A Course on Mathematics and the Christian Faith

W. David Laverell and Carl J. Sinke

The January interim term at Calvin College provides an opportunity for developing and teaching courses outside a normal major program. As a result faculty members are frequently given the interim off to provide time for research and development of new courses. In 1987 we were given such a leave in order to pursue the question of the relationship between mathematics and the Christian Faith. One result was our presentation at the 1987 *Association of Christians in the Mathematical Sciences* conference. Immediately thereafter we began to develop a specific interim course based on our studies. We offered the course during the 1988 interim, but it failed to achieve the required minimum enrollment because of a strategic blunder on our part. We did not think it necessary to have the course count in a major program and, quite honestly, feared that our department might not approve the course for such a purpose. With some modifications we proposed the course again for 1989, this time obtaining approval for including the course in a major program. This brought 15 students into the fold, about half of whom were in mathematics education. The others were mathematics majors except for one philosophy major and one computer science major.

The class met for two and a half hours each morning for three weeks with two days designated as reading days. Ordinarily, the first hour consisted of lectures on our part while the remaining time was devoted to discussion of the material for the day from the list of assigned readings. The main requirement was the preparation and presentation of a paper. These presentations occupied the last three days of the course.

Because of the nature of the usual undergraduate curriculum with its emphasis on the development of certain mathematical skills, even senior mathematics majors have often had little exposure to the areas of their discipline in which questions of philosophy and faith arise. As a result we felt we needed to spend a great deal of time developing a number of topics as background to our philosophical and theological considerations. We used our lecture time to make sure that our students were aware of such matters as non-euclidean geometry, logic and set theory, the development of the real number system from the set of natural numbers, Cantor's transfinite set theory with its mysteries, and Gödel's Theorem.

In choosing the readings we deliberately avoided emphasizing the traditional philosophy of mathematics. Instead most of the reading came from two books which call for a new approach. For financial reasons we required the students to purchase only the paperback edition of *The Mathematical Experience* by Philip J. Davis and Reuben Hersh.[1] We placed a copy of *New Directions in the Philosophy of Mathematics*[2] on reserve. The students found the latter to be much less accessible (both physically and academically) than the former. The reading list is included as appendix I, and a glance at its contents shows that several heavily philosophical articles are included. However, the main thrust is certainly in the Davis-Hersh direction. These authors believe that the search for foundations has not been meaningful for the working mathematician and that our philosophy ought to be more

[1] Boston: Houghton Mifflin, 1981.

[2] Tymoczko, Thomas, ed., Boston: Birkhäuser, 1986.

descriptive of what mathematicians actually do. As Christians who are uncomfortable with artificial separation in any area of life, we find this to be an intriguing idea which may give us greater opportunity to speak to mathematical issues than we have had up to now. We gave formal philosophy of mathematics somewhat short shrift because of our commitment to this approach. Our format for considering the assigned readings was one of general discussion. We tried quite hard to get the students to express their own views, but our efforts did not always meet with total success. The climax of this part of the course came when we presented the following nine propositions to the class for an informal vote:

