# Mathematics at Saint Michael's

A Guide for Students

## An Invitation

We asked some of our graduating seniors for their thoughts on the Mathematics major and how it met their expectations as an undergraduate at Saint Michael's College. Here are four recent responses:

- I feel that the faculty makes it a point to make sure students reach their fullest potential. This characteristic of the Mathematics Department vastly exceeded my expectations.
- The Mathematics Department has been extremely helpful to me as far as finding out what I want to do with my future. Faculty is always available to answer questions.
- The Math Dept. has exceeded my expectations in many ways – the support and advising from the faculty has been tremendous. The Math classes are also, by far, my most rigorous and demanding classes, and I have been extremely thankful for the opportunities over the years to be challenged, mentally. The support outside the classroom has also been great, whether it be summer plans, study abroad, or alumni contacts.
- The mathematics department has met my expectations in that I have received an excellent education in mathematics. Teachers were always available for extra help whenever I needed it. They were more than happy to answer questions and give advice.

If you enjoy working on mathematics, then please come join us and find out for yourself what the Mathematics Department can offer you. You can take more courses, sign up as a minor, and look into becoming a major. This guide will help you peruse our offerings. If you find something you might like, come in and ask any member of the Department about it. We'd love to talk to you!

## Our Program

The mathematics requirements have been set up to both ensure that you have a solid background, and allow you to explore your interests.

We have a backbone of required courses, most of which are full courses, so you will be strong in core mathematics. These courses include the calculus sequence, probability and statistics, introduction to proof, linear algebra, and abstract algebra/analysis. In addition to that, you will select some electives, so you can tailor your program to your taste. These electives allow you to explore a diversity of advanced topics. Some electives are differential equations, advanced statistics, history of mathematics, geometry, and more.

Here are the requirements for a major in mathematics at Saint Michael's:

| Mathematics course | Semester offered | Prerequisite |
|---|---|---|
| MA 160 Calculus II | Fall and Spring | MA 150 Calculus I or equivalent |
| MA 211 Calculus III | Fall and Spring | MA 160 Calculus II |
| MA 213 Linear Algebra | Fall | MA 160 Calculus II |
| MA 240 Introduction to Proof | Spring | MA 211 Calculus III |
| MA 251 Probability and Statistics | Spring | MA 160 Calculus II |
| MA 401 Real Analysis I or MA 406 Abstract Algebra I | Fall | MA 240 Introduction to Proof |
| One 400-level Elective course* | Fall and Spring | Depends upon course |
| Two Electives at 200-level or above** | Fall and Spring | Depends upon course |
| One Topics course at 300-level or above (half or full course) | Fall | Depends upon topic |
| Mathematics Seminar (half course) | Spring | Senior MA major or Permission of Instructor |
| CS 111 Introduction to Computer Science I | Fall | None |

## Consider the Minor

Almost any major is strengthened by a minor in mathematics. That's obvious for sciences, but majors in many other areas are also improved by the analytical sophistication our minor develops.

For instance, good M.B.A. schools expect students to know Calculus and Linear Algebra. A minor in math will help you get in, and help you succeed when you get there.

Some other majors that work well with a minor in math are economics, political science, biology, and computer science. If you are thinking about graduate school in one of those subjects, you should know that a minor in math may help you get financial support, because you'll be able to teach introductory math courses.

Many people don't realize how easily a minor fits their plans. Here are the requirements for a minor in mathematics:

Five math courses numbered at MA 150 and above, to include
both MA 211(Calculus III) and MA 213 (Linear Algebra)

Feel free to talk about this with your advisor or a faculty member in mathematics.

## Careers in Mathematics

We do mathematics because we like it. But isn't it nice to know you can be paid for it, too?

Sometimes people may say, "Sure, math is fun, but you can't do anything *with* it." Actually the opposite is true – in this technical world people have trouble doing anything without math.

For one thing, no scientific career can go far without good math abilities and skills. In business and economics, building even simple models takes a solid math base. And with computers appearing in almost every field, the mathematics needed to use them effectively is sure to gain importance.

We believe a background in mathematics will help a person master whatever new comes along in the forty years they will be in the work force.

Here's what some of the people we know in mathematics do.

