



VILLANOVA
UNIVERSITY

College of Liberal Arts
and Sciences



UNDERGRADUATE STUDIES
in
MATHEMATICS AND STATISTICS

Fall, 2019

Welcome to Mathematics and Statistics

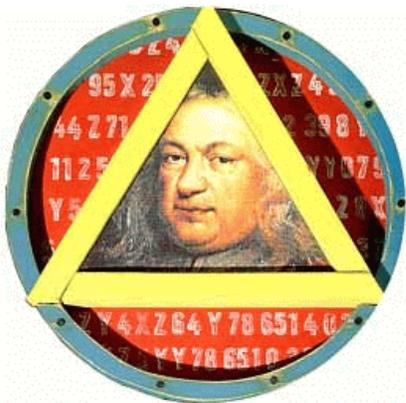
This manual has been prepared to provide you with information and guidance on matters relating to your course of studies in mathematics. However, the manual is by no means complete. You should feel free to approach your academic advisor or any other faculty member in the department for more information, and if you have any suggestions for making the manual more helpful, please give your ideas either to me or to the department administrative staff. This manual can hopefully serve as a useful reference throughout your undergraduate career. The information within is current as of August 2019.

Now that you are entering college, you should begin to think about your career after leaving Villanova. Whether you are planning to go on to graduate school or to enter the job market, it is never too early to start preparing for this transition. Good preparation includes getting good grades, taking appropriate courses, and distinguishing yourself in some way to the professors who will be writing letters of recommendation for you. Get to know the faculty, as it is very difficult for professors to write a detailed, supportive letter of recommendation when all they know is your name and final grade. The faculty and staff within the Department of Mathematics and Statistics are friendly and accessible people who want to help you make the most of your college career. Become an *active* student; seek help when you need it; ask questions when you have them; get to know your advisor; and become involved in the Math Club, the department chapter of the Association for Women in Mathematics, or other department activities.

As you can see, these suggestions are not about specific scheming for a future four years from now. They are intended to help you set the tone early for making connections and for getting to know each other and us. If you embrace new challenges, take advantage of opportunities, and become part of the department, the college, and the university, you will best prepare for that future by concentrating on the now.

Drop by and see me anytime. Again, welcome!

Dr. Jesse Frey, Chairperson

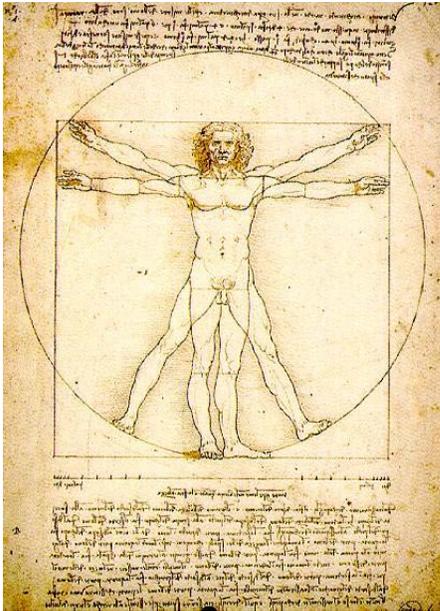


When not practicing law, Fermat did research in mathematics. He stated the famous result, usually called “Fermat’s Last Theorem,” for which he said “I have discovered a truly marvelous proof of this which, however, this margin is too narrow to hold.”

Pierre de Fermat (1601-1665)

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Leonardo da Vinci: “The shining of the sun is the greatest joy for the body, the clarity of a mathematical truth, the greatest pleasure for the mind.”

Galileo Galilei: “Nature’s great book is written in mathematical symbols.”

Mission Statement

The Department of Mathematics and Statistics is committed to exemplary teaching and learning, scholarship, and service. Our courses are designed to provide every student with the technical background they will need and to inculcate a love for the “veritas” of logical thought and elegant reasoning. Our aim is that our mathematics graduates can formalize, define, analyze, prove, and communicate mathematical results.

As an essential part of our educational mission, our department consists of scholarly and caring faculty members. We expect that each faculty member be aware of current developments in mathematics and mathematical pedagogy, with many faculty members contributing scholarly publications. The department assists the community, the profession and the University generously through committee and leadership roles and other forms of service.

Mathematics Major Program

The purpose of the standard course of study for a mathematics major is to provide the student with an introduction to the major branches of mathematics as an academic discipline within the context of a comprehensive education in the liberal arts and sciences. Students who complete this course of study will be prepared for a broad range of career opportunities in business, government, and service industries. Such students will also be prepared to undertake graduate study in mathematics and related disciplines.

Mathematics majors entering Villanova University in the fall of 2019 must plan their academic programs in accord with the requirements set forth in the Villanova University Catalog of Undergraduate Studies, 2019. You must satisfy the requirements of the Core program of the College of Liberal Arts and Sciences. Even if course requirements are changed while you are a student here, you must meet the requirements in effect at the time you entered. Throughout your stay at Villanova, you will refer to the catalog for information about requirements and courses. The university catalog can be found on-line at <http://www1.villanova.edu/villanova/provost/catalog.html>.

A four-year plan for taking the required courses is included in this manual. You may, with the approval of your advisor, vary the order in which courses are taken, and you may select whatever electives will help meet your interests and career objectives. In determining the order in which you will take the courses, you should keep prerequisites and co-requisites in mind. The checklist on page 23 of this booklet will help you keep a record of your progress.

Program Overview

The B.S. in Mathematics major program has three basic components: the “fundamental tools” course sequence, the “theoretical foundations” courses, and the elective courses. MAT 1500 (Calculus I), MAT 1505 (Calculus II), MAT 2500 (Calculus III), and MAT 2705 (Differential Equations with Linear Algebra) provide the basic calculus and linear algebra tools used by scientists, engineers, and mathematicians. MAT 2600 (Foundations of Mathematics I), MAT 3400 (Linear Algebra), MAT 3500 (Modern Algebra I), and MAT 3300 (Advanced Calculus) introduce the fundamental definitions and theoretical proofs that represent the heart of mathematics. The elective courses allow you to explore many areas of pure and applied mathematics. The capstone course is MAT 5900. This seminar course enhances your ability to research, organize, and make written and oral presentations of mathematics. The topic varies from year to year depending upon desires of students and faculty. Faculty or students may suggest topics to the Committee on the Undergraduate Mathematics Program (CUMP), which must approve them.

If you would like to study material not offered in a regular course, you may undertake an Independent Study course (MAT 5991, 5992, or 5993, depending on the number of credits) under the supervision of a faculty member. You must complete a form which details the content and the evaluation methodology of the independent study **before** registering for this course. Independent study forms are available in the department office (SAC 305).

The following courses are required for math majors:

- MAT 1500/1505/2500 Calculus I, II, III
- MAT 2600 Foundations of Mathematics
- MAT 2705 Differential Equations with Linear Algebra
- MAT 3300 Advanced Calculus
- MAT 3400 Linear Algebra
- MAT 3500 Modern Algebra I

- MAT 5900 Seminar in Mathematics

In addition, math majors must select:

- One approved upper level analysis course (for example, MAT 3305, MAT 4270, or MAT 5400)
- Four other mathematical courses numbered 3000 or above.
- One two-semester sequence of natural science courses with a lab at the science-major level (we strongly urge students to take PHY 2410/11 and PHY 2412/13 but will allow BIO 2105 and 2106, CHM 1151/03 and 1152/04 or AST 2122/MSE 2151 & AST 2121/MSE 2150, or GEV 1050 and 1051.)
- One additional science course at a science-major level with lab if appropriate (e.g. PHY 2414/15 or CSC 1051) (4 credits)
- Courses to fulfill the core requirements for the College of Liberal Arts and Sciences.

Operations of the Mathematics and Statistics Department

You are encouraged to participate fully in the affairs of the Department of Mathematics and Statistics. The department office is in Room 305 in the Saint Augustine Center for the Liberal Arts. The department staff members are Mrs. Christine Gadonas and Mrs. Maria Barrett. The chairperson, Dr. Jesse Frey, will be happy to meet with you about questions or problems you may have. Dr. Frey is assisted by Dr. Charles Ashley, who handles course scheduling.

The Committee on the Undergraduate Mathematics Program (CUMP) is responsible for planning and supervising all mathematics courses taken by undergraduates in the University. In particular, the committee establishes the course requirements for mathematics majors and chooses the electives for each semester. The Committee consists of faculty members from the department. The committee welcomes input from students, and students may be invited to discuss their concerns at a meeting of CUMP. For further information you should contact Dr. Ashley or Dr. Frey.