1. The content of mathematics is well defined. The only difference one's faith makes is one's reaction to that content. For the unbeliever the reaction may be one of praise of self. For the believer the reaction should be that of praise and thanksgiving to God.
2. If the preceding is true, then Christian teachers of mathematics should punctuate their teaching with appropriate expressions of praise and thanksgiving. Beyond that there is little difference between the secular and the Christian mathematics classroom.
3. Mathematics is discovered, not invented. It is possible for us to discover it because it is somehow embedded in the created world, and God somehow allows us to be aware of mathematical concepts as He used them in creating the world.
4. Mathematics is invented, not discovered. What makes it possible for human beings to create mathematics is the fact that they are made in the image of God, and therefore have at least some ability to create new things such as mathematical concepts. The reason that mathematics done by a diversity of people is so consistent is that God makes all minds work the same way when it comes to doing mathematics.
5. It does not make sense to distinguish between invention and discovery in mathematics. There is, in the mathematical activity of the human mind, some of both going on. A person is able to perceive somehow the underlying mathematical order of the created world as given by God and is also able to extend these basic ideas in new and creative ways.
6. The world of mathematics is in fact a Platonic world of some kind, perhaps created by God in the same way He has made the world in which angels live. Since the scriptures do not tell us how this world was made, the Bible has little to tell us about mathematics as such. It only gives us guidelines as to how to live, including how we should use mathematics.
7. The Reformed perspective on the Christian Faith says that every area of life, including mathematical activity, is subject to God's sovereignty. Our main source of knowledge in this regard is the Bible. Hence, it is to the Bible that we must turn for light on the possibility of a distinctively Christian mathematics.
8. It is impossible for the secular mind to come to the truth in any significant way. In fact, for the most part the secular mind turns out untruth. Since most of mathematics has been done by secular minds, most of it is worthless. If mathematics were truly done from a Christian perspective, the results would be totally different. That is the task of the Christian mathematician - to find out what this

distinctively Christian mathematics is like.

9. Mathematics, from a Christian point of view, must be thought of as being very closely tied to created reality, which is finite. Even the grains of sand on the seashore, though quite numerous, are finite in number. So also the number of atoms in the created universe. Therefore, the Christian mathematician should ignore Cantor's speculative transfinite set theory.

This list, of course, is in no way exhaustive. Our purpose was to promote discussion on the part of the students, and here we were somewhat successful.

Having struggled at several points because of our student's reluctance to express themselves orally, we were not surprised that many of their papers exhibited an inability, or perhaps reluctance, to do so in writing. Some of the papers, although interesting, were rather mechanical and did not really attempt to come to grips with the issues raised during the course. Others, however, were quite good in this regard, and we wish to illustrate with several examples.

One student analyzed some materials published by an organization called the *American Reformation Movement*, which believes (among other things) that every mathematical principle must be shown to be derived from Biblical data. We know that $187 + 782 = 969$ because we find that calculation in scripture (Genesis 5:25-27). We are also told that mathematics must not be isolated from other subjects, must always be applied, and must deal with real problems from God's world. Our student's conclusion was that, "even though the whole idea can sound attractive because of the foundation on which it stands, there are problems and discrepancies that arise upon closer examination." "How does one arrive at integrals and derivatives purely through the Bible?" "Not every mathematical problem is stated as such in the Bible." "The Bible is the Word of God for the salvation of God's people - it is not a math book."

A second paper of particular interest explored the thinking of Mrs. A. R. Horton, the wife of the president of Pennsacola Christian College. She has great influence upon the *A Beka Books* curriculum which is used in Christian schools across the nation. The student found herself in basic agreement with Mrs. Horton's basic tenet that we must approach mathematics with the assumption that there is a God who has given us the ability to discover His universe, and that we see Him in His handiwork. Our student, however, was not willing to agree with the rejection of much of the content of the new mathematics of some years ago. In particular, Mrs. Horton rejects set theory as too abstract and theoretical and representing an improper use of mathematics to find the secret of the universe. Likewise, she believes that mathematics is in serious trouble because the introduction of non-euclidean geometry removes its foundations. Our student's reaction is, "I feel this is a wrong view in light of our place as believers in His created universe. We are fallen beings, but created in His image. I do not see our belief in God leading to such a narrow idea of what mathematics is all about."

A third student had a remarkably personal response to our course. "For as long as I can remember, I have always let my head rule over my heart. Reason and logic superceded emotion even as a young child." He admired mathematics for its logical structure, for its being "clean cut, right and wrong, with no room for error." His high school experience confirmed this view, but in college his study of philosophy of mathematics was devastating. "My 'perfect language' had paradoxes. ... My 'building' was crumbling on a weak foundation that was once solid. I now had to devise a philosophy of mathematics I could personally be comfortable with." Through the readings this student found himself quite comfortable with Hersh's culturalist view of mathematics with its emphasis on applications and on how we actually go about doing mathematics. "Math must have meaning, not be reduced to something cold, abstract, and arbitrary."