### Industry

People certified in a series of exams to rate risks are called actuaries, and are highly valued by insurance companies. Mathematical modeling is an important part of any engineering analysis; we know people working on improving jet engines and in detecting distant underwater sound sources. Computer programming often needs the mathematically skilled – several people we know write software. Statistics are in ever-wider use and the statisticians to interpret them are in demand. For instance, biostatisticians are employed by many pharmaceutical firms. Some people use math as their pre-law or pre-med major (one of our students is now an optometrist). We even know people using mathematical models to predict what the stock market will do.

### Government

Here too, actuaries judge the risks and benefits of proposals. Of course, the government needs lots of statisticians. Another application is the optimization of complex projects – for instance, how many toll booths will suffice at the end of a new bridge, or how many people should be interviewed as prospective jurors to be fairly sure of getting at least twelve suitable? Some mathematicians are even at work cracking secret codes.

### Education

Many people in mathematics teach; the subject is fun to share. We find research fascinating, and in recent years several of our Saint Michael's students have gone on to graduate school and been awarded financial support from their school.

A final point: Please visit the Jobs Rated 2011 top 10 list, in which the top 5 jobs need advanced education in mathematics. This underlines our point – mathematics is not just fun, it is in demand!

# Course Descriptions

Here is both the catalog listing and an informal description of our offerings.

DEPARTMENT OF MATHEMATICS

ASHLINE, *CHAIR*; ELLIS-MONAGHAN, HEFFERON, KADAS, SIMONS, YATES

Mathematics has, for centuries, been the foundation and language of the physical sciences. In our time, mathematical models and tools have come to pervade the biological and social sciences as well. Mathematics is an art, apprehending and creating structure and order in the universe. Mathematics is intellectually stimulating because it demands clarity and precision. Consequently, the Mathematics Department believes that some understanding of Mathematics will enhance the study of every discipline, and offers courses at a variety of levels to help all students develop their skill in Mathematical reasoning.

The major is designed to encompass diverse goals ranging from applied work in science or industry to teaching or graduate study. The required courses provide a strong foundation in the principle areas of Mathematics; the electives offer an opportunity to tailor the program to individual needs. Students should consult an advisor in the Mathematics Department to design a program consistent with their aims.

Mathematics majors are attractive to a wide variety of business and industrial firms, especially if the major is combined with some coursework in computer science, a natural science, economics, or business; many find work in the actuarial field or as analysts in the computer or communications industry. Mathematics majors may prepare to teach at the secondary school or other levels by simultaneously completing Education courses, including a semester of student teaching, which leads to state certification.

The Mathematics major provides the background for graduate study in pure or applied mathematics or statistics. Combined with appropriate courses in other areas, the major may also be used to prepare for graduate or professional programs such as medical school, law school, or an MBA program.

*Major requirements: Mathematics 160, 211, 213, 240, 251, 380 (half), 401 or 406, 410 (half). Computer Science 111. Three mathematics electives at or above the 200 level, with at least one at the 400 level.*

*Minor requirements: Mathematics 211, 213, and three other mathematics courses, at or above MA 150*

**MA 104/105 Foundations for Calculus/Foundations for Calculus with Pre-Calculus Full/half courses**
Individually customized reviews of logarithms, exponentials, functions, graphing, polynomial and rational functions, conic sections, trigonometric functions and identities, limits, continuity and an introduction to derivatives.
*Open by permission of instructor only to students who will enroll or are enrolled in MA 130 or MA 150.*

MA 104 is a full course that covers more topics and at a slower pace than MA 105, which is a half course. MA104/105 do *not* satisfy the LSC Quantitative Requirement; they are intended only for students who need supplemental preparation for MA 130 or MA 150.

**MA 120 Elementary Statistics Full course**
Description of sample data; probability distributions including the Normal distribution; correlation and regression; sampling; hypothesis testing; statistical inference; other topics may include Chi-square tests, multiple regression, and ANOVA,
*Non-majors only.*

We have two different statistics courses, this one is not Calculus-based. It covers the basics of data analysis (for instance, mean and median, distributions, and hypothesis testing) at a descriptive level.

**MA 130 Elements of Calculus** **Full course**

A one-semester survey of calculus. Topics include limits, derivatives and the integral, with emphasis on applications. Not designed for those intending further study of calculus.

*Prerequisites: At least high school algebra and trigonometry; preferably pre-calculus. Credit will not be given for Mathematics 130 if credit has already been received for Mathematics 150.*

Calculus is offered with an emphasis on applying concepts to Business and Economics, and Biology and Ecology. Majors or minors should take Mathematics 150 instead of this course.

