Mathematics

Requirements:

One of the following Geometry courses:

- □ Geometry and Problem Solving (MATH 210)
- □ Geometry (MATH 211)
- □ Geometry Honors (MATH 212H)

One of the following Algebra II & Trigonometry courses:

- □ Algebra II & Trigonometry (MATH 221)
- □ Algebra II & Trigonometry Honors (MATH 222H)

Elective Courses Offered in 2024-25

300-level

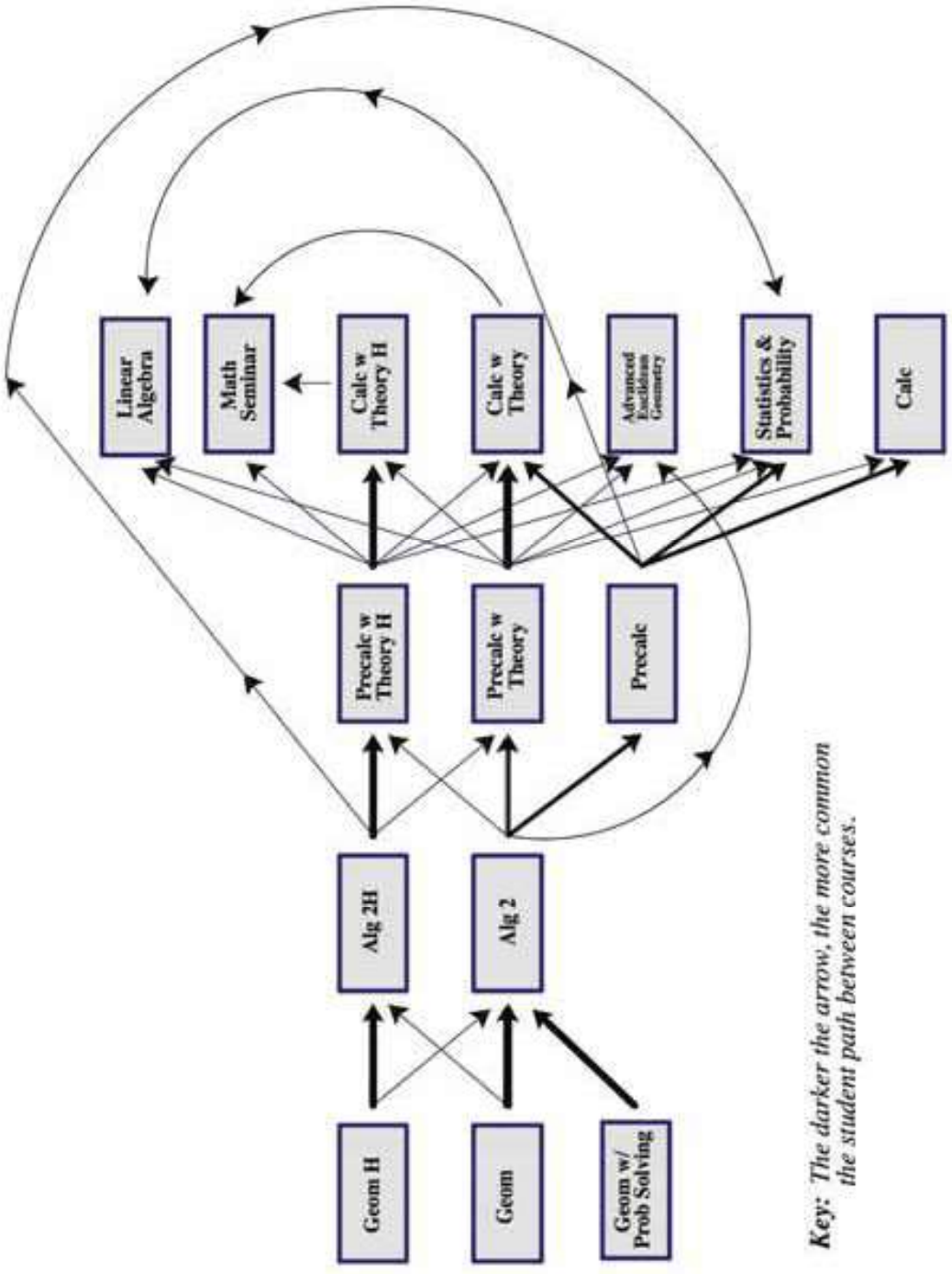
- □ Precalculus (MATH 310)
- □ Calculus (MATH 350)

400-level

- □ Precalculus with Theory (MATH 410)
- □ Precalculus with Theory Honors (MATH 411H)
- □ Calculus with Theory (MATH 420)
- □ Calculus with Theory Honors (MATH 421H)
- □ Statistics and Probability (MATH 430)
- □ Linear Algebra (MATH 445)
- □ Math Seminar (MATH 450)

Courses Not Offered in 2024-25

- □ Senior Math Electives (MATH 360)
- □ Discrete Math (MATH 361)
- □ Introduction to Stats and Probability (MATH 362)
- □ Advanced Euclidean Geometry (MATH 440)


Linear Algebra
Math Seminar
Calc w Theory H
Calc w Theory
Advanced Euclidean Geometry
Statistics & Probability
Calc
Precalc w Theory H
Precalc w Theory
Precalc
Alg 2H
Alg 2
Geom H
Geom
Geom w/ Prob Solving
Key: The darker the arrow, the more common the student path between courses.