Student reaction to the course was very positive. They criticized us for leaving the discussion of mathematics and faith to the end of the course. They wished that we had spent more time in this area and that the time had been disbursed throughout the course. We plan to take this into account the next time we teach the course. However, we wanted to help the students formulate their own views rather than impose our views, and we feel strongly that a great deal of background is necessary before profitable discussion can take place.

We are not sure at this point what the impact of this course on our curriculum will be. The possiblility of requiring such a course of all majors is presently under consideration. Quite honestly, sentiments in our department are divided on this. In terms of the effects the course has had on us personally, we are more than ever committed to seeing a place for such a course. Perhaps the best approach would be to spread these considerations across the curriculum, but we all know the pressures of completing the syllabus in a given course.

Much as we appreciate the traditional philosophical approaches to foundations of mathematics, we are impressed with the potential and the opportunity the new directions approach gives. The realization that mathematics does not offer absolute reliability leaves a certain intellectual vacuum for some. This may lead to a despair that such certainty can be found anywhere. It is our responsibility to present the only true source of infallible truth and knowledge. After all, we always knew that certain forms of foundationalism were misguided.

Appendix I
Reading List
Reading List for Mathematics W50
January 1989

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The text for the course is Philip J. Davis and Reuben Hersh, *The Mathematical Experience*, Boston: Birkhauser, 1981 (reprinted in paperback by Houghton Mifflin). Although this whole book is of significance we have not assigned every article in it. By all means read as much of it as you can. This is to be regarded as a semi-final version of the reading list. There will be a few additions later, but they will be almost exclusively in section nine. Good reading!

Section One. The Current Situation.

1. Nicholas D. Goodman, "Mathematics as an Objective Science," Thomas Tymoczko, Ed., *New Directions in the Philosophy of Mathematics*, Boston: Birkhauser, 1985, p. 79. Also found in *American Mathematical Monthly*, August-September 1979, p. 540.
2. "The Euclid Myth," *Mathematical Experience*, p. 322.
3. "Foundations, Found and Lost," *Mathematical Experience*, p. 330.
4. "The Formalist Philosophy of Mathematics," *Mathematical Experience*, p. 339.
5. "Platonism, Formalism, and Constructivism," *Mathematical Experience*, p. 318.

Section Two. Where Did the Foundations Go.

1. Reuben Hersh, "Some Proposals for Reviving the Philosophy of Mathematics," *New Directions*, p. 9.
2. Hilary Putnam, "Mathematics Without Foundations," Paul Benacerraf and Hilary Putnam, Ed., *Philosophy of Mathematics, Second Edition,* Cambridge: Cambridge University Press, 1983, p. 295.
3. "The Philosophical Plight of the Working Mathematician," *Mathematical Experience*, p. 321.

Section Three. Existence Questions in Mathematics.

1. Paul Benacerraf, "What Numbers Could Not Be," *Philosophy of Mathematics*, p. 272.
2. "Mathematical Objects and Structures; Existence," *Mathematical Experience*, p. 140.

Section Four. Truth.

1. Hilary Putnam, "What is Mathematical Truth?", *New Directions*, p. 49. Also found in Hilary Putnam, *Mathematics: Matter and Method,* Cambridge: Cambridge University Press, 1975, p. 60.
2. Paul Benacerraf, "Mathematical Truth," *Philosophy of Mathematics*, p. 403.

Section Five. Voices Blowing in the Wind.

1. "Polya's Craft of Discovery," *Mathematical Experience*, p. 285.
2. "The Creation of New Mathematics," *Mathematical Experience*, p. 291.
3. George Polya, "From the Preface of *Induction and Analogy in Mathematics*," *New Directions*, p. 99.
4. George Polya, "Generalization, Specialization, and Analogy," *New Directions*, p. 103.
5. W. V. Quine, "Carnap and Logical Truth," *Philosophy of Mathematics*, p. 355.