**MA 150 Calculus I** **Full course**

Differentiation and applications; transcendental functions; introduction to antiderivatives and the definite integral, including applications; Fundamental Theorem of Calculus.

*Prerequisites: Appropriate high school preparation, with at least pre-calculus.*

We focus on the derivative and the integral, including their geometric implications, and consider various applications of these important concepts.

Students with Calculus AP or college credit should begin in MA 160. Students completing a good high school Calculus course should take the Calculus Readiness test and consider signing up for MA 160.

**MA 160 Calculus II** **Full course**

Integration techniques and applications; sequences and series; plane analytic geometry including parametric curves; polar coordinates; space geometry including an introduction to vectors.

*Prerequisites: Mathematics 150, or permission of instructor.*

In the first part of the course, we focus on integration of various functions, with various techniques and applications. In the final part of the course, we consider infinite series, including convergence tests and series representations of functions, and an introduction to vectors.

Required of all majors and minors. First-year students having completed a good high school Calculus course should consider signing up for this course.

**MA 207 Discrete Mathematics** **Full course**

Propositional logic; sets, functions, relations; elementary combinatorics; techniques of mathematical proof, including induction; recurrence and recurrence relations. Emphasis on connections to computing.

*Prerequisites: Mathematics 150.*

Computer Science relies heavily on mathematical analysis. Deciding how fast a program runs, proving it always runs correctly, and defining what a computer program is, all rely on ideas from mathematics. We start with formal logic rules, show how they can be used to construct circuits, and see how to build any electronic digital computer. In an elementary number theory context, we practice advanced argument techniques used in proofs and apply them to Discrete Math topics, dealing mostly with integers.

Credit will not be given for both MA 207 and MA 240.

**MA 208 Theory of Computation** **Full course**

Primitive recursion and recursive functions; Turing machines; weaker computational models, including finite state machines and pushdown automata; regular expressions and Kleene's theorem; nondeterminism; Halting Problem and Rice's Theorem; NP completeness. Emphasis on conceptual overview of the role the topics play in computing.

*Prerequisites: Mathematics 207 or Mathematics 240.*

We study various models of computation, considering what they can and cannot compute.

Elective option for majors and minors.

**MA 211 Calculus III** **Full course**

Vector-valued functions; partial differentiation; multiple integrals and applications, line integrals; Green's Theorem and other vector calculus results.

*Prerequisites: Mathematics 160.*

The ideas of Calculus I and II are broadened and extended to several variables. For instance, in Calculus II we find the two-dimensional area of odd-shaped regions. Here we find three-dimensional volumes (and even volumes of higher-dimensional shapes). We also extend the concept of a derivative. While in the plane we use tangent lines, in three-space we study tangent planes.

Required of all majors and minors.

**MA 213 Linear Algebra** **Full course**

Systems of linear equations; vector spaces; linear independence and bases; linear maps; matrices; determinants; eigenvalues and eigenvectors; diagonalization.

*Prerequisites: Mathematics 211.*

In Calculus I, we sometimes work with a function's tangent lines instead of with the function itself. In Calculus III, in three dimensions we similarly use tangent planes, or the higher-dimensional analog, linear surfaces. The reason we study linear objects is because they are the easiest to understand. Here we study notion of linearity in greater depth.

Required of all majors and minors.

**MA 217 Applied Graph Theory** **Full course**

Graphs, networks, paths, trees, coloring, etc. in the context of current applications such as network connectivity, conflict scheduling, optimal workforce assignment, and DNA sequencing, as well as classical problems such as the Four Color Theorem. May also include related algorithms and special topics.

*Prerequisites: Mathematics 150, or permission of instructor.*

We focus on foundational concepts in Graph Theory, particularly how it can be used to model discrete and interconnectivity problems. There is an emphasis on entry-level experience in reading and writing mathematical proofs and an exposure to emergent areas of mathematics, including open problems and new, application-driven mathematics.

Elective option for majors and minors.

**MA 240 Introduction to Mathematical Proof** **Full course**

Fundamentals of sets and logic; logical quantifiers; methods of direct and indirect proof; mathematical induction; functions and relations; divisibility theory and modular arithmetic in the integers. Emphasis on construction of mathematical arguments and writing these arguments in a clear and convincing manner.

