Last update: 11/11/2025

Note: Qualifying tracks can exhibit **depth** (when a 2-course sequence is completed), or **breadth** (when 2 non-sequenced courses are completed). If a student's desire is to continue to a doctoral program in one of the concentration areas, then depth is preferred, when possible. For the pure math concentration, completing at least one track showing depth is required.

Start: MS in Math: Core Courses and/or Ramp Courses

Optional ramp courses (consult GAR):
MAT 5033 Foundations and Fundamental Concepts of Mathematics;
MAT 5103 Introduction to Mathematical Analysis

Core Courses (15)

Must complete the following 3 courses (9):
MAT 5653 Differential Equations I
MAT 5283 Linear Algebra
MAT 5603 Numerical Analysis

Choose 2 of the following courses (6):
MAT 5053 Perspectives on Teaching [1]
MAT 5123 Intro to Cryptography [2]
MAT 5173 Algebra I [2,3]
MAT 5203 Theory of Fun. of a Real Variable I [2,3]
MAT 5423 Discrete Math I [2]

[1] Highly recommended for Mathematics Education Concentration
[2] Prerequisite for a track course; consult GAR before completion of track
[3] Highly recommended for Concentration in Pure Mathematics

Choose one of four concentrations (9 credits in each)

Applied-Industrial Mathematics (9)
AIM 5113 Introduction to Industrial Mathematics
AIM 6943 Internship and Research Project
MAT 5323 Mathematical Modeling

Mathematics Education (9)
MAT 5963 Introduction to Math Education Research
MAT 5023 Problem-Solving Seminar
MAT 5043 Euclidean and Non-Euclidean Geometry

General Mathematical Studies (9)
Complete 9 hours of graduate-level coursework in the Department of Mathematics. Must be approved by the Graduate Advisor of Record. Students in this concentration are advised to complete a track, including the qualifying exam for that coursework.

Pure Mathematics (9)
Complete one qualifying track plus one grad-level math course. If a student took a sequenced course in Section A (MAT 5123, MAT 5173, MAT 5203, or MAT 5423), they should select a track that includes the second part of that sequence or MAT 5663. If a student is interested in continuing on to a PhD program, it is strongly recommended to complete two qualifying tracks.

Qualifying Tracks

Note: A track is called *complete* once a student passes two courses in the track and the qualifying exam for that coursework.

- **Mathematics of Life Sciences:** MAT 5133 Mathematical Biology, MAT 5323 Mathematical Modeling, MAT 5643 Optimal Control and Calculus of Variations
- **Scientific Computing:** MAT 5163 Probability Theory and Computing, MAT 5613 Numerical Solutions of Differential Equations
- **Mathematics of Information, Data and Communications:** MAT 5143 Cryptography II (MAT 5123 is a prerequisite), MAT 5153 Data Analytics
- **Differential Equations:** MAT 5663 Differential Equations II (MAT 5653 is a prerequisite), MAT 5673 Partial Differential Equations I, MAT 5683 Partial Differential Equations II
- **Foundations of Mathematics:** MAT 5243 General Topology I, MAT 5253 General Topology II; MAT 5433 Discrete Mathematics II (MMAT 5423 is a prerequisite), MAT 5453 Quantum Logic
- **Analysis:** MAT 5213 Theory of Functions of a Real Variable II (MAT 5203 is a prerequisite), MAT 5223 Theory of Functions of a Complex Variable I, MAT 5233 Theory of Functions of a Complex Variable II, MAT 5553 Harmonic Analysis, MAT 5403 Functional Analysis I, MAT 5413 Functional Analysis II
- **Algebra-Cryptography:** MAT 5143 Cryptography II (MAT 5123 is a prerequisite), MAT 5183 Algebra II (MAST 5173 is a prerequisite)
- **Geometry-Topology:** MAT 5243 General Topology I, MAT 5253 General Topology II, MAT 5343 Differential Geometry
- **Discrete Math & Logic:** MAT 5433 Discrete Math II (MAT 5423), MAT 5453 Quantum Logic
- **Mathematical Physics:** MAT 5343 Differential Geometry, MAT 5453 Quantum Logic, MAT 5863 Mathematical Physics, MAT 5873 Mathematical Physics II, MAT 6003 or QST 6003 Introduction to Quantum Information

Choose one of the following options (6 credits total):

Non-thesis: With GAR advice and approval, choose the requisite number of graduate-level courses from Mathematics or related disciplines to complete their degree. Additionally, candidates must complete one of the following options:
(i) One qualifying examination that has not already been completed (**Pure Math conc,** or **General Math Studies conc**)
OR
(ii) One qualifying examination plus an Industry Internship **(Applied Mathematics Concentration)**
OR
(iii) Qualifying examination covering MAT 5053 and MAT 5963 (the "Mathematics Education qualifying track"); optional: one additional qualifying examination **(Mathematics Education Concentration)**

Graduation

Preparing and defending a **Master's Thesis**. Candidates who choose this option must be enrolled for at least six hours of Master's Thesis (MAT 6983). The thesis must be on a research project and must be finalized by a public defense.

Note on what defines a Comprehensive Exam in the Department of Mathematics
Non-thesis option: 2 qualifying exams for Pure or General Math; 1 qualifying exam plus an Industry Internship for Applied Math; Math Ed qualifying exam for Math Ed.
Thesis option: the successful completion and defense of the thesis.