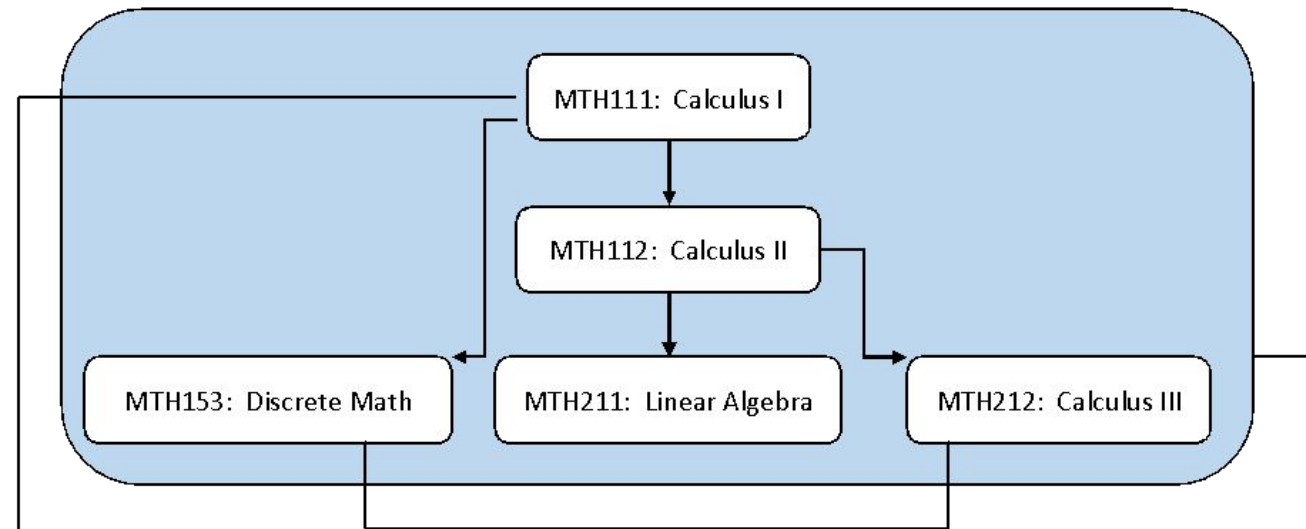
Depth Requirement: At least one course numbered MTH310-390

Credit Requirement: A total of 36 credits numbered 153 or above is required for the major\*

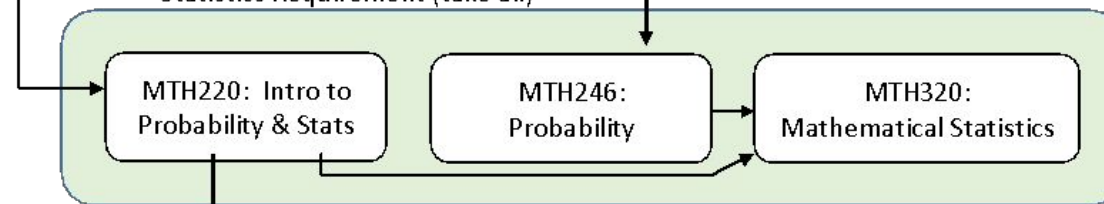
\*With approval of the department, up to 8 of the credits may be satisfied by courses containing significant mathematical or statistical content taken outside of the MTH department. Generally such a 4-credit course will be given 2 credits towards the major.



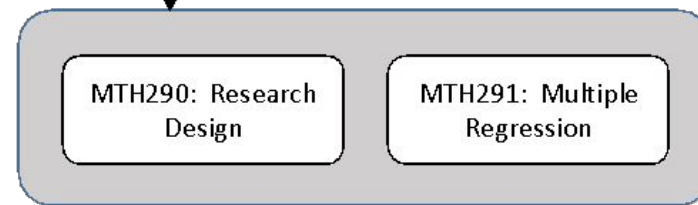
Foundation Requirements (take all)



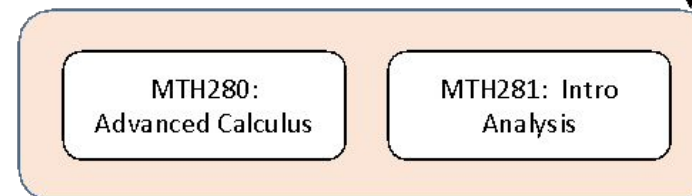
Statistics Requirement (take all)



Statistics Option (choose one)

