Suggested Paper Topics

1. Philosophy of mathematics, and the nature of mathematical truth and thinking, as considered in the writings of (for example) Plato, Aristotle, Pascal, Descartes, Berkeley, Bertrand Russell, A. N. Whitehead, Ludwig Wittgenstein, L. E. J. Brouwer, Kurt Gödel, G. H. Hardy, David Hilbert. Or: the philosophical controversies surrounding: infinite sets, the idea of the limit, the Axiom of Choice, constructive mathematics, undecidability, computability. (Does the demand for rigor retard or stimulate mathematical discovery?)

2. The development of important mathematical concepts: continuity; the integral; the real numbers; statistical independence.

3. Mathematics and society: Ronald Fisher (the founder of the modern science of statistics); John Maynard Keynes (economist and mathematician; he worked on probability theory); George Gallup (invented modern opinion polling); insurance (how are premiums computed?); epidemiology (the government says that 350,000 people die from smoking-related causes every year—where do they get that figure?); mathematical language (why are number words basically unrelated to others? why do we say “third,” “fourth,” and “fifth,” but not “oneth” or “twoth”?).


5. Mathematics and technology: Denis Gabor and holography; Claude Shannon and information theory; Norbert Wiener and cybernetics; John von Neumann and several things (digital computers, quantum mechanics, game theory); James Clerk Maxwell and electromagnetism; Alan Turing and computers (also cryptography).

6. The teaching of mathematics: How was it taught—and what was taught—in ancient Greece, medieval India, Renaissance Italy, one-room schoolhouses, etc.?

7. Puzzles and fun: John H. Conway’s Game of Life; Sam Lloyd’s “Get off the Earth” and variations (see Martin Gardner’s Mathematics, Magic, and Mystery); logic puzzles (such as the “Liar” paradox—see Raymond Smullyan’s What is the Name of this Book? for a good bundle of puzzles); Lewis Carroll’s many mathematical recreations.

8. Celebrated problems: angle trisection; circle squaring; cube doubling; construction of regular polygons; computing the digits of \( \pi \); the Riemann Hypothesis; Goldbach’s Conjecture; Fermat’s Last Theorem. This list also includes math-related problems in the other sciences and in engineering: the discovery of Neptune; the construction of sundials; efforts to determine longitude at sea; ballistics.

9. Talented outsiders: N. Bowditch (American navigator); S. Ramanujan (Indian number theorist).

Don’t let the list limit you. (A student once wrote an excellent paper on the geometry of medieval church windows.) Try to surprise me! However, I strongly urge you to discuss your paper topics with me before beginning your research.