Statement on Teaching and Other Non-Research Activities

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K-12 Outreach

Since 1996 I have been working with Dr. Michael Poliakoff, Deputy Secretary of Education in the Commonwealth of Pennsylvania, on a variety of projects to improve mathematics teaching in Pennsylvania. I have served as a resource person for the Governor's Institute for Mathematics Education and other panels and boards.

Scholarly Outreach

I have done a lot to bring my research area, mathematical logic and foundations of mathematics, to the public. My expository article *Logic and Mathematics*[1] is intended for the general reader and will soon be published by the Book-of-the-Month Club. My recently published book *Subsystems of Second Order Arithmetic*[2] is widely regarded as a milestone in foundations of mathematics. I run the Penn State Logic Seminar[3]. Since 1997 I have been running the FOM list[4], an important scholarly resource in foundations of mathematics. This mailing list is very active, with more than 400 subscribers including some of the best known researchers. In March 2000 I did a talk-radio interview on Gödel's theorem for the Prodos radio show[5] in Melbourne, Australia.

*http://www.math.psu.edu/simpson/
[1]http://www.math.psu.edu/simpson/papers/philmath/
[2]http://www.math.psu.edu/simpson/sosoa/
[3]http://www.math.psu.edu/simpson/logic/seminar/
[4]http://www.math.psu.edu/simpson/fom/
[5]http://www.prodos.com

Computer System

On the Penn State Mathematics Department computer system, I maintain some important user software including TeX/LaTeX[6], Emacs[7], and foreign language software[8]. I have also helped to develop an extensive on-line User's Guide[9].

Teaching

I am a committed and dedicated teacher of mathematics. I especially enjoy teaching calculus classes, and I believe I am successful in communicating my high enthusiasm for the subject. For several years I was the coordinator of approximately 10 sections of one of our calculus courses, Math 230.

I routinely make my lecture notes and other class materials available on the web[10]. Over the last few years I have developed a graph theory course, wherein I use the Maple symbolic mathematics package for demonstrations and projects in our web-enabled classrooms. I have also used a web-enabled classroom to teach an advanced graduate topics course on lambda calculus and the theory of programming languages.

Because the Department of Mathematics at Penn State University is very large and diverse, the majority of my advanced undergraduate teaching and all of my graduate teaching has been in the area of my research specialty, mathematical logic and foundations of mathematics. However, I am also quite able and happy to teach courses in many other areas of mathematics, including any standard undergraduate and beginning graduate course. I would particularly welcome opportunities to teach courses in calculus, ordinary and partial differential equations, differential geometry, algebra, combinatorics, computational complexity, and formal languages.

Courses Taught at Penn State University

Beginning Undergraduate

- Math 140. Calculus with Analytic Geometry I (4 credits). Functions; limits; analytic geometry; derivatives, differentials, applications; integrals, applications.
- Math 141. Calculus with Analytic Geometry II (4 credits). Derivatives, integrals, applications; sequences and series; analytic geometry; polar coordinates. Prerequisite: Math 140.
- Math 230. Calculus and Vector Analysis (4 credits). Three-dimensional analytic geometry; vectors in space; partial differentiation; double and triple integrals; integral vector calculus. Prerequisite: Math 141.

[6] http://www.math.psu.edu/guide/texlatex.html
[7] http://www.math.psu.edu/guide/emacs.html
[8] http://www.math.psu.edu/guide/foreign.html
[9] http://www.math.psu.edu/guide/
[10] http://www.math.psu.edu/simpson/courses/

- Math 250. Ordinary Differential Equations (3 credits). First- and second-order equations; numerical methods; special functions; Laplace transform solutions; higher order equations. Prerequisite: Math 141.

- Math 251. Ordinary and Partial Differential Equations (4 credits). First- and second-order equations; special functions; Laplace transform solutions; higher order equations; Fourier series; partial differential equations. Prerequisite: Math 141.

Advanced Undergraduate

- Math 411. Ordinary Differential Equations (3 credits). Linear ordinary differential equations; existence and uniqueness questions; series solutions; special functions; eigenvalue problems; Laplace transforms; additional topics and applications. Prerequisites: Math 230; Math 250 or 251.

- Math 412. Fourier Series and Partial Differential Equations (3 credits). Orthogonal systems and Fourier series; derivation and classification of partial differential equations; eigenvalue function method and its applications; additional topics. Prerequisites: Math 230; Math 250 or 251.

- Math 421. Complex Analysis (3 credits). Infinite sequences and series; algebra and geometry of complex numbers; analytic functions; integration; power series; residue calculus; conformal mapping, applications. Prerequisites: Math 230; Math 401 or 403.

- Math 457. Introduction to Mathematical Logic (3 credits). Propositional logic, first-order predicate logic, axioms and rule of inference, structures, models, definability, completeness, compactness. Prerequisites: Math 311.

- Math 459. Computability and Unsolvability (3 credits). An introduction to the theory of recursive functions; solvable and unsolvable decision problems; applications. Prerequisite: Math 311.

- Math 485. Graph Theory (3 credits). Introduction to the theory and applications of graphs and directed graphs. Emphasis on the fundamental theorems and their proofs. Prerequisite: Math 311.

Graduate

- Math 557. Mathematical Logic (3 credits). The predicate calculus. Completeness and compactness. Gdel's first and second incompleteness theorems. Introduction to model theory. Introduction to proof theory. Prerequisite: Math 435 or 457 or equivalent.

- Math 558. Foundations of Mathematics I (3 credits). Decidability of the real numbers. Computability. Undecidability of the natural numbers. Models of set theory. Axiom of choice. Continuum hypothesis. Prerequisite: any 400-level Math course or equivalent.

- Math 559-560. Recursion Theory I, II (3 credits each). Recursive functions; degrees of unsolvability. Hyperarithmetic theory; applications to Borel combinatorics. Computational complexity. Combinatory logic and the lambda calculus. Prerequisite: Math 459 or 557 or 558.

- Math 561-562. Set Theory I, II (3 credits each). Models of set theory. Inner models, forcing, large cardinals, determinacy. Descriptive set theory. Applications to analysis. Prerequisite: Math 557 or 558.

- Math 563-564. Model Theory I, II (3 credits each). Interpolation and definability. Prime and saturated models. Stability. Additional topics. Applications to algebra. Prerequisite: Math 557.

- Math 565. Foundations of Mathematics II (3 credits). Subsystems of second order arithmetic. Set existence axioms. Reverse mathematics. Foundations of analysis and algebra. Prerequisite: Math 557 and 558.

- Math 574. Topics in Logic and Foundations (3-6 credits; may be taken repeatedly). Topics in mathematical logic and the foundations of mathematics. Prerequisite: Math 558.