MATHEMATICS (BS/MS)

The accelerated BS/MS program in Mathematics gives academically successful Loyola undergraduates the opportunity to pursue the MS degree in Mathematics while completing their BS degree. This is best suited for students pursuing a BS in mathematics, but can be pursued with other BS degrees (http://www.luc.edu/math/undergradprogs.shtml/) offered by the Department of Mathematics and Statistics at the program director's discretion.

There are several advantages to pursuing the BS/MS program. Chief among them are time and cost: by taking graduate courses during their senior year (at the undergraduate tuition rate), students in the BS/MS program save one semester over the usual path to a Master's degree. Additionally, students in the STEM fields holding an MS degree are more competitive for jobs.

STEM DESIGNATION

The MS in Mathematics has been granted a STEM designation from the U.S. Department of Homeland Security. International students completing degrees with this designation can qualify for extended OPT (Optional Practical Training), bringing the total OPT time granted to 36 months.

Related Programs

Master's

- Applied Statistics (MS) (https://catalog.luc.edu/graduate-professional/graduate-school/arts-sciences/mathematics-statistics/applied-statistics-ms/)
- Data Science (MS) (https://catalog.luc.edu/graduate-professional/graduate-school/arts-sciences/data-science/data-science-ms/)
- Mathematics (MS) (https://catalog.luc.edu/graduate-professional/graduate-school/arts-sciences/mathematics-statistics/mathematics-ms/)

Combined

- Mathematics/Applied Statistics (BS/MS) (https://catalog.luc.edu/undergraduate/accelerated-bachelors-masters-program/mathematics-applied-statistics-bs-ms/)

Curriculum

Students in the BS/MS program are permitted to take up to 10 credit hours of 400-level courses that would apply toward their MS program requirements while completing their undergraduate degree. Of these, nine credits may come 400-level courses that have 300-level equivalents that satisfy BS program requirements. The one-credit course MATH 401 should also be taken during the student's undergraduate career. (While it does not fulfill any specific Mathematics BS program requirement, it does count towards the credit-hours requirement for a degree from the College of Arts & Sciences.)

The coursework includes required ("foundational") courses in algebra, analysis and statistics, as well as 18 credit hours of electives, chosen from courses in Mathematics and cognate fields (such as Applied Statistics, Data Science and Computer Science). With their practicum, students design and independently carry out a research project under faculty supervision.

Code	Title	Hours
BS Requirements [1]		
Foundational Requirements		
MATH 161	Calculus I	4
MATH 162	Calculus II	4
MATH 263	Multivariable Calculus	4
MATH 264	Ordinary Differential Equations	3
MATH 201	Introduction to Discrete Mathematics & Number Theory	3
MATH 212	Linear Algebra	3
STAT 203	Introduction to Probability & Statistics	3
or MATH 304 / STAT 304	Introduction to Probability	
MATH 215	Object-Oriented Programming with Mathematics	3
or COMP 170	Introduction to Object-Oriented Programming	
One year of Modern Algebra:		
MATH 313	Abstract Algebra	3
MATH 314	Advanced Topics Abstract Algebra	3
or MATH 315	Advanced Topics in Linear Algebra	
One year of Analysis:		
MATH 351	Introduction to Real Analysis I	3
MATH 352	Introduction to Real Analysis II	3
or MATH 353	Introduction to Complex Analysis	
Two 3-credit upper division (300-level) electives in mathematics [1]		6
Science Requirements		
Select two of the following:		6
ANTH 101	Human Origins	
BIOL 101	General Biology I	
BIOL 102	General Biology II	
CHEM 160	Chemical Structure and Properties	
CHEM 180	Chemical Reactivity I	
ENVS 101	The Scientific Basis of Environmental Issues	
PHYS 121	College Physics I with Calculus Lecture/ Discussion	
PHYS 122	College Physics II with Calculus Lecture/ Discussion	
MS Requirements		
Foundational Course Requirements		
MATH 416	Survey of Algebra	3
MATH 454	Survey of Analysis	3
MATH 404 / STAT 404	Probability & Statistics I [2]	3
or STAT 408	Applied Regression Analysis	
Algebra or Analysis. Select one of the following:		*3*
MATH 414	Algebra II	
MATH 415	Topics in Linear Algebra	
MATH 452	Analysis II	
MATH 453	Complex Analysis	
Cognate Fields. Select one of the following: [3]		*3*
STAT 405 / MATH 405	Probability & Statistics II	
STAT 408	Applied Regression Analysis	
STAT 410	Categorical Data Analysis	