*Prerequisites: Mathematics 211.*

Proof is at the heart of mathematics. We focus on the basic mathematical symbols and grammar, translating between standard mathematical terms and symbols and English. We emphasize the language of set theory (sets, elements, subsets, intersections, unions) and functions (domain, codomain, image, one-to-one, onto) and basic logic (statements, implication, converse, contrapositive, negation, equivalence, quantifiers). We consider various forms of mathematical argument in different contexts, such as direct proof, indirect proof and proof by contradiction, mathematical induction, counterexamples, and contrapositives. Carefully reading and writing mathematics will be emphasized.

Required of all majors; designated "writing in the major" course.

**MA 251 Probability and Statistics** **Full course**

Introduction to probability and combinatorics; discrete distributions; density functions, moments; normal and exponential distributions with applications; Central Limit Theorem.

*Prerequisites: Mathematics 160.*

Most mathematics courses taken before the sophomore year emphasize solving problems with a single solution. Here we begin to deal with the nature of uncertainty in our world. We try to analyze problems where chance or luck cloud our vision of what's really happening. One central question is, "What accounts for the difference between similar events? Luck? Or is there a real difference?"

Required of all majors.

**MA 303 Differential Equations** **Full course**

First order differential equations with applications primarily from physics and population biology; qualitative analysis; approximation of solutions. Second order linear d.e.'s and applications; series solutions; Laplace transforms. Other topics may include difference equations and iterated functions, systems, boundary value problems.

*Prerequisites: Mathematics 160; Mathematics 211 is recommended.*

When there is change in the physical world, differential equations are at work. Often we know how something changes and, from that, we want to predict its future behavior. Describing how something changes means giving equations involving derivatives; then we look for functions satisfying those equations. We study methods for solving certain types of differential equations, and we look at many applications including population growth, mixing problems, and oscillating springs.

Elective option for majors and minors.

**MA 304 History of Mathematics** **Full course**

A problem study approach to the history of mathematics. Topics may include: Babylonian and Egyptian mathematics, number systems, Pythagorean mathematics, duplication, trisection, and quadrature, Greek mathematics including Euclid's Elements, Hindu-Arabian and Chinese mathematics, and the prelude to and dawn of modern mathematics.

*Prerequisites: Mathematics 160.*

Some people find fascinating the development of our mathematical knowledge. We'll trace major threads up to and including the start of the development of Calculus and modern mathematics.

Elective option for majors and minors; especially suitable for future math teachers.

**MA 305 Scientific Computing** **Full course**

Methods for approximating the solutions of problems that are difficult or impossible to solve exactly. Floating point representation; approximation of functions; roots of nonlinear equations; interpolation and curve-fitting; linear systems; some operations research methods; additional topics possibly including numerical integration and differentiation.

*Prerequisites: Mathematics 160.*

We often approximate solutions and need to know the most accurate (or fastest) methods. For instance, if a polynomial has a root between 5 and 6, what is the fastest way to estimate that root to 8 decimal places?

Elective option for majors and minors.

**MA 308 Euclidean and Non-Euclidean Geometries** **Full course**

Euclidean geometry; the discovery of non-Euclidean geometry and the independence of the parallel postulate; neutral geometry; Hilbert's axioms; some philosophical implications. Additional geometric topics such as finite geometries; an introduction to elementary topology; fractals.

*Prerequisites: Mathematics 160.*

Euclid's geometry served for many centuries as a model of precise and exhaustive analysis. Imagine the surprise when people found geometric systems other than Euclid's. We look at Euclid's and the other systems, developing the theorems from classical axioms and discussing them from a modern viewpoint.

Elective option for majors and minors; especially suitable for future math teachers.

**MA 315 Complex Analysis** **Full course**

The theory of functions of one complex variable. Topics will include: topology and algebraic structure of the complex numbers; differentiation of complex-valued functions and the Cauchy-Riemann equations; contour integration and Cauchy's Theorem; classification of singularities; Laurent series; the residue calculus.

*Prerequisites: Mathematics 211.*

Expanding the real number system to include a solution (denoted $i$) of $x^2 = -1$ and closing up to including numbers like $5 + 2i$ gives us the complex number system. In this system we can solve any polynomial equation. We'll study the geometry of this number system, and the Calculus, too.

Elective option for majors and minors.

