

An overview of graduate programs in the
mathematical sciences at Arizona

Department of Mathematics
Program in Applied Mathematics
University of Arizona



Overview

- Degrees
- Details of PhD programs
- Funding
- Inputs
- Outputs

Degrees

- 3 closely related PhD programs:
 - Math (Math dept)
 - Math education (Math dept)
 - Applied Math (GIDP in Applied Math)
 - (Stats coming soon)
- Several MS/MA/MS-MBA/PSM programs

Overall structure of our PhD programs

- First year: rigorous fixed core curriculum ending with qualifying exams
- Years 2 and 3: advanced course work, research tutorial group, seminar attendance leading to comprehensive (oral and written) exam
- Years 4 and 5: dissertation research and writing

Core curriculum

- In Math:
 - Algebra (Lang or Rotman)
 - Analysis (Folland, Royden, or Faris notes)
 - Topology-Geometry (Lee + Massey)

Core curriculum

- In Applied Math:
 - Analysis (Flaschka notes)
 - Methods (Tabor & Faris notes)
 - Numerical Analysis (Trefethen)

Additional first-year support

- In Math: pre-first year “integration workshop” reviews material, builds relationships
- In Applied Math: first-year, lab-based professional skills course builds communication, data analysis skills
- Both programs offer term paper options in core courses: another way for students to show their capabilities

Qual outcomes

- High pass or PhD pass \Rightarrow on to advanced coursework
- Pass or MS pass \Rightarrow in Math, write MS thesis, possible re-entry PhD program. In Applied Math, terminal MS
- Qual evaluation looks at all available info: RTG, term papers, etc.

Research tutorial group

- In both programs, an early research experience individually or in small teams
- 3 units of credit
- Output is a paper and a short talk
- Main work is in the Fall of the second year

Advanced coursework

- There is a broad array of “post-core” courses: algebraic geometry, complex analysis, differential geometry, dynamical systems, functional analysis, Lie groups, mathematical physics, number theory, ODEs, PDEs, probability, statistics, stochastic processes
- Post-core students participate in the roughly 12 weekly seminars
- Students from both programs share many courses
- Math students take at least 2 outside courses, Applied Math students take 3-6

Later years

- Oral comp exam, usually in 3rd year
- Dissertation research and writing
 - Most Math students have advisors from math
 - About 1/2 of Applied Math students have advisors from other units (20 departments across campus)
- Average time to degree: 5-6 years

Professional development

- Extensive teacher training and supervision
- Opportunities to teach from trig through linear algebra and multivariable calculus
- Peer-mentoring/tutoring: super-TA, URA projects, summer program, HS workshops
- Internship opportunities (LANL, IBM, ...)
- Computing and communication skills built into program requirements

Variations

- 2-year core: students with less background are offered the chance to complete the core in two years. They might take “dual-numbered” (undergrad) course to fill in background
- MS degree: the Math program has the possibility for students with weaker qual performance to continue in PhD after writing an MS thesis. Applied Math gives a terminal, non-thesis MS.
- Math Ed: These students must pass the math quals (!), then continue with research in math education

Funding

- Essentially all students are funded. Most funding comes from Teaching Assistantships, Research Assistantships (from individual investigator grants), VIGRE and other training grants
- TA requires teach 9 hours per year (with full responsibility for classes of ~30)
- RA duties vary with sponsor
- VIGRE funding is awarded to a few first-year students and via a proposal system. VIGRE fellows must have a professional development activity

Inputs: statistics

- Math:
 - Accept 10-12 per year. Currently have 50 students, of which 5 MS, 3-4 Math Ed. Want more.
 - 35 US, 15 foreign. 34 male, 16 female. Of 35 US, currently only 2 are underrepresented minorities
- Applied Math:
 - Accept 8-10 per year. Currently have 41 students.
 - 31 US, 10 foreign. 22 male, 19 female. Of 31 US, currently 7 are underrepresented minorities

Inputs: ideal candidates (Math)

- Coursework: solid background comparable to our comprehensive option:
 - Full year of algebra (Gallian) and analysis (baby Rudin)
 - Ideally also complex (C&B, Marsden) and advanced linear algebra (FI&S, Strang)
- Some independent work: REU, senior thesis, ...
- Test scores: no cut off, but useful in normalizing grades from schools we are not acquainted with yet.
- Evidence of maturity in statement

Inputs: ideal candidates (Applied Math)

- BS or MS in mathematics, physical, and engineering sciences, or with double major in math and another field
- Course work - strong record in at least 2 of:
 - analysis (Fitzpatrick, Wade)
 - methods (Kreyszig)
 - computational science (Matlab and Mathematica)
- Some undergraduate research experience
- Evidence of interdisciplinary interests

Outputs

- 1/2 to 2/3 of admitted students get a PhD. Recent years at high end.
- Placement:
 - academia: Tenure track (Res I, MS, and Bachelors), Post-docs (universities and institutes). 2/3 of graduates
 - labs (LANL, Sandia, LBL), government (FDA, EPA, NSA),
 - industry (Entelos, Honeywell, Samsung, Premera Blue Cross, Rincon Research, Raytheon, IBM)