Section Six. The Practice of Mathematics.

1. Hao Wang, "Theory and Practice in Mathematics," *New Directions*, p. 129.
2. Imre Lakatos, "What Does a Mathematical Proof Prove?" *New Directions*, p. 153.
3. "Proof," *Mathematical Experience*, p. 147.
4. Philip J. Davis, "Fidelity in Mathematical Discourse: Is One and One Really Two?" *New Directions*, p. 163. Also found in *American Mathematical Monthly*, March 1972, p. 252.
5. "The Ideal Mathematician," *Mathematical Experience*, p. 34.

Section Seven. Mathematics and Culture.

1. Raymond L. Wilder, "The Cultural Basis of Mathematics," *New Directions*, p. 185.
2. Judith V. Grabiner, "Is Mathematical Truth Time-Dependent?" *New Directions*, p. 201. Also *American Mathematical Monthly*, April 1974, p. 354.
3. Philip Kitcher, "Mathematical Change and Scientific Change," *New Directions*, p. 215.
4. "The Individual and The Culture," *Mathematical Experience*, p. 60.

Section Eight. Teaching Mathematics.

1. "Confessions of a Prep School Math Teacher," *Mathematical Experience*, p. 272.
2. "The Classic Classroom Crisis of Understanding and Pedagogy," *Mathematical Experience*, p. 274.
3. René Thom, "'Modern' Mathematics: An Educational and Philosophical Error?" *New Directions*, p. 67.

Section Nine. Religion and Mathematics.

1. "I. R. Shafarevitch and the New Neo-platonism," *Mathematical Experience*, p. 52.
2. "Unorthodoxies," *Mathematical Experience*, p. 55.
3. "Religion," *Mathematical Experience*, p. 108.
4. "Abstraction and Scholastic Theology," *Mathematical Experience*, p. 113.
5. "Platonic Mathematics Meets Platonic Philosophy of Religion: An Ethical Metaphor," Philip J. Davis and Reuben Hersh, *Descartes Dream,* Boston: Houghton Mifflin, 1986, p. 231.
6. Alfred Jules Ayer, "The *a priori*," *Philosophy of Mathematics*, p. 315.
7. W. David Laverell and Carl J. Sinke, "Observations on Mathematics and the Christian Faith," in Robert L. Brabenec, *A Sixth Conference on Mathematics From a Christian Perspective*.

Appendix II
Student Papers

Krischa Boonstra, "A Unique Philosophy of Mathematics." Based on a lecture given by Mrs. A. R. Horton of Pensacola Christian College.

Nellie Bouman, "How Does the Christian Faith Influence Mathematics?" Based on an article by Ralph Verno from our 1979 Proceedings.

Yvonne Carson, "Constructivism."

Philip deJong, "Nicholas of Cusa."

David Doorlag, "Artificial Intelligence."

Naomi Driscoll, "Presentation of *The Psychology of Invention in the Mathematical Field* by Jacques Hadamard."

Cheri Drukker, "The Life of Cantor."

Kristen W. Engelsma, "*The Bible*: A Mathbook?"

Brenden Kelly, "The Theory of Evolution and the Discovery of Non-Euclidean Geometry."

Steve Kroese, "Limits of Finite Systems."

A. Paul Nylaan, "Mathematics as Part of Human Culture."

Paula Pruis, "The Fourth Dimension and the Spiritual Realm." Based largely on *Flatland.*

Lisa M. Stob, "Christian Theology: The Influence of Mathematics Throughout the Centuries." Based on Grandville C. Henry, Jr.'s book, *Logos.*

Todd Veenstra, "Philosophies of Math and Missions: How Do They Interact?"

Ann Woodhull, "The 'New Math': An Old Failure?"