COMP 429	Natural Language Processing	
COMP 487	Deep Learning	
DSCI 401	Introduction to Data Science	
Or Another Course with Graduate Program Director Approval [4]		
Additional Requirements		
MATH 401	Introduction to Graduate Study in Mathematics	1
MATH 495	Graduate Practicum in Mathematics (elect four electives chosen from Mathematics and approved Statistics courses at the 400 level.)	2
Select four approved 400-level Electives in Mathematics or Statistics [5]		12
Total Hours		**72**

1. This BS degree has waivers for both Quantitative and Scientific core.
2. Graduate MATH 400+ courses can also count towards this. This means students have the opportunity to concurrently fulfill elective requirements for both the Bachelor's and Master's part of the program by selecting MATH 400+ elective courses.
3. Students who select MATH 404/STAT 404 as a Foundational Course may opt to take STAT 408 as a Depth Course, and vice versa.
4. The depth requirement for Cognate Fields may be fulfilled by other courses, including courses from other departments, with approval of Graduate Program Director.
5. Approved elective courses should be selected with advice of Graduate Program Director to complement student's previous learning and support future plans.

Interested students should reach out to the Graduate Program Director in their sophomore year (or early junior year) to optimize course selection for their remaining semesters.

Eligibility Requirements

- 3.5 minimum GPA, in major-program coursework: MATH 161, MATH 162, MATH 263, MATH 201, and three courses (9 credits total) chosen from MATH 212 and 300-level math/stat courses
- 3.3 minimum GPA, across all Loyola coursework
- Satisfactory progress towards completion of Loyola's core

Program Policies

- **AP Credit Policies**
- No 300-level courses will apply toward graduate requirements.
- A student with credit for a 300-level MATH/STAT/COMP course that has an equivalent 400-level offering may not take the 400-level course for separate credit.
- Additional MS policies appear below.

MS Policies

- At most three 400-level courses (nine credits) outside the MATH designation will be counted for the MS program.
- At most six credits of independent study (MATH 498) or research (MATH 495) will be counted for the program.
- Course selection for all 400-level electives should be made in consultation with the Graduate Program Director

Suggested Sequence of Courses

The below sequence of courses is meant to be used as a suggested path for completing coursework. An individual student's completion of requirements depends on course offerings in a given term as well as the start term for a major or graduate study. Students should consult their undergraduate and graduate program advisors for assistance with course selection.

Important Note: what follows is *one choice*, of **many,** for selection of three 400-level courses to take during one's senior year.

Course	Title	Hours
Year 1		
Fall		
MATH 161	Calculus I	4
Science Requirement		3
	Hours	**7**
Spring		
MATH 162	Calculus II	4
MATH 201	Introduction to Discrete Mathematics & Number Theory	3
Science Requirement		3
	Hours	**10**
Year 2		
Fall		
MATH 263	Multivariable Calculus	4
MATH 215 or COMP 170	Object-Oriented Programming with Mathematics or Introduction to Object-Oriented Programming	3
	Hours	**7**
Spring		
MATH 212	Linear Algebra	3
MATH 264	Ordinary Differential Equations	3
	Hours	**6**
Year 3		
Fall		
MATH 313	Abstract Algebra	3
STAT 203	Introduction to Probability & Statistics	3
	Hours	**6**
Spring		
MATH 314	Advanced Topics Abstract Algebra	3
	Hours	**3**
Year 4		
Fall		
MATH 351	Introduction to Real Analysis I	3
MATH 401	Introduction to Graduate Study in Mathematics [1]	1
400-level Math Elective [1]		3
	Hours	**7**
Spring		
MATH 452	Analysis II [1,2]	3
400-level Math Elective [1]		3
	Hours	**6**
Year 5		
Fall		
STAT 408	Applied Regression Analysis	3
MATH 454	Survey of Analysis	3

MATH 495	Graduate Practicum in Mathematics	2
400-level Math/Stat Elective		3
	Hours	**11**
Spring		
STAT 410	Categorical Data Analysis [3]	3
MATH 416	Survey of Algebra	3
400-level Math/Stat Elective		3
	Hours	**9**
	Total Hours	**72**

[1] Fulfills undergraduate degree requirement and MS degree requirement.
[2] Used to satisfy the depth requirement in Algebra or Analysis.
[3] Used to satisfy the Cognate Fields depth requirement.