Mathematics

In every course we offer, the Mathematics Department strives to convey math as intrinsically interesting, interconnected, and deep. Our hope is that the curriculum will stimulate curiosity in students, and inspire creativity in problem-solving. Each course is designed to develop students' confidence in their ability to solve problems, and, ultimately, a love of learning. We see learning as collaborative, and we hope to cultivate compassionate communicators and listeners. We hope students see the utility of math beyond just the classroom, and that the habits of mind we pass on will serve them throughout their lives.

Requirements:
Geometry
Algebra II & Trigonometry

Required Courses

MATH 210 - Geometry and Problem Solving
Full credit, meets 5 days/week
Prerequisites: Algebra I
This geometry course is designed to serve students who have completed an Algebra I course and who need more work with algebra skills and more attention to individual learning needs. Like Geometry, this course conveys an appreciation of geometry as a deductive system and covers the traditional relationships between points, lines, triangles, polygons and circles in the plane. There is an emphasis on problem-solving techniques common to all studies of mathematics. Successful completion of this course leads to enrollment in Algebra II & Trigonometry in the following year.

MATH 211 - Geometry
Full credit, meets 4 days/week
Prerequisites: Algebra I
The course is designed to convey an appreciation of geometry as a deductive system. Starting with undefined terms, postulates, and definitions, the students follow the progressive development of theorems and their proofs to create a mathematical structure with rich aesthetic and practical value. In building this axiomatic structure, they improve their ability to recognize and organize the various relationships among points, lines, triangles, polygons, and circles in the plane.

MATH 212H - Geometry Honors

Full credit, meets 4 days/week

Prerequisites: Honors Algebra I or Algebra I, departmental approval (see below)

In addition to the major topics of Geometry, the Honors sections study the advanced geometry of the triangle. After using the dynamic geometry software *Geometer's Sketchpad* to conjecture relationships in triangles, students prove theorems associated with the orthocenter, incenter, circumcenter and centroid. Throughout the course great emphasis is placed on proof and the skills associated with effective communication of complex ideas. The year culminates in a final project in which pairs of students present the proof of a "great" theorem during a full class period. Approval requirements: Algebra I Honors and Algebra I students interested in Geometry Honors will be considered based on a combination of factors including: teacher recommendation, grades, and performance on a placement test.

MATH 221 - Algebra II & Trigonometry

Full credit, meets 4 days/week

Prerequisites: Geometry and Problem Solving (MATH 210), Geometry (MATH 211), or Geometry Honors (MATH 212H)

The thematic thread that ties this course together is the mathematical concept of a function. Students learn to interpret functions algebraically and graphically, as well as how to connect the two. Functions of particular interest are the sine, cosine, exponential, logarithmic, linear, quadratic, and absolute value. There is a substantial treatment of trigonometry and complex numbers. The course is driven by student-led investigations, facilitated by a graphing calculator and other tools. Skill-building is emphasized as students develop a toolbox of techniques for solving problems. Of equal importance, students encounter open-ended problem-solving in wich they learn how to devise their own strategies for tackling non-routine problems.

MATH 222H - Algebra II & Trigonometry Honors

Full credit, meets 4 days/week

Prerequisites: Geometry (MATH 211) or Geometry Honors (MATH 212H), departmental approval (see below)

This Honors course covers the topics in Algebra II & Trigonometry in greater depth and serves as a rigorous introduction to higher mathematics. The course begins with abstract set theory and branches off to cover areas of mathematical modeling with functions, geometric and analytic trigonometry, and advanced analytic geometry. This is a demanding course, requiring a high level of abstraction and mathematical maturity. Students will be expected to stretch themselves intellectually and to grapple with exciting, difficult material throughout the year.

Approval requirements: A successful year in Honors Geometry, which for most students is indicated by a year-end grade of a B or higher. Students earning a year-end grade lower than a B in Honors Geometry must have departmental approval. In addition, in the spring, very high performing students in Geometry (MATH 211) who have been identified by their teachers as candidates for the jump to this course will be invited to sit for a non-routine problem-solving test to help gauge their readiness. In every case, departmental approval is required.

Elective Courses

MATH 310 - Precalculus

Full credit, meets 4 days/week

Prerequisites: Algebra II & Trigonometry (MATH 221) or Algebra II & Trigonometry Honors (MATH 222H), departmental approval (see below)

In this course, students will use the skills they've developed in previous math courses to explore strategies for solving challenging, exciting problems. Through real-world examples and modeling, students will learn how math appears in their everyday lives. The course includes a review of trigonometric functions along with a deeper look at their graphs, inverses, and applications. Other topics include sequences, polynomials, combinatorics, probability, exponential growth and decay, and optimization.