The Department sponsors a Mathematics Colloquium series in which faculty members and other professional mathematicians give talks on a variety of topics, frequently reporting on their research. Students are welcome and encouraged to participate. The talks are organized by Dr. Tim Feeman.

Computing Resources

Because computers are so prevalent in modern society and because the proper use of computers involves mathematical knowledge and mathematical ways of thinking, mathematically-trained people should have knowledge of computers. Some math majors choose to take the 4-credit introductory computing course, CSC 1051. A combination of mathematics and computing courses will prepare you for various career options in a technological society. Even a double major in mathematics and computer science is possible with careful planning and some extra work. Interested students should see the chairperson (Dr. Joyce) of the Department of Computing Sciences.

The University has extensive computing resources. Each student will receive a **myNOVA** account that has been customized to bring you targeted information you need based on your role within the University. You will log into **myNOVA** at the Villanova University homepage and have access to many of Villanova's applications such as email, web, Blackboard/WebCT/Vista, and more without having to log in again to those applications. You can find information about **myNOVA** at www.villanova.edu/villanova/unit/accounts/mynovaaccount.html.

Math students are strongly encouraged to read their email messages on this Villanova account since this address is used to send information to students on all departmental/campus activities. Faculty and staff email addresses are usually firstname.lastname@villanova.edu (There are a few exceptions.) The Mathematics and Statistics Department web page is located at <https://www1.villanova.edu/villanova/artsci/mathematics.html> and contains information on the faculty, course syllabi, and career information. Villanova Math also has a Facebook group page and a LinkedIn group where students and alumni are encouraged to join.

The Department uses computing in a systematic way in our mathematics courses. We have chosen MAPLE as our primary computing utility for the calculus sequence. MAPLE is a very powerful program that does numerical and symbolic calculations, graphing, and programming, all in the same environment. This will be explained to you in your calculus classes and will be used throughout your Villanova mathematical career. In statistics courses, computing is done using a variety of different statistical computing packages, usually Minitab, R, or SAS.

Dual Majors and Minors

Dual Majors

Mathematics majors who pursue a second major in economics, physics, chemistry, biology, or finance may count **at most one course** from the following list as a math elective:

ECO 3138: Game Theory
PHY 4202: Mathematical Physics II
CHM 3412: Physical Chemistry II
BIO 3105: Biostatistics & Experimental Design
FIN 2325: Introduction to Derivatives

Because of the inherently mathematical nature of engineering and computer science, math majors with a second major in those disciplines may count **up to two courses** from the following list:

CEE 3705: Engineering Economics
CHM 3416: Physical Chemistry for Engineers
ECE 3720: Eng. Probability & Statistics (only if MAT4310 is not also counted)
ME 3103: Dynamic Systems III
ME 4102: System Dynamics
CSC 1700: Analysis of Algorithms
CSC 4170: Theory of Computation

Minors

By choosing electives carefully, you can combine a mathematics major with a minor or specialization in some other area such as business, physics, computing sciences, philosophy, economics, or a language. Your advisor can help you design a program to suit your specific goals. Minor requirements are subject to change.

All mathematics majors are encouraged to take one or more statistics courses as part of their program of study. Those who wish to do more with statistics may also consider obtaining a **minor in statistics**. Obtaining this minor requires taking MAT 1500, 1505, 2500, 4310, 4315, 5700, and two approved statistics electives. The four courses MAT 1500, 1505, 2500, and either 4310 or 5700 may be counted towards both the mathematics major and the minor in statistics. Thus, obtaining a minor in statistics requires four courses beyond those required for the mathematics major. Courses that count as statistics electives include MAT 5705, approved undergraduate MAT electives with substantial statistical content, and approved courses offered by the Applied Statistics graduate program. For more information about the minor or to declare a minor in statistics, see **Dr. Yimin Zhang, statistics minor coordinator**. It is recommended that you talk with Dr. Zhang as early as possible.

A computer science minor is valuable for two reasons: the logical structure of computer science parallels the logical thinking skills required in mathematics, and the current job market favors mathematics graduates with minors such as computer science. It is fairly easy to earn this minor; eight computing courses are needed. With careful course selection, a math major can earn the CS minor by taking only four courses beyond the math major requirements. A prospective computer science minor must go to the Computing Science office (Mendel 161) and complete an application form. Note that CSC 1700 and CSC 4170 can count as two of the four required math elective courses.

In addition to the computer science minor, several other minors have attracted mathematics majors and are valuable both to round out your education and to enhance your resume.

To earn a minor in Applied Physics, math majors are required to take all the Math courses required for the Math degree, plus MAT4310, PHY 2410/11 through PHY 2416/17, PHY 3310/3311, and PHY 4301/4303.

Students can minor in Economics by completing Calculus (MAT 1320 or higher) and a total of 18 credits consisting of ECO 1001, 1002, 2101, 2102, and two elective courses with course numbers of ECO 3000 or higher.

Students can minor in Philosophy by taking any five courses offered by the Philosophy Department, including PHI 1000 and four additional upper division philosophy courses, with no more than two courses from the following list:

PHI 1000, PHI 2010, PHI 2030, PHI 2115, PHI 2150.

One very popular minor is the Business Minor. There are two options for A&S students to earn a business minor: the **Academic Year Business Minor** and the **Summer Business Institute**. Students considering either of these options should meet with their primary academic advisor and are required to attend a Business Minor Information Session before applying. See the following VSB website for additional information:

<https://www1.villanova.edu/villanova/business/undergraduate/degrees/minorsnonbusiness.html>

Career Opportunities

A major in mathematics coupled with a good liberal arts education provides a good foundation for many different kinds of careers including law, medicine, corporate management, or public administration. The majority of our graduates find positions in companies that seek someone with general technical expertise and problem-solving skills.

Our graduates work in a variety of firms, including actuary/insurance firms (ING, XL Insurance, Penn Mutual, Towers Watson, The Hartford Financial Services Group, Price Waterhouse Coopers, MetLife, Prudential), pharmaceutical and statistical firms (Merck, GlaxoSmithKline, Pfizer, U.S. Census Bureau), and finance and other firms (Goldman Sachs, Gateway Financial Group, Accenture, Boeing, Deutsche Bank, Lockheed Martin, Cigna, Deloitte, Morgan Stanley, Johnson and Johnson). Many of our graduates teach, some locally and others in places such as Boulder, CO, Boston, MA, and Corpus Christi, TX. Others attended graduate school at Cornell, Boston University, UC Berkeley, UConn, University of Delaware, Temple, and Columbia University. We are also very proud of our graduates who pursued volunteer opportunities such as PACT (Providence Alliance for Catholic Teachers), ACE (Alliance for Catholic Education), Chicago Teaching Fellows program, Peace Corps, and Teach for America. For additional career information, see <http://www.ams.org/profession/career-info/career-index>.

In recent decades, the use of mathematical methods in decision-making in business, industry and government has increased, giving rise to a new field of knowledge called operations research, which joins an older mathematical science of decision-making statistics. Persons trained in these fields are in great demand.

There is a steady need for mathematicians in the insurance industry, where they are called actuaries. To become an actuary, one needs to take a series of examinations. If you are interested, you could begin taking these examinations as early as the end of your sophomore year. Students should refer to the "Actuarial Preparation" page on our department website for additional information.

Another career path is teaching mathematics at the high school level. The Education and Counseling Department offers a degree in math education, plus a special Master's program that leads to Pennsylvania public high school teacher certification.

Opportunities in theoretical research and university teaching in mathematics are again opening up after a period of severe restrictions.