Guidelines for Accelerated Bachelor's/ Master's Programs

Terms

- Accelerated Bachelor's/Master's programs: In this type of program, students share limited credits between their undergraduate and graduate degrees to facilitate completion of both degrees.
- Shared credits: Graduate level credit hours taken during the undergraduate program and then applied towards graduate program requirements will be referred to as shared credits.

Admission Requirements

Accelerated Bachelor's/Master's programs are designed to enhance opportunities for advanced training for Loyola's undergraduates. Admission to these programs must be competitive and will depend upon a positive review of credentials by the program's admissions committee. Accordingly, the admission requirements for these programs may be higher than those required if the master's degree were pursued entirely after the receipt of a bachelor's degree. That is, programs may choose to have more stringent admissions requirements in addition to those minimal requirements below.

Requirements:

- Declared appropriate undergraduate major,
- By the time students begin taking graduate courses as an undergraduate, the student has completed approximately 90 credit hours, or the credit hours required in a program that is accredited by a specialty organization,[1]
- A minimum cumulative GPA for coursework at Loyola that is at or above the program-specific requirements, a minimum major GPA that is at or above the program-specific requirements, and/or appropriate designated coursework for evaluation of student readiness in their discipline.[2]

Students not eligible for the Accelerated Bachelor's/Master's program (e.g., students who have not declared the appropriate undergraduate major) may apply to the master's program through the regular admissions process. Students enrolled in an Accelerated Bachelor's/Master's program who choose not to continue to the master's degree program upon completion of the bachelor's degree will face no consequences.[3]

Ideally, a student will apply for admission (or confirm interest in proceeding towards the graduate degree in opt-out programs) as they approach 90 credit hours. Programs are encouraged to begin advising students early in their major so that they are aware of the program and, if interested, can complete their bachelor's degree requirements in a way that facilitates completion of the program. Once admitted as an undergraduate, Program Directors should ensure that students are enrolled using the plan code associated with the Accelerated Bachelor's/ Master's program. Using the plan code associated with the Accelerated Bachelor's/Master's program will ensure that students may be easily identified as they move through the program. Students will not officially matriculate into the master's degree program and be labeled as a graduate student by the university, with accompanying changes to tuition and Financial Aid (see below), until the undergraduate degree has been awarded. Once admitted to the graduate program, students must meet the academic standing requirements of their graduate program as they complete the program curriculum.

[1] Programs that have specialized accreditation will adhere to the admissions criteria provided by, or approved by, their specialized accreditors.
[2] The program will identify appropriate indicators of student readiness for graduate coursework (e.g., high-level performance in 300 level courses). Recognizing differences between how majors are designed, we do not specify a blanket requirement.
[3] If students choose not to enroll in the Accelerated Bachelor's/Master's program, they still must complete all of the standard requirements associated with the undergraduate degree (e.g., a capstone).

For more information on Admissions requirements, visit here (https://gpem.luc.edu/portal/admission/?tab=home).

Curriculum

Level and progression of courses. The Accelerated Bachelor's/Master's programs are designed to be competitive and attractive to our most capable students. Students admitted to Accelerated Bachelor's/ Master's programs should be capable of meeting graduate level learning outcomes. Following guidance from the Higher Learning Commission, only courses taken at the 400 level or higher (including 300/400 level courses taken at the 400 level) will count toward the graduate program.[1,2] Up to 50% of the total graduate level credit hours, required in the graduate program, may come from 300/400 level courses where the student is enrolled in the 400 level of the course. Further, at least 50% of the credit hours for the graduate program must come from courses that are designed for and restricted to graduate students who have been admitted to a graduate program at Loyola (e.g., enrolled in plan code that indicates the Accelerated Bachelor's/Master's program, typically ending with the letter "D").[3]