**MA 351 Applied Regression Analysis** **Full course**

Regression analysis and its applications. Topics include simple and multiple linear regression, model diagnostics and testing, residual analysis, transformations, indicator variables, variable selection techniques, logistic regression and analysis of variance. Most methods assume use of a statistical computing package.

*Prerequisites: Mathematics 251 or permission of instructor.*

We set up models for simple linear, multiple regression, and variants of these, carry out model parameter inferences, construct prediction intervals and confidence bands of the regression line, and assess model fit or lack of fit. We use a statistical computing package and interpret output accordingly.

Elective option for majors and minors.

**MA 380 Topics in Mathematics** **Half/Full course**

Topics of current interest not covered in the standard courses.

*Prerequisites: Dependent upon topic or permission of instructor.*

Keep an eye out for these regularly-offered courses to explore an advanced topic.

Required of all majors (at least one half course)

**MA 381 Mathematics Education Seminar** **Half course**

Topics in teaching mathematics at the secondary level or other levels, including effective mathematics lesson preparation and delivery, current issues in mathematics education, the use of ancillary teaching resources, and engagement in teaching and learning in local classrooms.

*Prerequisites: MA 150 or permission of instructor.*

We focus on effective crafting and delivering a mathematics lesson, and current issues in mathematics education.

Elective option for majors and minors; especially suitable for future math teachers.

**MA 399 Mathematics Internship** **Half/Full course**

An opportunity to utilize mathematical skills in a non-academic environment.

*Prerequisites: Junior standing.*

With our Internship Director, students can find an appropriate math internship, requiring departmental faculty supervision. Internships don't count toward the major or minor, but rather as an additional course.

**MA 401 Real Analysis I** **Full course**

A rigorous study of the real number system: field and order axioms, completeness, and topology. Limits, sequences and series. Functions and continuity; pointwise and uniform convergence. The derivative and the Riemann integral.

*Prerequisites: Mathematics 240.*

We study the foundational theory of Calculus. In Calculus we often touch on topics, but not in significant detail for lack of time. For instance, we see that a continuous function on a closed interval must have a maximum, but if the interval is open it need not have a maximum. What is so special about "closed"? Do other kinds of sets have this property? This is "Calculus done right" in the sense that when we come to an interesting (and, perhaps, difficult) point we stick with it until we've analyzed it.

MA 401 or MA 406 is required of all majors.

**MA 403 Real Analysis II** **Full course**

Functions of several variables; the derivative and Riemann integral in higher dimensional real spaces; implicit and inverse function theorems; other topics in analysis.

*Prerequisites: Mathematics 401.*

A continuation and extension of MA 401.

Elective option for majors and minors.

**MA 406 Abstract Algebra I** **Full course**

Groups, rings, and fields with an emphasis on group theory. Topics will include: subgroups, cosets, and Lagrange's theorem; normal subgroups and quotient groups; the homomorphism theorems; the structure theorem for finite abelian groups; rings and ideals; quotient rings; integral domains and fields.

*Prerequisites: Mathematics 213 and Mathematics 240.*

The integers and the real numbers require two different algebra systems; in the reals the rule "if $x$ is a number and $y \neq 0$ then $x/y$ is another number" holds while in the integers it does not. We often run across such different kinds of algebra systems. For instance, any two $2 \times 2$ matrices can be added, subtracted, or multiplied, but only some have inverses. We'll study some common types of algebra systems. A typical question is, "In this kind of algebra system, must every polynomial have a root?"

MA 401 or MA 406 is required of all majors.

**MA 407 Abstract Algebra II** **Full course**

Commutative rings, ideals, and the construction of quotient rings. Axiomatic description of fields; algebraic (and transcendental) extensions of fields. Applications of field theory to ruler-and-compass constructions; Galois theory and the non-solvability by radicals of quintic equations. Other topics as time permits.

*Prerequisites: Mathematics 406.*

A continuation and extension of MA 406.

Elective option for majors and minors.

**MA 410 Seminar in Mathematics** **Half course**

Exposes students to a variety of topics in current mathematics, including research, career, and ethics-related issues. Students will give presentations on selected topics.

*Prerequisites: Senior Math Major or permission of instructor.*

This course involves exposure to areas people in mathematics are working on now. Topics may be Chaos and Dynamical Systems, Cryptography, the Four Color Theorem, or Graph Theory. Among other things, students study an area of mathematical research and report on it.

Required of all majors.