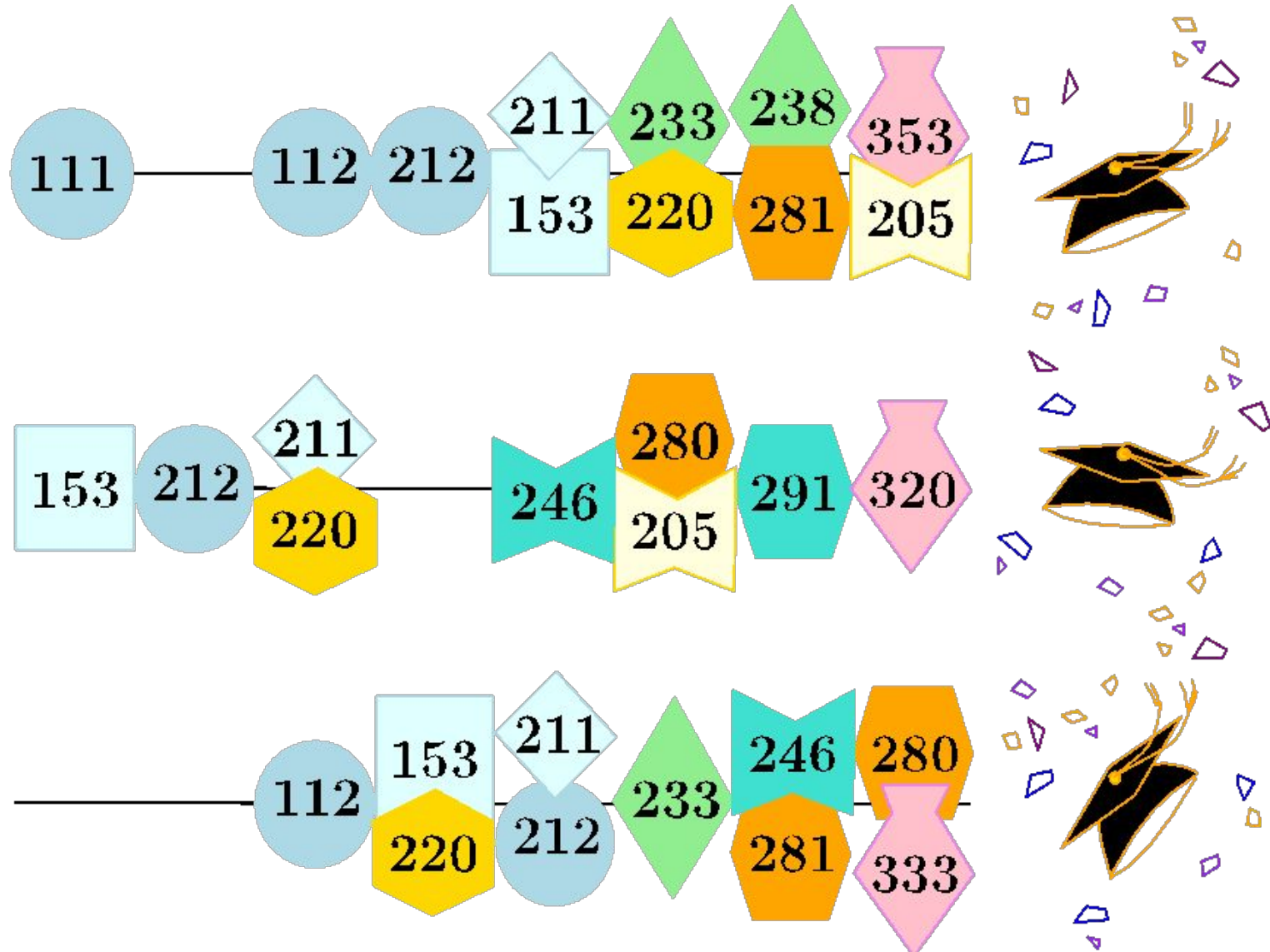


Analysis Requirement (choose one)



Credit Requirement: A total of 36 credits numbered 153 or above is required for the major\*

A Major in Mathematics is very flexible!