In general, graduate level coursework should not be taken prior to admission into the Accelerated Bachelor's/Master's program. Exceptions may be granted for professional programs where curriculum for the Accelerated Bachelor's/Master's program is designed to begin earlier. On the recommendation of the program's Graduate Director, students may take one of their graduate level courses before they are admitted to the Accelerated Bachelors/Master's program if they have advanced abilities in their discipline and course offerings warrant such an exception.[4] Undergraduate degree requirements outside of the major are in no way impacted by admission to an Accelerated Bachelor's/Master's program.[5]

Shared credits. Undergraduate courses (i.e., courses offered at the 300 level or below) cannot be counted as shared credits nor count towards the master's degree. Up to 50% of the total graduate level credit hours, required in the graduate program, may be counted in meeting both the undergraduate and graduate degree requirements. Of those shared credits, students in an Accelerated Bachelor's/Master's program should

begin their graduate program with the standard introductory course(s) for the program whenever possible. So that students may progress through the Accelerated Bachelor's/Master's program in a timely manner, undergraduate programs are encouraged to design their curriculum such that a student can complete some required graduate credit hours while completing the undergraduate degree. For instance, some of the graduate curriculum should also satisfy electives for the undergraduate major.

The program's Graduate Director will designate credit hours to be shared through the advising form and master's degree conferral review process. Shared credit hours will not be marked on the undergraduate record as having a special status in the undergraduate program. They will be included in the student's undergraduate earned hours and GPA. Graduate credit hours taken during the undergraduate program will not be included in the graduate GPA calculation.

[1] If students wish to transfer credits from another university to Loyola University Chicago, the program's Graduate director will review the relevant syllabus(es) to determine whether it meets the criteria for a 400 level course or higher.

[2] Programs with specialized accreditation requirements that allow programs to offer graduate curriculum to undergraduate students will conform to those specialized accreditation requirements.

[3] In rare cases, the Graduate Director may authorize enrollment in a 400-level course for a highly qualified and highly motivated undergraduate, ensuring that the undergraduate's exceptional participation in the graduate class will not diminish in any way the experience of the graduate students regularly enrolled.

[4] For example, if a particular course is only offered once every 2-3 years, and a student has demonstrated the necessary ability to be successful, the Graduate Director may allow a student to take a graduate level course to be shared prior to the student being formally admitted to the graduate program. See, also, footnote 3.

[5] Students should not, for example, attempt to negotiate themselves out of a writing intensive requirement on the basis of admission to a graduate program.

Graduation

Degrees are awarded sequentially. All details of undergraduate commencement are handled in the ordinary way as for all students in the School/College/Institute. Once in the graduate program, students abide by the graduation deadlines set forth by the graduate program. Students in these programs must be continuously enrolled from undergraduate to graduate degree program unless given explicit permission by their program for a gap year or approved leave of absence. In offering the option of an Accelerated Bachelor's/Master's program, the university is making possible the acceleration of a student's graduate degree completion. It should be understood that students may not request deferral of their matriculation into the Master's degree program. If students would like to delay their graduate studies after earning the undergraduate degree, they may apply for admission to the traditional master's degree program. Any application of graduate credit earned while in the undergraduate program is subject to the policies of the graduate degree granting school.

Graduate & Professional Standards and Regulations

Students in graduate and professional programs can find their Academic Policies in Graduate and Professional Academic Standards and Regulations (https://catalog.luc.edu/academic-standards-regulations/graduate-professional/) under their school. Any additional University Policies supersede school policies.

Dual Degree Programs

Students in dual degree programs are responsible for abiding by academic policies and graduation requirements of both academic units to which they are enrolled. It is strongly recommended that students schedule regular meetings with academic advisors from both units to ensure timely degree completion. Dual degree programs may have slightly different degree requirements from the standard for one or both of the degrees earned. Students should closely read through all degree requirements and ask for clarification as needed.

Learning Outcomes

Graduates of the BS/MS in Mathematics Program will:

- be able to construct mathematical proofs of basic theorems, and to write these proofs clearly using correct grammatical constructs and appropriate mathematical notation;
- have seen applications of mathematics to areas across mathematical disciplines and outside of mathematical disciplines;
- receive the training sufficient for acceptance into PhD programs or professional schools, or for hire in mathematics related industries;
- receive training on how to act responsibly and ethically within the discipline.