The department web page has links to various career opportunities. For more specific information about areas of interest to you, contact the following faculty members:

- Computing & Computational Mathematics - Dr. Osvaldo Marrero, Dr. Kaitlyn Muller
- Statistics & Biostatistics – Dr. Paul Bernhardt, Dr. Jesse Frey, Dr. Michael Levitan, Dr. Paul Lupinacci, Dr. Osvaldo Marrero, Dr. Michael Posner, Dr. Yimin Zhang
- Actuarial Science - Mr. Steven Chiacchiere, Dr. Paul Lupinacci
- Operations Research - Dr. Michael Levitan, Dr. Bruce Pollack-Johnson
- High School/Junior College Teaching - Dr. Michael Posner
- University Teaching & Research – Dr. Paul Bernhardt, Dr. Jesse Frey, Dr. Alexander Diaz-Lopez, Dr. Kathryn Haymaker, Dr. Amanda Knecht, Dr. Kaitlyn Muller, Dr. Bruce Pollack-Johnson, Dr. Andrew Woldar
- Financial Mathematics – Dr. Klaus Volpert

Students often ask what courses they should take for a particular career choice. In general, the best advice is to take the courses that interest you most. Taking a broad range of courses will give you a good overview of mathematics, and, at the undergraduate level, there is no need to specialize. However, if you know that you are especially interested in one area of mathematics, you can choose electives to emphasize that area. Some possibilities:

- Pure Mathematics: MAT 5110, 5200, 5400, 5500
- Probability and Statistics: MAT 4310, 4315, 4380, 4610, 5700, 5705
- Mathematics Education: MAT 5110, 5200, 7300 (a graduate course)
- Continuous Applied Mathematics: MAT 4270, 5400
- Discrete Applied Mathematics and Computer Science: MAT 4110
You may also use one of the courses CSC 1700, CSC 1800, or CSC 4170 as a math elective
- Operations Research: MAT 4110, 4310, 4410, 4600, 4610
- Actuarial Studies: MAT 4310, 4315, 4550, 5700, 5705

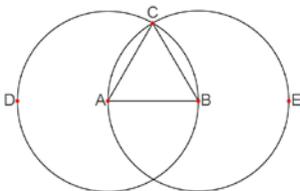
All students may use the services of the Career Center, located in Garey Hall. The Center provides advice about writing resumes, interviewing, and posting resumes on-line. Students are encouraged to register with the Career Center and take advantage of all opportunities available. Information sessions are sponsored periodically throughout the year. Students should refer to this website for information about career counselors and career assistants:

<http://www.villanova.edu/villanova/provost/careers.html>

Students should create an account on **Handshake**, the Career Center's integrated events, internships, and job search engine. It's a powerful tool that delivers internships and job opportunities directly to your newsfeed. You can find the Handshake login page at:

<https://villanova.joinhandshake.com/login>

From Euclid Book 1 Prop 1



"Mathematics is like checkers in being suitable for the young, not too difficult, amusing, and without peril to the state." ~ Plato

"The mathematical sciences particularly exhibit order, symmetry, and limitation; and these are the greatest forms of the beautiful." ~ Aristotle

B.S. in Mathematics/M.S. in Applied Statistics Combined Program

The combined BS/MS Program allows a Villanova student to earn both a Bachelor of Science (BS) degree in Mathematics and a Master of Science degree in Applied Statistics (MSAS) in a condensed timeframe, usually five years. Additionally, the final graduate Applied Statistics course for students in this program is tuition-free.

Students in the combined program complete all required work for a B.S. in mathematics, including the core curriculum and all free electives, plus all of the requirements for an M.S. in Applied Statistics. However, the timeframe to complete each of these degrees is accelerated since students may double-count up to four graduate courses taken as an undergraduate toward both the BS and the MSAS degrees.

Because curricular decisions can either facilitate or complicate application to and success in the combined degree program, and because the number of students accepted into the program is limited, it is important that students interested in the program contact Dr. Paul Bernhardt early in their undergraduate careers. A maximum of five students may be accepted into the program each academic year, and applying to the program late in one's undergraduate career may make it difficult to complete all of the degree requirements within a five-year period.

Combined BS/MS Program Requirements

In order to be accepted into the combined program, students must have achieved the following:

- Junior status
- A cumulative GPA of at least 3.3
- A cumulative GPA of at least 3.5 in Villanova mathematics courses
- At least an A- in MAT 4310 or 7404.

After being accepted into the combined program in Applied Statistics, students should plan to take four graduate courses during their undergraduate careers, usually MAT 7500, 8400, 8401, and 8406. For students who have completed MAT 4310, 5700, and/or 5705 prior to acceptance into the program, the graduate equivalents MAT 7404, 8400, and 8401 may be waived, thus allowing a student to take more elective courses.

Students who are interested in the combined BS/MS Program, but do not yet meet the requirements for admission, may submit a request to Dr. Paul Bernhardt for permission to take a graduate level course.

For additional information on the combined BS/MS Program, contact the Director of the Applied Statistics Graduate Program, Dr. Paul Bernhardt (paul.bernhardt@villanova.edu).

Students who are not enrolled in the combined program are also eligible to have graduate Applied Statistics courses double-count towards both their BS in Mathematics and their MS In Applied Statistics. Please contact Dr. Bernhardt for more information and for advice on which graduate-level courses to take.

Degree requirements are subject to change.

B.S. in Mathematics/M.A. in Mathematics Combined Program

The combined BS/MA program allows a Villanova student to earn both a Bachelor of Science (BS) degree and a Master of Arts (MA) degree in Mathematics in a condensed timeframe, usually five years. In addition, the final two graduate Mathematics courses are tuition-free for students in the program.

Because curricular decisions can either facilitate or complicate application to and success in the combined degree program, and because the number of students accepted into the program is limited, **it is important that students interested in the program contact Dr. Klaus Volpert early in their undergraduate careers – well in advance of the application deadline.**

Combined BS/MA Program Requirements

- Accepted qualified students in the program will complete all of the required work for a B.S. in mathematics, including core curriculum and all free electives.

- They will also complete all requirements for an M.A. in mathematics.
- Villanova students may apply for the program after completing MAT 3300 or 3500 and after they have earned at least 24 credits in mathematics.
- Students must have a cumulative GPA of at least 3.3 overall and a GPA of 3.3 or higher in all required courses in mathematics that they have taken at Villanova University.
- The accelerated timeframe depends on three specific courses that are cross-listed as both undergraduate and graduate.

For additional information on the Combined BS/MA Program, students may contact Dr. Klaus Volpert at 610-519-4670.

Degree requirements are subject to change.

Admission Requirements and Regulations for Students Continuing in the BS/MS or BS/MA Programs

1. A student's application to the combined BS/MS or BS/MA Program should be submitted to the Director of the graduate program (either Dr. Paul Bernhardt or Dr. Klaus Volpert) and will consist of the following:
 - a. A submitted application form for the appropriate combined degree program.
 - b. A copy of the student's Villanova transcript.
2. Once admitted to the combined degree program, the student will be permitted to take graduate courses in Applied Statistics or Mathematics. Undergraduates who have been formally accepted into the combined program will still need to complete the yellow permission card used for individuals not formally enrolled in Graduate Studies, but interested in taking a graduate course.
3. A student may withdraw from either combined degree program at any time after being accepted into the program simply by notifying the appropriate program director (Bernhardt or Volpert). The student would then complete whatever coursework is required to earn their undergraduate degree.
4. When a student in the program is entering the last semester of undergraduate studies (typically the eighth semester), the Department of Mathematics and Statistics will complete the Combined Undergraduate/Graduate Information form and CAPP report and forward them to the Graduate Studies office.
5. Students in the Combined BS/MS or BS/MA program must fulfill all of the requirements associated with the corresponding Master's program if they are to remain in the program and obtain their Master's degree.

Graduate Programs in Mathematics & Statistics

Our department offers two graduate Master degrees: A Master of Arts in Mathematics, and a Master of Science in Applied Statistics. Several Certificate programs are also offered. For more information, please see the Graduate Program link at the bottom right on the math web page:

<http://www1.villanova.edu/villanova/artsci/graduate/graduate-programs.html>

Department Policies

Students wishing to receive the Bachelor of Science in Mathematics degree must maintain a technical GPA of at least 2.00 in their science and mathematics courses as well as an overall GPA of at least 2.00. The record of any student falling below 2.00 (either overall or technical) in any semester will be reviewed by the College Academic Standing Committee for appropriate action. All science and mathematics courses that a student has taken count in the computation of the technical GPA.

Departmental Honors

The Department allows outstanding students to earn Departmental Honors in Mathematics. The honors track encourages students to do in-depth study of mathematics at a high level. It gives recognition to those students who have done exceptional work in mathematics and aids them in their pursuit of graduate fellowships.

This program is intended primarily for a select group of students who plan to continue studying mathematics or a closely allied discipline in graduate school. The program is administered by the Department Chairperson, Dr. Jesse Frey, and by the assistant chair Dr. Charles Ashley.

REQUIREMENTS:

The honors student must:

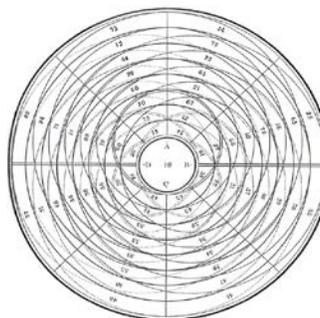
1. Complete all the requirements for the B.S. in Mathematics;
2. Maintain a 3.5 GPA in mathematics courses;
3. Take MAT 5400 Complex Analysis or MAT 5500 Topology (or approved substitutes); and
4. Complete a substantial independent study on a topic in mathematics and deliver a lecture presenting the results of this study. For this purpose, the student enrolls in MAT 5993 Independent Study in Mathematics, which is directed and supervised by a Department faculty member.

