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 => on to advanced coursework

• Pass or MS pass => 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
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 (Fl&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 1, 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)