Philosophy of Mathematics:
Philosophy 43906
Curtis Franks

CONTACT INFORMATION

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THIS COURSE

In this seminar, we attend to crucial moments in the history of mathematics when new techniques of proof and construction were introduced, mathematical thought annexed new sorts of problems, and abstractions of various sorts arose. We hope to understand some of the scientific and aesthetic factors that have shaped mathematics up to the modern era. In the first part of the course, we will study some classic mathematical manuscripts and also some classic expository writing wherein mathematicians articulate their motivations and misgivings. Later in the course, we will study some retrospective work by prominent contemporary mathematicians, historians, and philosophers.

Although we will focus on events and particular results, and while our interest is philosophical, neither mathematical expertise nor philosophical training is assumed. Students with solid background in any one of (1) the history of European philosophy, (2) basic modern algebra or analysis, (3) the history or philosophy of science, or (4) the sociology of intellectual culture, each would have a valuable framework from which to approach our readings and contribute to our discussions.

REQUIREMENTS

There will be some lecturing, some discussion. Students seeking a grade are expected to participate actively in discussions and also write three short papers, drawing on the details of some actual mathematics (results or cultural trends), in support of some claim or in the service of some observation about one of the areas outlined above. The seminar will read one another's papers and provide comments on them in the course of our discussions. At the end of the term, everyone seeking a grade will submit one of their three papers, revised and perhaps expanded in light of our comments and discussion.

READINGS

For the first several weeks we will read historical papers. Most of these are found in the two volume sourcebook *Ewald 1996*. Simultaneously, we will read chapters from *Kline 1972*, in order to be familiar with the relevant mathematical climate. In the latter weeks we will read contemporary papers, either more critical histories than one finds in Kline or more self-consciously philosophical writing. The list below is a projected schedule of weekly readings.

1. Kline, chapter 26. George Berkeley, "Of infinities" and "The analyst." Colin MacLaurin, "A treatise of fluxions" (in part)

2. Bernard Bolzano, "Contributions to a better-grounded presentation of mathematics," "Purely analytic proof of the theorem that between any two values which give results of opposite sign there lies at least one real root of the equation," "Paradoxes of the infinite" (in part).

3. Kline, chapters 31 and 32. Carl Friedrich Gauss, "Notice on the theory of biquadratic residues." Duncan Gregory, "On the real nature of symbolical algebra." Augustus de Morgan, "On the foundation of algebra." William Rowan Hamilton, the preface to the "Lecture on Quaternions."

4. James Joseph Sylvester, presidential address to the British Association. Arthur Cayley, presidential address to the British Association. Charles Sanders Peirce, "The simplest mathematics" (in part).

5. Kline, chapters 36, 37, and 38. G. F. B. Riemann, "On the hypotheses which lie at the foundation of geometry." Hermann von Helmholtz, "The origin and meaning of geometrical axioms," "Numbering and measuring from an epistemological point of view."

6. Kline, chapters 41, 42, and 43. Richard Dedekind, "On the introduction of new functions in mathematics," "Was sind und was sollen die Zahlen?"

7. Georg Cantor, "On a property of the set of real algebraic numbers," "Foundation of a general theory of manifolds: a mathematico-philosophical investigation into the theory of the infinite."

8. Felix Klein, "On the mathematical character of space-intuition and the relation of pure matheamtics to the applied sciences," "The arithmetizing of mathematics." "Felix Klein and his 'Erlanger Program'," by Birkhoff and Bennett.

9. Henri Poincaré, "On the nautre of mathematical reasoning," "On the foundations of geometry," "Intuition and logic in mathematics." "Poincaré against the logicists," by Goldfarb.

10. Kline, chapter 51. David Hilbert, "Axiomatic thought," "The new grounding of mathematics: first report."

11. L. E. J. Brouwer, "Mathematics, science, and language," "Historical background, principles, and methods of intuitionism."

12. Kline, chapters 49 and 50. "Emmy Noether's 'set-theoretic' topology: from Dedikend to the rise of functors," by McLarty. "A path to the epistemology of mathematics: homotopy theory," by Marquis.

13. "The cultural basis of mathematics," by Wilder. "Is mathematical truth time-dependent?" by Gabiner. "On proof and progress in mathematics," by Thurston. "Modern mathematics as a cultural phenomenon," by Gray.

14. "Generaliziation, specialization, analogy," by Polya. "What does a mathematical proof prove?" by Lakatos.

NOTE

Please be aware of the University's policies regarding academic honesty, anti-discrimination, and access to education for students with disabilities.

Here is the web-page of the office for students with disabilities:

`http://www.nd.edu/~osd/NEWHOMEPAGE.htm`

Here is the Philosophy Department's web-page devoted to academic honesty, with links to information about plagiarism and the University's honor code:

`http://philosophy.nd.edu/undergraduate-program/honesty/`

In addition I am someone you can approach if you have concerns about discrimination or proper scholarly behavior, whether or not the concern is related to this course.

IMPORTANT DATES

March 8	no class	Purim
March 13	no class	spring break
March 15	no class	spring break
April 10	no class	Passover
April 12	no class	Passover
May 10	10:30am	final exam (due)