ADMISSION TO CANDIDACY FOR THIS PROGRAM: An applicant for this honor should be highly motivated to study mathematics and should have performed exceptionally well in their mathematics courses taken at Villanova. A student interested in and qualified for this program should apply in writing to Dr. Frey or Dr. Ashley. This application should be made no later than December 1st of the student's junior year. Normally, the student will be informed of the admission decision before March 1st. A student is expected to complete the requirements for this program in the same amount of time required for the B.S. in mathematics. Therefore, a late application may, by itself, lead to rejection. For students who successfully earn departmental honors, the following citation will appear on their transcript:

GRADUATED WITH DEPARTMENTAL HONORS IN MATHEMATICS

Benjamin Franklin: *“What science then can there be more noble, more excellent, more useful for men, more admirably high and demonstrative, than this of the mathematics?”*

Napoleon Bonaparte: *“The advance and perfecting of mathematics are closely joined to the prosperity of the nation.”*



Resources in the College of Arts and Sciences

A college publication called the *Enchiridion* summarizes policies of the College of Arts and Sciences, such as college graduation honors, registration and grade policies, complaint procedures, academic integrity policies, overload information, requirements for graduation, etc. The Enchiridion can be found online at:

<http://www1.villanova.edu/villanova/artsci/undergrad/enchiridion.html>

Dean's List

At the end of the fall semester and at the end of the spring semester, the College of Liberal Arts and Sciences officially recognizes its best students by including their names on the Dean's List. In order to be named to the Dean's List, a full-time student must maintain a minimum semester GPA of 3.50. All students included on the list receive a congratulatory letter from the Dean following the conclusion of the fall and spring semesters.

Graduation Honors

Graduation honors will be noted on the degrees of graduating students meeting the following requirements:

- *Summa cum laude*..... minimum cumulative GPA of 3.90
- *Magna cum laude* minimum cumulative GPA of 3.75
- *Cum laude*..... minimum cumulative GPA of 3.50

To be eligible for these honors, students must attain a minimum cumulative quality point average indicated and at least sixty credits of course work must have been taken at Villanova University and taken for a grade, i.e., A through F, which specifically excludes the "S" grade in Satisfactory/Unsatisfactory courses.

Internships

The College of Liberal Arts and Sciences provides its students with the opportunity to earn **free elective course credit** in departmentally related and academically creditable internships. Internships are not restricted to the Delaware Valley, and might take place in Washington, DC, as well as other parts of the country. Eligible applicants should have rising sophomore standing (minimum 30 credits completed) or rising junior standing (minimum 60 credits completed) or a senior for internship credit in a Major, Minor or Concentration with at least a 3.00 GPA for fall and spring internships or 2.7 GPA for summer internships. For further information and application material contact Kathryn Szumanski at 610-519-3942 or the Internship office located in the Office for Undergraduate Students in St. Augustine Center, room 107 at 610-519-4232. The website for the Internship office can be found at:

<http://www1.villanova.edu/villanova/artsci/undergrad/ous/internship.html>.

Leadership & Professional Development

As you proceed through your studies in the College of Liberal Arts and Sciences, Leadership & Professional Development offers you programming, mentoring, and courses that will enable you to identify your strengths, explore professional and education possibilities, and develop the skills necessary to prepare you for the professional life. For classes or additional information, contact the OUS office in St. Augustine Center 107.

Bridge Society

The BRIDGE Society was formed to provide an opportunity for students in the College of Liberal Arts & Sciences to explore professional opportunities that complement their academic studies. The mission of the BRIDGE Society, which stands for "Build Relationships, Inspire Development, Gain Expertise," is "to build relationships among students and alumni in the College of Liberal Arts and Sciences, to inspire both student professional development and alumni institutional development, as well as to provide a forum for students to gain the experiences necessary to forge their future direction."

Please visit <http://www1.villanova.edu/villanova/artsci/undergrad/ous/lpdsociety.html> for more information about BRIDGE, to download the application, and to view upcoming events. Please email bridgesocietyvu@gmail.com if you have any questions.

Summer Research Opportunities

There are many summer research opportunities for mathematics majors. The National Science Foundation, NASA, Lockheed-Martin, Woods Hole Oceanographic Institute, Louisiana State University, University of Tennessee, Oregon State University and Rose-Hulman Institute of Technology are just a few of the institutions who sponsor these programs. These summer research programs offer outstanding opportunities for majors to pursue their interest in mathematics, begin to develop their skills in research, make contacts in the professional world, and possibly open doors to future career prospects. Information on Research Experiences for Undergraduates (REU) can be found on the National Science Foundation website at:

http://www.nsf.gov/crssprgm/reu/reu_contacts.jsp

Student Employment

There are several positions available in the Mathematics and Statistics department for students. We encourage math majors to apply for a position with the Math Learning and Resource Center (MLRC) on the second floor of Falvey Memorial Library in Room 204. Mathematics majors who qualify can apply for grading and tutoring jobs, as well as clerical work in the math office. Students are encouraged to visit the VU jobs website at <https://jobs.villanova.edu/> Students can create a new account, and they will be guided through the application process and be able to search and apply for open positions.

Organizations

Your involvement in mathematics can extend beyond the classroom to interaction with faculty and other math majors and participation in activities and organizations. What you do outside the classroom may be as important in your mathematical development as your course work. You should participate fully in the various opportunities offered.

Math Club - SUM - Society for Undergraduate Mathematicians

The Society of Undergraduate Mathematicians (known as "SUM") (Math Club) is a collection of mathematics majors who plan informal activities that bring students, faculty, and alumni together.

The Math Club organizes a number of events every year, including career and graduate school information nights, service projects, a formal social, bake sales, and math faculty vs. math majors softball game. In recent years, students have designed and sold mathematical t-shirts.

If you would like to become involved in or help plan Math Club activities, or if you have ideas for interesting and fun things, please contact Dr. Amanda Knecht, Math Club advisor. Her office is in St. Augustine Center 381.

Association for Women in Mathematics

The department also has a chapter of the Association for Women in Mathematics. For more information, please contact Dr. Kaitlyn Muller. Her office is SAC 317.

Pi Mu Epsilon

The Pennsylvania Iota Chapter of Pi Mu Epsilon is located at Villanova. Pi Mu Epsilon is a national honorary society for mathematics students. To qualify for membership a student must have had at least two years of college mathematics including calculus, have completed their mathematical work with honor (at least B average), be in the top one-third of their class in their general college work, and be approved by the faculty in the Department of Mathematics and Statistics. For additional information, contact the math office in SAC 305. Information can be also be found at the Pi Mu Epsilon website at:

<https://pme-math.org/>

Scholarships and Prizes

Scholarship

Emil Amelotti Memorial* - awards up to \$300 per year to a junior or senior mathematics major.

*Note: Professor Amelotti served as chairman of the department from its inception in 1948 until his death in March, 1968.

Prizes

Emil Amelotti Medallion of Excellence - An honor usually awarded to one senior mathematics major who has achieved academic excellence. Recent winners include:

Tianjiao Wang '12
James Phillips '13
Taylor Berrang '14
Lucas Allen '15
Matthew Thomas Pasquale '16
Anthony Morgan '17
Tasha Boland '18
Alexander Vetter '19

The William Lowell Putnam Mathematical Competition

Every year, students from Villanova compete in The William Lowell Putnam Mathematical Competition, a nationwide problem contest sponsored by the Mathematical Association of America. Three students make up the Villanova team. Others may compete as individuals. Prizes include public recognition in the American Mathematical Monthly, cash awards and graduate fellowships. If you would like to compete, see Dr. Feeman.

Counseling and Study Skills Center

Personal/Psychological Counseling

The Counseling Center, located in the Student Health Center Room 206 (Phone 610-519-4050), helps students deal with a variety of personal concerns and decisions in a private and confidential setting. Unlike some high schools, we have no mandatory counseling sessions. The decision to seek counseling is completely up to you. Among students' challenges are: separating from family, becoming self-sustaining adults, building satisfying friendships, negotiating conflict, making responsible decisions, clarifying values, and establishing an individual identity. Many students make use of counseling to assist them with their personal development. The counseling process helps students learn more about themselves, identify coping strategies, and emerge with enhanced self-confidence.

The University Counseling Center provides services that help students function optimally with regard to emotional, academic, social and psychological issues. Counseling is provided on a voluntary basis. All contacts are completely confidential and are not recorded on the student's university records. Information is not released to anyone without the student's permission. All services are free of charge to current students.

Study Skills Center

Located within the Counseling Center, this service is staffed by a study skills counselor who can help you make the adjustments to the academic demands of college, improve your study skills and help develop a better approach to time management and self-motivation.