## Biomathematical Sciences: 5 College Certificate

- Integrates Math, Stats, Comp Science and Engineering with Bio, Biochem and Neuroscience.
  - A gateway course (MTH 205 Modeling in the Sciences or other such courses in the 5 Colleges)
  - Four electives in bio sciences (if you're a math major)
  - One research experience
  - A capstone experience (a biomath oriented 3XX course or a thesis)
  - Students normally apply in their sophomore year
- <https://www.fivecolleges.edu/biomathematics>
- Contact person: Dr. Gole

## It Helps to Start Planning Early!



Frequency of Offerings (rule of thumb):

- **Both semesters:** Calc I, II, III (111, 112, 212), Discrete 153, Linear Algebra 211, Prob & Stats 220, Regression SDS 291, Dialogue + Topics: research 300/301
- **Fall:** Number Theory 238, Probability 246, Differential Equations 264, Analysis 281, two 3XX (one applied the other theoretical)
- **Spring:** Modeling 205, Modern Algebra 233, Advanced Calc 280, Math Stats 320 and two other 3XX (one applied the other theoretical) (Spring 22: Partial Differential Equations 364, Advanced Linear Algebra 333)
- **Every Other Year:** Complex Analysis 282, Geometry 270, Combinatorics 254, Graph Theory 255

Class offerings			
Class #	Name	Spring 22	Fall 22
111	Calculus I	✓	✓
112	Calculus II	✓	✓
153	Discrete Math	✓	✓
205 (MTH/CSC)	Modeling in Sciences	✓	
211	Linear Algebra	✓	✓
212	Calculus III	✓	✓
220 (SDS)	Proba & Stats	✓	✓
233	Modern Algebra	✓	
238	Number Theory		✓
246	Probability		✓
254	Combinatorics	23	
255	Graph Theory	✓	
264	Differential Equations		✓
270	Geometry	22	
280	Advanced Calculus	✓	
281	Intro Real Analysis		✓
282 (New!)	Complex Analysis	23?	
290 (SDS)	Research Design	✓	
291 (SDS)	Multiple Regression	✓	✓
300	Dialogue	✓	✓
301	Topics: Research	✓	✓
320 (MTH/SDS)	Math Stats	✓	
325 IDP	Math Studio	✓	
333	Adv. Algebra	Adv Linear Alg.	TBD
353	Topics Applied Discr.		TBD
364	Topics Applied Conts	PDE	TBD
370	Topics Geom/Topo		TBD
381	Topics Analysis		TBD



: Every such semester

Some courses from other depts. count for 2 or 4 CR. See catalogue

Normally: 320 every spring, and two other 3XX each semester: one applied one theoretical

## Study Abroad:

- Take math classes in another language? (e.g Sciences `a Paris: 1-2 year French)
- Take no math classes abroad? (many programs)
- A study abroad program that is math intensive? (Budapest, Moscow - In English)

## Externally funded Research opportunities with Math faculty

Patricia Cahn: National Science Foundation - "Data-Driven Methods in Classical Knot Theory", 2018-2022. The goal is to use computer experimentation to study invariants of knots, with applications to 4-dimensional topology.

Luca Capogna: National Science Foundation – “Applications of Quasiconformal Geometry and Partial Differential Equations” 2020-2023. The goal is to explore properties of solutions of partial differential equations to study certain problems in geometry.

Candice Price – National Science Foundation - “DNA Knot Shadows Exploration”, 2022-2024. The goal is to use combinatorial tools to study projections of DNA knots.

Julianna Tymoczko – National Science Foundation - “Combinatorial Group Actions and Applications to Geometry, Knot Theory, and Representation Theory”, 2021-2024. The project studies group actions using combinatorial tools such as graphs and tableaux in order to characterize their underlying algebraic structures.

**Math Research: At Smith: MTH 301, SURF and more.  
Outside Smith: REU and Internship Applications**

[https://www.nsf.gov/crssprgm/reu/list\\_result.jsp?unitid=5044](https://www.nsf.gov/crssprgm/reu/list_result.jsp?unitid=5044)

# Choosing an advisor

**Possible Math Advisors:** Pau Atela, Jennifer Beichman, Patricia Cahn (sabbatical S23), Luca Capogna, Christophe Golé, Rajan Mehta (sabbatical 22-23), Candice Price, Geremias Polanco, Daniel Schultheis, Julianna Tymoczko, and also Benjamin Baumer (SDS), Ileana Streinu (CSC).



## More ways to connect

- Jobs! Graders and QM Tutors - sign up if interested!
- Putnam team! Contact Dr. Cahn and Dr. Polanco
- Thursday Lunch Talks!  
Talks about different cool math topics, pure or applied, as well as career oriented.
- Center for Women in Math: Postbacc program & WIMIN and SURF, Special Studies, McKinley Fellowship, etc.
- T-Shirt design contest for the Smith Math Major Official T-Shirts!!!