**MA 417 Applied Mathematics** **Full course**

Mathematical methods and models used in the sciences. Topics typically include linear and nonlinear systems of differential equations, Fourier series methods, and partial differential equations.

*Prerequisites: Mathematics 211, 213, 303.*

This is a topics course with applications and methods fitting student interests. The course builds on MA 211, MA 213, and MA 303. For example, we consider some partial differential equations – those enable us to deal with quantities that vary in both space and time – like vibrating drum heads or populations of animals.

Elective option for majors and minors.

**MA 451 Statistical Inference** **Full course**

Exploration of common statistical techniques using the theory and methods of probability and statistics. Topics include review of inferential statistics, ANOVA, time series, nonparametric and multivariate statistics, Chi-square tests, and logistic regression. Most methods assume use of a statistical computing package.

*Prerequisites: Mathematics 251.*

We continue and extend results from MA 251. We look at how a particular Statistical investigation typically proceeds, emphasizing depth in several methods.

Elective option for majors and minors.

**MA 490 Readings and Research in Mathematics** **Credits/Meetings to be arranged**

Independent reading and/or research of an advanced topic, under the direction and supervision of a faculty member. Results for the course are often submitted in written form and presented in a seminar setting or a student symposium.

*Prerequisites: At least Junior standing; permission of supervisor and department chair.*

A chance for an advanced student to investigate an area not covered in our regular courses.

**MA 495 Honors Thesis in Mathematics** **Full course**

Independent research and thesis under the supervison of a member of the mathematics faculty.

*Prerequisites: At least Junior standing; membership in the Saint Michael's Honors Program; permission of the supervisor and department chair.*

Students must have permission of a supervisor and submit their research proposal to the department chair before preregistration for the semester in which the proposed research is to take place.

This course does not count toward the major requirements; it is taken to fulfill requirements of the Honors Program.

# Activities

### Pi Mu Epsilon

In 2003, we installed the Vermont Alpha Chapter of Pi Mu Epsilon, Honorary National Mathematics Society. PME promotes scholarly activity in mathematics among the students in academic institutions and among the staffs of qualified non-academic institutions.

We typically induct new student members each fall semester. Our chapter elects student officers and hosts speakers and other events which are open to the campus community.

### Hudson River Undergraduate Mathematics Conference

Every spring we go to the HRUMC. This is a one-day event held at a different college each year and attended by students and faculty from a variety of schools from all over New York and New England. The goal is to provide students with the experience of attending and presenting at a professional mathematics meeting.

Consequently, in addition to a longer invited address by a noted mathematician, the main activity is many concurrent sets of shorter talks, given by student and faculty attendees. Every year some SMC students (and faculty) give talks. They are always well-received, and it is a great experience.

### Putnam competition

This is a national mathematics contest held the first Saturday of December. Putnam questions are puzzles, and each contest has a dozen of them. An emphasis is on creativity with basic mathematics.

This is strictly for the fun of a challenge; anyone who has taken Calculus can join in. Talk to Prof. Simons about practice sessions.

### Mathematics Awareness Month

Mathematics Awareness Month is held each April. Its goal is to increase public understanding of and appreciation for mathematics. During this month, national math organizations sponsor activities, and we often organize a campus lecture or event. Recent themes include Mathematics and Climate, Mathematics and Voting, Mathematics and the Brain, and Unraveling Complex Systems.

### Actuarial and Praxis exams

These exams can be quite challenging, and students preparing for them may find study groups helpful. Ask if there are other people interested, and we may be able to arrange a group. There may be other Education students interested in Praxis preparation.

### Research opportunities

There are a number of opportunities to pursue research projects in mathematics and mathematics-related fields, including independent study courses, undergraduate research experiences, and participation in ongoing research projects with various department members.

This is a chance to learn research skills beyond the classroom and often to work on open questions in mathematics and current applications. The experiences typically lead to presentations at conferences such as HRUMC and have even resulted in publication of journal articles. We also support our mathematics students in applying to a number of summer undergraduate research programs, and study abroad opportunities (such as the Budapest Semester in Mathematics).