Mathematics Learning Resource Center (MLRC)

The Mathematics Learning Resource Center (MLRC) is located on the 2nd Floor of Falvey Memorial Library in room 204 adjacent to the Writing Center. The MLRC provides tutoring assistance and study resources for all University students. At the MLRC, students gather to discuss mathematics, to work on group projects, or to study independently. Mathematics majors are encouraged to apply for the MLRC staff positions. They should contact the MLRC Director, Mrs. Melissa Ferreira, at 610-519-7823.

Writing Center

The Writing Center is in Falvey Memorial Library on the 2nd floor in room 202 adjacent to the MLRC. The Writing Center provides assistance for all University students in every kind of writing. Peer tutors work with students at any stage of the writing process from brainstorming ideas, to evaluating first drafts, to proofreading for grammar and punctuation errors. The Writing Center phone is 610-519-4604.

International Studies

Since its establishment in 1986, the Office of International Studies has encouraged students to consider the many options available for study abroad in a variety of academic programs overseas, as well as enrollment in Area Studies programs on campus. Countries as diverse as Japan, Morocco, Austria, France, Germany, Italy, China, Switzerland, India, England, Ireland, and Australia have been settings where students have chosen to study. Many math majors have studied abroad, and they uniformly loved the experience. Overseas courses completed in approved programs count towards your Villanova undergraduate degree.

All students wishing to study overseas must apply to the Office of International Studies located in Middleton Hall on the 2nd Floor. Sophomores with permission of their college dean, juniors, and first semester seniors are eligible for overseas study. A minimum 2.75 GPA and full-time status are required by Villanova, though some programs and overseas institutions may require a higher GPA. For study abroad, students must have the approval of the Director of International Studies, their Department Chairperson and their College Dean. For additional information please contact the International Studies office at 610-519-6412 or on their website at:

<http://www1.villanova.edu/villanova/provost/abroad.html>

Advice About Advisors

Almost half of your program will consist of elective courses - either free electives or electives within the major. Careful thought should be given to selecting these electives so that you will obtain a well-rounded education and meet your career (or post-college) objectives. By properly choosing electives, the mathematics major can prepare for graduate study in mathematics, statistics, computer science, economics, or other areas or can prepare for a career in actuarial science, finance, operations research, scientific computing, biostatistics, mathematical physics, or one of many other areas which use mathematics and statistics.

As you look over the curriculum, you may wonder how you will decide which courses to take and when to take them. Questions such as: "What courses will best serve me and my career goals? Which ones am I ready to take?" are excellent questions to put to your advisor. Upon entering Villanova as a mathematics major you will be assigned a faculty member to advise you. Your advisor can help you plan a course of study that will focus on your needs and interests while also meeting the various college requirements.

Each semester you will meet with your advisor to plan and pre-register for the next term's courses. Use these meeting opportunities to discuss your academic program and career objectives. You may also find it helpful to consult with other members of the faculty about your plans for the future.

At any time, you may change advisors. If you wish to do so, simply obtain the agreement of the faculty member and notify the department administrative staff.



Leibniz: "Music is the pleasure the human soul experiences from counting without being aware it is counting."

Stravinsky: "Musical form is close to mathematics."

Registration Procedures

Preparing for Registration

Meet with your Academic Advisor:

- Discuss your course options for next semester
- Receive your Registration PIN (a.k.a. Alternate PIN)

Registration PIN:

- Save it to your phone or email
- Changes each semester
 - Spring Registration PINs begin: sp _ _ _ _ (four random numbers)
 - Fall Registration PINs begin: fa _ _ _ _ (four random numbers)
- Take the time to test your PIN before your registration time begins

How to “Test” your PIN: Go to your *Student* tab -> *My Schedule and Registration* -> *Login to Register* -> Select the appropriate term -> type your PIN

- If you enter the correct PIN, the system display your registration time appointment
- If you enter an incorrect PIN, you will receive an error message: *Authorization Failure – Invalid Alternate PIN*
- If you feel you have the incorrect PIN, contact your Advisor or your Advising Center

Note: The system is “case sensitive.” The letters are lower case.

Check your Registration Status link will display the following:

- Date and time you can begin registering and the date and time online registration ends.
- An alert if you have Holds on your account which will prevent registration
- Link to *View Holds* is at the bottom of the screen
- Your Academic Standing
- Your Student Status
- Your Class for registration (example: *Sophomore* class will not permit registration into courses restricted to Juniors and Seniors only)

Holds that prevent registration: (Holds most often seen – not a complete list)

- Acad Integ Pledge – VPAA – student has not completed the Pledge
- No Med Form – Call Health Center
- No Social Security # on file – Bursar’s Office needs this to complete tax forms for students
- Bursar Registration Hold – student has a balance owing
- Must Call Dean of Students
- Financial Aid Hold – Call FinAID

Note: A hold can be removed only by the originating office

Search for Classes: The *Master Schedule Class Search* will allow you to search the semester’s course offerings using various criteria. You can be as vague or as detailed in your search as you want. For example, you can search by just selecting an Attribute Type like Diversity Requirement 2.

When planning your schedule, be flexible and make notes of your options. Some sections may be filled and you will need to select a different time or teacher or course.

Satisfactory/Unsatisfactory Option

Sophomores, juniors, and seniors may take **one elective course per semester on a satisfactory/ unsatisfactory basis**. Grades of Satisfactory (equivalent to a "C" or better) and Unsatisfactory (equivalent to a "C-" or worse) are shown on the transcript but not included in the grade point average. The Satisfactory/Unsatisfactory option may not be used for courses that fulfill core, major, or minor requirements.

Drop/Add

Changes may be made in your schedule only before or during the Drop/Add period, which takes place during the first week of classes. Please meet with your advisor to discuss any changes you wish to make.

Withdrawal From A Course

After the Drop/Add period students may withdraw from a course without academic penalty up to nine weeks after the commencement of classes. A grade of "WX" will be issued. After this period, students may request an authorized withdrawal from any course up to and including the last day of the semester by providing to the Dean a written statement of justifiable cause as well as the written recommendation of the instructor and the student's chairperson. Withdrawal from the course is contingent upon the Dean's approval. Justifiable cause is a reason such as serious illness that is extrinsic to the nature or difficulty of a course.

Overload Policy

All students in Mathematics will be allowed to take 6 courses providing their GPA is a 3.0 or higher. No paperwork will be required. However, a student will only be allowed to sign up for up to 5 courses during their initial registration. After all students have had the opportunity to register for 5 courses, credit limits will be raised by the Registrar for students with a GPA of 3.0 or higher and for seniors in order to allow them to register for a 6th course. In no case will permission be given for a seventh course, or six courses and associated labs totaling more than 21 credit hours.



Sonya Kovalevsky (1850-1891)

"I understand your surprise at my being able to busy myself simultaneously with literature and mathematics.... It seems to me that the poet has only to perceive that which others do not perceive, to look deeper than others look...and the mathematician must do the same thing."

Mathematics Courses for Math Majors

MAT 1500	Calculus I
Description: Limits, transcendental functions (logarithms, exponential functions, inverse trigonometric functions), differentiation (definition, tangent lines, rates of change, techniques, implicit differentiation, related rates), applications of differentiation (graphing, optimization), indeterminate forms and L'Hopital's Rule. Use of a computer algebra system, eg. MAPLE. <i>4.0 credit(s)</i>	
MAT 1505	Calculus II
Description: Integration (indefinite, definite), applications of integration (area, volume, applications to physics and economics, etc.), methods of integration, approximate integration (trapezoidal and Simpson's rules), improper integrals, differential equations, infinite sequences and series. Continued use of a computer algebra system. <i>4.0 credit(s)</i> Prerequisites: MAT1500	
MAT 2100	Theory of Interest
Description: Interest measurements: accumulated and present value factors, annuities certain, amortization schedules, sinking funds, bonds and related securities. <i>3.0 credit(s)</i> Prerequisites: MAT 1505	
MAT 2500	Calculus III
Description: Parametric equations; polar, cylindrical, and spherical coordinates; vectors and the geometry of space; vector functions (derivatives, integrals, curvature, etc.); partial derivatives; optimization; multiple integration and its applications; vector calculus (line integrals, vector analysis). Continued use of a computer algebra system. <i>4.0 credit(s)</i> Prerequisites: MAT 1505	
MAT 2600	Foundation of Math I
Description: Topics selected from natural numbers, mathematical induction, irrational and transcendental real numbers, complex numbers, Fundamental Theorem of Algebra, infinite cardinals, symbolic logic, functions and relations, iterated functions, mathematical chaos. <i>3.0 credit(s)</i> Prerequisites: MAT 1500	
MAT 2705	Differential Equation with Linear Algebra
Description: First order and linear second order differential equations, matrices and linear equation systems, eigenvalues and eigenvectors, and linear systems of differential equations. <i>4.0 credit(s)</i> Prerequisites: MAT 1505	
MAT 3300	Advanced Calculus
Description: Real numbers, sequences, convergence, supremum and infimum, completeness of the reals, continuous functions, Intermediate Value Theorem, differentiable functions, Mean Value Theorem, Riemann integral, Fundamental Theorem of Calculus, Taylor's Theorem. <i>3.0 credit(s)</i> Prerequisites: MAT 2500 and MAT 2600	
MAT 3305	Topics in Analysis
Description: Advanced topics selected from real analysis, complex analysis, or higher analysis. <i>3.0 credit(s)</i> Prerequisites: MAT 3300	
MAT 3400	Linear Algebra
Description: Vector spaces, linear transformations, basis and dimension, orthogonal transformations, least squares, eigenvalues and eigenvectors, similarity, diagonalization, symmetric, applications. <i>3.0 credit(s)</i> Prerequisites: MAT 2705	
MAT 3500	Modern Algebra I
Description: Topics selected from groups and subgroups, cyclic groups, permutation groups, isomorphisms, direct products, cosets and Lagrange's Theorem, normal subgroups and factor groups, group homomorphisms, the Fundamental Theorem of Finite Abelian Groups, rings, fields. <i>3.0 credit(s)</i> Prerequisites: MAT 2600 and MAT 2705	
MAT 3505	Modern Algebra II
Description: Rings, subrings, integral domains, ideals and factor rings, ring homomorphisms, polynomial rings, fields, extensions fields, finite fields. <i>3.0 credit(s)</i> Prerequisites: MAT 3500	
MAT 3930	History of Mathematics
Description: Development of mathematics from ancient times to the birth of calculus in the seventeenth century. <i>3.0 credit(s)</i> Prerequisites: MAT 1500 and 1505	
MAT 4110	Combinatorics
Description: Induction, permutations and combinations, general counting methods, generating functions, recurrence relations, principle of inclusion-exclusion, graph theory, trees, planarity, crossing numbers, Hamiltonian cycles, Eulerian tours. <i>3.0 credit(s)</i> Prerequisites: MAT1505	
MAT 4270	Numerical Analysis
Description: Numerical and computational aspects of root-finding methods, interpolation and polynomial approximation, numerical differentiation and integration, approximation theory. <i>3.0 credit(s)</i> Prerequisites: MAT1505	
MAT 4310	Stat Methods
Description: Data displays and summarization, probability distributions, point and interval estimation, hypothesis testing, categorical data analysis, regression and correlation. <i>3.0 credit(s)</i> Prerequisites: MAT1505	

MAT 4315	Applied Statistical Models
Description:	Simple and multiple linear regression, including prediction, correlation, model building, multicollinearity, influential observations, and model fit; ANOVA for designed experiments, including completely randomized, randomized block, and factorial designs; Time Series including linear time series models, moving averages, autoregressive and ARIMA models, estimation and forecasting. Prerequisites: MAT 4310
MAT 4410	Math Modeling
Description:	Model formulation, the modeling process, graphs as models, examples from the physical and social sciences, parameter estimation, experimental modeling, dimensional analysis, modeling discrete and continuous dynamic behavior, implementation. <i>3.0 credit(s)</i> Prerequisites: MAT 2705
MAT 4550	Math of Financial Derivatives
Description:	Basic tools of financial markets; options; asset price random walks; estimation of parameters; arbitrage put-call parity; Black-Scholes Model; implied volatility; portfolio-optimization; hedging. <i>3.0 credit(s)</i> Prerequisites: MAT 2705
MAT 4600	Deterministic Operations Research
Description:	Deterministic methods: mathematical optimization, linear programming, formulation and solution techniques, duality, integer linear programming, transportation problem, assignment problem, network flows, dynamic programming. <i>3.0 credit(s)</i> Prerequisites: MAT 2705
MAT 4610	Stochastic Operations Research
Description:	Probabilistic methods: brief review of probability, transient and asymptotic properties of Markov chains, queuing models and their applications, Markov decision processes, forecasting, game theory, simulation. <i>3.0 credit(s)</i> Prerequisites: MAT 2705
MAT 5110	Topics in Geometry
Description:	Topics selected from affine, hyperbolic, spherical, elliptic, Euclidean or projective geometry. <i>3.0 credit(s)</i> Prerequisites: MAT2600
MAT 5200	Theory of Numbers
Description:	Congruences, quadratic reciprocity, Diophantine equations; applications. <i>3.0 credit(s)</i> Prerequisites: MAT 2600
MAT 5400	Complex Analysis
Description:	Algebra of complex numbers, analytic functions, Cauchy- Riemann equation, Laplace equations, conformal mapping, integrals of complex functions, Cauchy's theorem, power series, Taylor's theorem, Laurent's theorem, residues, entire functions. <i>3.0 credit(s)</i> Prerequisites: MAT 2500 and 2600
MAT 5500	Topology
Description:	Topological equivalence, connectedness, compactness, topology of subsets of R^n , manifolds, topological embeddings, topological spaces. <i>3.0 credit(s)</i> Corequisites: MAT 3300
MAT 5600	Differential Geometry
Description:	Geometry of curves and surfaces, curvature, first and second fundamental forms, minimal surfaces, use of MAPLE. <i>3.0 credit(s)</i> Prerequisites: MAT2500
MAT 5700	Math Statistics I
Description:	Probability, random variables, joint distributions, expected values, limit theorems, distributions derived from the normal distribution. <i>3.0 credit(s)</i> Prerequisites: MAT2500
MAT 5705	Math Statistics II
Description:	Survey sampling, parameter estimation, hypothesis testing, two sample tests, analysis of variance, analysis of categorical data, linear least squares. <i>3.0 credit(s)</i> Prerequisites: MAT 5700
MAT 5900	Seminar in Mathematics
Description:	Supervised study of selected topics or problems in mathematics, student presentations. May be repeated for credit if content is different. <i>3.0 credit(s)</i> Prerequisites: MAT3300 or MAT 3500
MAT 5920	Topics in Applied Mathematics
Description:	Lecture course in an area of applied mathematics. May be repeated for credit if topics are different. <i>3.0 credit(s)</i>
MAT 5930	Topics in Pure Mathematics
Description:	Lecture course in an area of pure mathematics. May be repeated for credit if topics are different. <i>3.0 credit(s)</i>

VILLANOVA UNIVERSITY ~ DEPARTMENT OF MATHEMATICS AND STATISTICS
B.S. IN MATHEMATICS REQUIREMENT: CLASS OF 2023

CORE CURRICULUM REQUIREMENTS		MATH MAJOR REQUIREMENTS	
	Semester		Semester
2 Augustine and Cultural Seminars		MAT 1500 Calculus I	
ACS 1000 "Ancients" Seminar *		MAT 1505 Calculus II	
ACS 1001 "Moderns" Seminar *		MAT 2500 Calculus III	
		MAT 2600 Foundations of Mathematics *	
		Fills Sophomore/Junior Research requirement	
2 Theology Courses		MAT 2705 Differential Equations w/Linear Alg.	
THL 1000 "Faith, Reason and Culture" *		MAT 3300 Advanced Calculus I	
Core Upper Level Theology		Advanced Analysis	
		MAT 3400 Linear Algebra	
1 Philosophy Course		MAT 3500 Modern Algebra	
PHI 1000 "Knowledge, Reality, and Self" *		MAT 5900 Seminar* Fills Senior Capstone requirement	
		Math Electives: (4 courses)	
1 Ethics Course		1)	
ETH 2050 "The Good Life: Ethics and Contemporary Moral Problems" *		2)	
		3)	
2 Language Courses		4)	
1)		Science Elective:	
2)		(CSC1051 or science course w/lab-science student level)	
		2 Science courses sequence each with a lab (at a science student level)—fills core requirement for science	
1 Literature and Writing Sophomore Seminar * +		Options to include one of the following combinations: PHY2410/2411 & PHY2412/13&2414/15 or CHM, BIO, AST, or GEV at a major level.	
1)		1)	
(listed as "Core Lit & Writing Sem" attribute)		Lab:	
1 History Course +		2)	
HIS-		Lab:	
(listed as "Core History" attribute)			
2 Social Science Courses +		Free Electives (10 courses):	
1)		1)	
2)		2)	
(listed as "Core Social Science" attribute)		3)	
1 Fine Arts Course		4)	
1)		5)	
(listed as "Core Fine Arts" attribute)		6)	
		7)	
+ AP credit cannot be used to satisfy this requirement.		8)	
		9)	
		10)	
Diversity Requirements: 2 Diversity Courses			
Students are required to select one course in two of the three following areas:			
Diversity 1: Courses that focus on dominant groups, minority groups, or impoverished groups in the United States; also courses focusing on the experiences of minorities in Western Europe as "marginalized" people. Course Taken:			
Diversity 2: Courses that provide a focus on women's experiences and/or highlight the relationship between gender and culture. Course Taken:			
Diversity 3: Courses that provide a focus on the culture, economics, politics or ecology of societies and nations other than those of Europe and the United States. Service learning courses, internships, and other experiential courses may be applied toward this requirement, provided they include a significant reflective component, just as traditional diversity courses do. Study abroad courses may also be applied toward this requirement: such as courses will be assessed the same way as courses at Villanova. Course Taken:			