# Mathematics Department

**Faculty Members**: These are the full-time faculty members of our department.

**George Ashline** *Professor of Mathematics (Department Chair)*
*B.S. St. Lawrence University; M.S., Ph.D. University of Notre Dame*

Courses Taught: Elementary Statistics; Calculus; Number Theory; Probability and Statistics; Linear Algebra; History of Mathematics; Complex Analysis; Mathematics Education Seminar; Real Analysis

Areas of Expertise: Mathematics education and mathematics pedagogy; mathematical preparation of in-service and pre-service teachers; complex analysis

Recent Scholarly Achievements: Dr. Ashline co-wrote the article "Using Mathematically Rich Tasks to Deepen the Pedagogical Content Knowledge of Primary Teachers" which has been published as a chapter in the *Springer-Verlag text Tasks in Primary Mathematics Teacher Education: Purpose, Use and Exemplars* (2009). He co-developed and co-taught courses for Vermont mathematics teachers through the Vermont Mathematics Partnership. He also created course materials and co-taught other courses through the Vermont Mathematics Initiative.

**Joanna Ellis-Monaghan** *Associate Professor of Mathematics*
*B.A. Bennington College; M.S. University of Vermont;*
*Ph.D. University of North Carolina, Chapel Hill*

Courses Taught: Elementary Statistics; Calculus; Number Theory; Combinatorics; Real Analysis; Abstract Algebra

Areas of Expertise: Algebraic combinatorics, especially graph polynomials, and applied graph theory in statistical mechanics, computer chip design and bioinformatics.

Recent Scholarly Achievements: Dr. Ellis-Monaghan recently completed a visiting fellowship at the Isaac Newton Institute, Cambridge University in Cambridge, England. The fellowship was in the combinatorics and statistical mechanics program.

**Jim Hefferon** *Professor of Mathematics,*
*B.S., M.S., Ph.D. University of Connecticut*

Courses Taught: Elementary Statistics; Calculus; Theory of Computing; Linear Algebra; Probability and Statistics; Geometries; Numerical Methods; Real Analysis; Abstract Algebra

Areas of Expertise: Dr. Hefferon's background is in the theory of computation. In addition, he administers the CTAN archive of software for the TeX typesetting system at www.ctan.org.

Recent Scholarly Achievements: Dr. Hefferon co-wrote The TeX family in 2009 for the American Mathematical Society's *Notices*. He gave the invited address at the EuroBacho TeX 2007 conference in Tama Brodzka, Poland, on "An Experimental Upload System for CTAN."

**Zsuzsanna Kadas** *Professor of Mathematics*
*B.S. St. John's University; M.S., Ph.D. Rutgers University*

Courses Taught: Calculus; Discrete Mathematics; Linear Algebra; Differential Equations; Real Analysis; Applied Mathematics

Areas of Expertise: Differential equations; nonlinear dynamics; chaos and fractals; reaction-diffusion systems; mathematical models in chemistry, physiology, population dynamics

Recent Scholarly Achievements: Dr. Kadas is the project director on a $70,000 grant that's used to support undergraduate research at Saint Michael's. The grant is funded by the NASA-National Space Grant and Fellowship Program.

**Lloyd Simons** *Professor of Mathematics*
*B.Sc. University of British Columbia;*
*M.Sc., Ph.D. McGill University*

Courses Taught: Elementary Statistics; Calculus; Linear Algebra; Probability and Statistics; Geometries; Complex Analysis; Real Analysis; Abstract Algebra

Areas of Expertise: Algebraic Number Theory; Algebraic K Theory

Recent Scholarly Achievements: Dr. Simons helped to host the Spring Northeast Section Mathematical Association of America meeting at Saint Michael's in May 2008. The meeting focused on "Mathematical Modeling in Biology and the Environment."

**Philip Yates** *Associate Professor of Mathematics*
*B.S. DePaul University; M.S. University of Vermont;*
*Ph.D. University of South Carolina*

Courses Taught: Elementary Statistics; Probability and Statistics; Applied Regression; Advanced Statistical Methods; Mathematics Seminar

Areas of Expertise: Applied statistical techniques for environmental science, biostatistics, and sports; Statistical education; Statistical consulting.

Recent Scholarly Achievements: Dr. Yates is a consultant for the U.S.D.A. Forest Service providing mathematical and statistical services for the San Bernardino National Forest. The contract runs through March 2014.

## The Math Program for You

For more information about our program and examples, see the *Majoring in Mathematics at Saint Michael's* document, or consult with a member of the Mathematics department.

More information about our program is available on our departmental webpage on the Saint Michael's academic server at http://www.smcvt.edu/academics/mathematics/. Check it out!