Revised 7/20/18

**VILLANOVA UNIVERSITY
DEPARTMENT OF MATHEMATICS AND STATISTICS
BACHELOR OF SCIENCE IN MATHEMATICS
CLASS OF 2023**

A sample program, subject to variation/change at the discretion of the student and the student's advisor, follows:

FRESHMAN				
1st Semester	Credits		2nd Semester	Credits
MAT 1500 Calculus I	4		MAT 1505 Calculus II	4
ACS 1000 "Ancients" Seminar	3		ACS 1001 "Moderns" Seminar	3
Core History	3		PHI 1000 Knowledge, Reality, and Self	3
CSC 1051 or Science Elective	4		THL 1000 "Christian Faith and Life"	3
Core Language (Intermediate I)	3		Core Language (Intermediate II)	3
	17			16
SOPHOMORE				
MAT 2600 Foundations of Mathematics	3		MAT 2500 Calculus III	4
MAT 2705 Differential Equations	4		MAT 3400 Linear Algebra	3
Core ENG Literature & Writing Soph. Seminar	3		Core Advanced Theology	3
Natural Science I (Phy, Bio, etc.) w/Lab *	4		Natural Science II (Phy, Bio, etc.) w/Lab *	4
Core Social Science			ETH 2050 The Good Life: Eth. & Con. Mor. Pro.	3
	17			17
JUNIOR				
MAT 3300 Advanced Calculus I	3		Upper Level Math Analysis Course	3
MAT 3500 Modern Algebra	3		MAT Elective	3
Core Social Science	3		Elective	3
Core Fine Arts	3		Elective	3
Elective	3		Elective	3
	15			15
SENIOR				
MAT 5900 Math Seminar	3		MAT Elective	3
MAT Elective	3		MAT Elective	3
Elective	3		Elective	3
Elective	3		Elective	3
Elective	3		Elective	3
	15			15

You may, with the approval of your advisor, vary the order in which courses are taken and you may select whatever electives will help meet your interests and career objectives. In determining the order in which you will take the courses, you should keep prerequisites and co-requisites in mind.

* or CHM (1151/03 & 1152/04), BIO (2105 & 2106), AST (AST2122/MSE2151 & AST2121/MSE2150), PHY (2410/11 & 2412/13 or 2414/15), GEV (1050 & 1051) at a major level. Must include 2 semesters with labs.

VILLANOVA UNIVERSITY
DEPARTMENT OF MATHEMATICS AND STATISTICS
DOUBLE MAJOR -- BACHELOR OF SCIENCE IN MATHEMATICS and IN EDUCATION
CLASS OF 2023

A **sample program**, subject to variation/change at the discretion of the student and the student's advisor, follows: (no AP credit):

FRESHMAN				
1st Semester	Credits		2nd Semester	Credits
MAT 1500 Calculus I	4		ACS 1001 "Moderns" Seminar	3
ACS 1000 "Ancients" Seminar	3		Core History **	3
PHI 1000 Knowledge, Reality, and Self	3		MAT 1505 Calculus II	4
CSC 1051 or Science Elective	4		THL 1000 "Faith, Reason and Culture"	3
Core Language (Intermediate I)	3		Core Language (Intermediate II)	3
	17			16
SOPHOMORE				
EDU 2202 Soc. Foundations	3		MAT 2500 Calculus III	4
MAT 2705 Differential Equations	4		MAT 3400 Linear Algebra	3
MAT 2600 Foundations of Mathematics	3		Core Advanced Theology **	3
Natural Science I (Phy, Bio, etc.) w/Lab *	4		Natural Science II (Phy, Bio, etc.) w/Lab *	4
Core ENG Literature & Writing Soph. Seminar	3		EDU 2300 Research Seminar	3
	17		EDU 3000 Professional Development in Education	1
				18
JUNIOR				
MAT 3300 Advanced Calculus I	3		Upper Level Math Analysis Course	3
MAT 3930 History of Mathematics (E) ***	3		MAT 3500 Modern Algebra	3
Math Elective	3		MAT 4310 Statistical Methods (E)	3
EDU 3251 Psych. of Learning & Teaching	3		EDU 3263 Diversity & Inclusion **	3
Ethics ETH 2050 The Good Life	3		EDU 4290 Philosophy of Education	3
Core Fine Arts	3			15
	18			
SENIOR				
MAT 5900 Math Seminar	3		EDU 4291 Student Teaching	9
MAT 5110 Topics in Geometry (E) ***	3		EDU 4292 Seminar	3
EDU 4283 Methods of Teaching Math	3			12
EDU 4245 Literature & Language Learning	3			
English	3			
EDU 3264 Disability Studies	3			
	18			

* or CHM (1151/03 & 1152/04), BIO (2105 & 2106), (AST2122/MSE2151 & AST2121/MSE2150), PHY (2410/11 & 2412/13 or 2414/15), GEV (1050 & 1051) at a major level. Must include 2 semesters with labs (fills requirements for both Math and Education).

** Need 3 diversity credits – use these classes to acquire them.

***Only offered in altering fall semesters – switch depending on what is offered.

(E) Math electives.

Department Full Time Faculty & Staff

2019-2020

<u>NAME</u>	<u>OFFICE</u>	<u>PHONE/VOICE MAIL</u>
Acker, Dr. Kathleen	SAC 187	85604(voicemail box)
Ashley, Dr. Charles	SAC 328	96962
Baranski, Miss Maria	SAC 318	96949
Barrett, Mrs. Maria	SAC 305	94850
Bernhardt, Dr. Paul	SAC 323	97343
Canzanese, Mr. Dominic	SAC 75	86857(voicemail box)
Chi, Dr. Peter	SAC 367	97336
Chiacchiere, Mr. Steven	SAC 369	96951
Corwin, Dr. Nathan	SAC 377	96601
Diaz-Lopez, Dr. Alexander	SAC 373	96991
Feeman, Dr. Timothy	SAC 447	94693
Ferreira, Mrs. Melissa	Falvey Library 204 (MLRC)	97823
Frey, Dr. Jesse	SAC 305	94851
Gadonas, Mrs. Christine	SAC 305	94809
Gilley, Ms. Ebony	SAC187	86249(voicemail box)
Gluchoff, Dr. Alan	SAC 383	94673
Gou, Dr. Jiangtao	SAC 375	TBA
Haymaker, Dr. Kathryn	SAC 384	98355
Jantzen, Dr. Robert	SAC 370	97335
Kamat, Dr. Vikram	SAC 332	94681(voicemail box)
Knecht, Dr. Amanda	SAC 381	96659(voicemail box)
Levitan, Dr. Michael	SAC 376	94818
Lukens, Mrs. R. Edel	SAC 121	97351
Lupinacci, Dr. Paul	SAC 390	97435
Marrero, Dr. Osvaldo	SAC 327	94844
Muller, Dr. Kaitlyn	SAC 317	97334
Muller, Dr. Peter	SAC 335	TBA
Norton, Dr. Douglas	SAC 334	TBA
Nsowaa, Dr. Bright	SAC 377	TBA
Pasles, Dr. Elise	SAC 320	96950
Pasles, Dr. Paul	SAC 324	97345
Pollack-Johnson, Dr. Bruce	SAC 368	96926
Posner, Dr. Michael	SAC 387	93016
Romito, Miss Chelsea	SAC 75	86861(voicemail box)
Santomas, Mr. John	SAC 321	97049
Smiley, Dr. Danielle	SAC 332	94681(voicemail box)
Styer, Dr. Robert	SAC 372	94845
Tait, Dr. Michael	SAC 378	TBA
Volpert, Dr. Klaus	SAC 374	94670
Wang, Dr. Le	SAC 371	97347
Woldar, Dr. Andrew	SAC 380	94672
Zhang, Dr. Yimin	SAC 325	94704
Math Learning Resource Center	Falvey Memorial Library – 2 nd Floor Room 204	96572

Useful Campus Phone Numbers

EMERGENCY NUMBERS :

Campus Security (Emergency).....	610-519-4444
Radnor Fire Department	610-688-0450
Snow and Emergency Closings.....	610-519-4505

OTHER USEFUL NUMBERS :

Mathematics and Statistics Department (SAC305).....	610-519-4850
Arts & Sciences Dean's Office (SAC105).....	610-519-4600
• Office for Undergraduate Students (OUS) (SAC107).....	610-519-3900
Wells Fargo Bank (Dougherty, 1st Floor).....	610-527-0726
Wildcard Office (Dougherty, 1st Floor).....	610-519-5031

OFFICES & PROGRAMS *

OFFICE/PROGRAM	LOCATION	PHONE
ATHLETICS	Field House, 1 st Floor	9-7719 or 9-5205
ALCOHOL & DRUG INTERVENTION	208B Dougherty Hall	9-4203
BURSAR	Kennedy Hall	9-4258
CAMPUS MINISTRY	St. Rita Hall	9-4080
CAREER SERVICES	Garey Hall	9-4060
CLAY CENTER	Bartley 1045	9-5532
COUNSELING CENTER	Health Services Bldg.	9-4050
DEAN OF STUDENTS	213 Dougherty Hall	9-4200
FALVEY LIBRARY	Falvey Hall	9-4290
FINANCIAL ASSISTANCE	Kennedy Hall, 2 nd Floor	9-4010
GREEK LIFE	Corr Hall	9-7280
HEALTH CENTER	Health Services Bldg.	9-4070
HEALTH PROFESSIONS ADVISING	Mendel 143	9-4833
HEALTH PROMOTION	Health Services Bldg.	9-7407
INTERNATIONAL STUDIES	Middleton Hall, 2 nd Floor	9-6412
INTERNATIONAL STUDENT SRVCS	Connelly, 2 nd Floor	9-8017 or 9-7827
INTERNSHIPS	SAC 107	9-3942
LEADERSHIP & PROFESSIONAL DEVELOPMENT	SAC 107	9-4232
LEARNING SUPPORT SERVICES	212 Falvey Library	9-5176
MATH CENTER (MLRC)	204 Falvey Library	9-6572
MULTICULTURAL AFFAIRS	102 Dougherty Hall	9-4075
MUSIC ACTIVITIES	St. Mary's, ground floor	9-5050
PHYSICAL DISABILITIES	Connelly, 2 nd Floor	9-4095
PRE-LAW ADVISING	Garey Hall	9-4060
PREGNANCY SUPPORT SERVICES	202 Dougherty Hall	9-4550
PUBLIC SAFETY (non-emergency)	Garey Hall	9-6979
*REGISTRAR'S OFFICE	202-204 Tolentine Hall	9-4030
RESIDENCE LIFE	Kennedy Hall	9-4154 or 4150
SERVICE LEARNING	SAC 386	9-3251
SEXUAL ASSAULT RESOURCE COODINATOR	HSB 1 st floor	484-343-6028
STUDENT LIFE	214/17 Dougherty Hall	9-4210
STUDENT GOVERNMENT (SGA)	206 Dougherty Hall	9-7203
SUMMER BUSINESS INST. (SBI)	1050 Bartley Hall	9-5951
UNIT HELP DESK	Falvey 1 st floor	9-7777
WILDCARD OFFICE	Dougherty Hall, 1 st Floor	9-6202
WRITING CENTER	210 Falvey Library	9-4604

Please note: All contacts are subject to change.

*The Registrar's Office will be moving in the fall of 2018 to Kennedy Hall, 2nd Floor

ARTS & SCIENCES MAJORS *

DEPARTMENT/PROGRAM	LOCATION	PHONE
Arab and Islamic Studies	SAC 254	97712
Art History	SAC 403	94662
Astronomy and Astrophysics	Mendel 456	94820
Biochemistry	Mendel 215	94868
Biology	Mendel 147	94830
Chemistry	Mendel 215	94840
Classical Studies	SAC 304	96165
Communication	Garey Hall 28	94750
Comprehensive Science	Mendel 347	94862
Computing Science	Mendel 161	97344
Criminology	SAC 204	94482
Cultural Studies	SAC 348 or SAC 458	93069 or 97872
Economics	Bartley Hall 2015	94370
Education, Secondary	SAC 302	94620
English	SAC 402	94630
Environmental Science/Studies	Mendel G67D	93337
French and Francophone Studies	SAC 303	96955
Gender and Women's Studies	SAC 488	93815
Geography	Mendel G67D	93337
Global Interdisciplinary Studies	Garey Hall 35	96964
History	SAC 403	94677
Humanities	SAC 304	96165
Italian Studies	SAC 303	94696
Latin American Studies	SAC 446	94640
Mathematics & Statistics	SAC 305	94850
Philosophy	SAC 108	94690
Physics	Mendel 347	94860
Political Science	SAC 202	94553
Psychological & Brain Sciences	Tolentine 334	94722
Sociology	SAC 204	94482
Spanish Studies	SAC 303	97478
Theology and Religious Studies	SAC 203	94731

* All contacts are subject to change.

Go to <https://www1.villanova.edu/villanova/artsci/undergrad.html> for more information

MINORS & INTERDISCIPLINARY CONCENTRATIONS *

DEPARTMENT/PROGRAM	LOCATION	PHONE
Africana Studies	Garey Hall 36	94640
Arabic Language and Cultural Studies	SAC 430	94683
Art History	SAC 403	94677
Asian Studies	Garey Hall	94640
Astronomy and Astrophysics	Mendel 460	96396
Augustine in Dialogue with Faith & Culture	SAC 203	94730
Biochemistry	Mendel 215	94840
Bioengineering	Mendel 147	94830
Business Minor (General)	Bartley 1054	95532
Chemistry	Mendel 215	94840
Chinese Studies	SAC 277	94682
Classical Studies	SAC 304	96165
Cognitive Science	Tolentine 252	97464
Communication	Garey Hall 28	94750
Computing Science	Mendel 161	97341
Criminology	SAC 204	94482
East Asian Studies	SAC 277	94682
Economics	Bartley Hall 2015	94370
Education, Secondary	SAC 302	94620
English	SAC 402	94630
Environmental Studies	Mendel G67D	93337
Ethics	SAC 485	94692
French & Francophone Studies	SAC 303	96955
Gender & Women's Studies	SAC 488	93815
Geography	Mendel G67D	93337
History	SAC 403	94677
Honors Program	Garey 106	94650
Humanities	SAC 304	96165
Irish Studies	SAC 455	94647
Italian Studies	SAC 303	96955
Japanese Studies	Garey 36	96302
Latin American Studies	SAC 273	94773
Mathematics	SAC 324	97345
ROTC, Air Force (Aerospace Studies)	St. Joseph's University	610-660-3190
ROTC, Army (Military Science)	Military Science Bldg 2	95953
ROTC, Navy (Naval Science)	John Barry 115	97391
Peace and Justice Education	Corr, 1 st floor	94499
Philosophy	SAC 108	94690
Physics	Mendel 347	94860
Political Science	SAC 202	94553
Psychological & Brain Sciences	Tolentine 334	94722
Russian Area Studies	SAC 437	97243
Russian Language & Cultural Studies	Garey 36	96302
Sociology	SAC 204	94482
Spanish Studies	SAC 303	96955
Statistics	SAC 323	97343
Teacher Certification	SAC 302	94620
Theatre	SAC 205	94760
Theology & Religious Studies	SAC 203	94731
Writing & Rhetoric	SAC 458	97872

ADDITIONAL DEGREES

Honors Program	BAH, BSH	Thomas W. Smith	Garey 106	94650
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* All contacts are subject to change. Go to <https://www1.villanova.edu/villanova/artsci/undergrad.html> for more information

SCHEDULE WORKSHEET

REGISTRATION PIN: _____

*This Registration PIN is valid until 11:59PM on the last day of Drop/Add.
Tip: For easy access until the end of Drop / Add, email your PIN to yourself.*

CRN	SUBJECT	COURSE #	SECTION	COURSE NAME

TIME	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
8:30					
9:00					
9:30					
10:00					
10:30					
11:00					
11:30					
12:00					
12:30					
1:00					
1:30					
2:00					
2:30					
3:00					
3:30					
4:00					
4:30					
5:00					
Eve:					
Eve:					

Frequently Used Phone Numbers/Email

Name: _____
Phone: _____
Email: _____

Name: _____
Phone: _____
Email: _____