Approval requirements: A minimum grade of a C- in Algebra II & Trigonometry (MATH 221).

MATH 410 – Precalculus with Theory

Full credit, meets 4 days/week

Prerequisites: Algebra II & Trigonometry (MATH 221) or Algebra II & Trigonometry Honors (MATH 222H), departmental approval (see below)

In this course, students will cover a variety of topics that inspire curiosity and require creative problem-solving techniques. Specifically, students will study elementary functions, including trigonometric, rational, polynomial, exponential, and logarithmic, both theoretically and through applications. This course also covers sequences and series, combinatorics, and probability.

Approval requirements: A minimum grade of an exact B+ or higher when averaging both semester grades in Algebra II & Trigonometry (211).

MATH 411H – Precalculus with Theory Honors

Full credit, meets 4 days/week

Prerequisites: Algebra II & Trigonometry (MATH 221) or Algebra II & Trigonometry Honors (MATH 222H), departmental approval (see below)

This course involves a highly theoretical and rigorous approach to precalculus. Topics include vector analysis, modeling with parametric equations, combinatorics and probability, sequences and series, recursion, polar coordinates. Graphing calculators and computer applications are used for exploration.

Approval requirements: A successful year in Algebra II & Trigonometry Honors, which for most students is indicated by a year-end grade of a B or higher. Students earning a year-end grade lower than a B in Algebra II & Trigonometry Honors must have departmental approval. In unique circumstances, students who demonstrate exceptionally high achievement in Algebra II & Trigonometry (221) may be considered for approval for this course.

MATH 350 - Calculus

Full credit, meets 4 days/week

Prerequisites: Precalculus (MATH 310) or Precalculus with Theory (MATH 410), departmental approval (see below)

This calculus course emphasizes depth and exploration. Technology, such as a graphing calculator, is used as a tool to examine the topics included in a traditional introductory calculus course: functions and their graphs; limits; the derivative and its applications; definite and indefinite integrals; and logarithmic, exponential, and trigonometric functions. In addition, students study topics not usually accessible in traditional calculus courses. Through calculator exercises, students take advantage of numerical methods to analyze problems, discover underlying concepts, and gain insight into the relationship between the geometric and algebraic representation of the central ideas.

Approval requirements: A minimum grade of C or higher in Precalculus.

MATH 420 – Calculus with Theory

Full credit, meets 5 days/week

Prerequisites: Precalculus (MATH 310), Precalculus with Theory (MATH 410), or Precalculus with Theory Honors (MATH 411H), departmental approval (see below)

This is a challenging math course that equips students with a strong foundation in calculus that will serve them well in future STEM courses. The focus of this course is differentiation and integration with applications to rates of change, optimization, area, and volume.

Approval requirements: A minimum grade of an exact B+ or higher when averaging both semester grades in Precalculus with Theory. In addition, in the spring, very high performing students in Precalculus who would like to take Calculus with Theory and have talked to their teacher about this jump will be asked to sit for a diagnostic test to help gauge their readiness. Precalculus with Theory students ending the year with a 6.5 on the 10 pt scale when averaging both semesters will also be eligible to take the diagnostic test.

MATH 421H – Calculus with Theory Honors

Full credit, meets 5 days/week

Prerequisites: Precalculus with Theory (MATH 410) or Precalculus with Theory Honors (MATH 411H), departmental approval (see below)

Calculus with Theory Honors is the culmination of the honors sequence in mathematics. In this course, students will investigate the central themes of both differential and integral calculus. Topics also covered are: special methods of integration, differential equations, infinite series, polar coordinates, arc lengths, and vectors and parametric equations.

Approval requirements: A successful year in Precalculus with Theory Honors, which for most students is indicated by a year-end grade of a B or higher. Students earning a year-end grade lower than a B in Precalculus with Theory Honors must have departmental approval. In unique circumstances, students who demonstrate exceptionally high achievement in Precalculus with Theory may be considered for this course. Departmental approval is required.

MATH 430 - Statistics and Probability

Full credit, meets 5 days/week

Prerequisites: Algebra II & Trigonometry (MATH 221) or Algebra II & Trigonometry Honors (MATH 222H); Precalculus (MATH 310), Precalculus with Theory (MATH 410), or Precalculus with Theory Honors (MATH 411H), departmental approval (see below)

This statistics course is similar to those required for college majors in the social sciences, health sciences, and business. Major concepts such as combinatorics, probability, data collecting, analyzing data, and drawing conclusions from data will be covered. Additionally, students will learn to interpret the various statistical representations that we encounter in our daily lives. Students should expect to learn through activities, lab exercises, discussion, and projects. This class makes extensive use of dynamic statistical data analysis software, such as Fathom.

Approval requirements: A minimum grade of an exact A- or higher when averaging both semester grades in Algebra II & Trigonometry. From Algebra II & Trigonometry Honors, a minimum of an exact B+ is required. From Precalculus, the requirement is a B+, Precalculus with Theory is a B, and Precalculus with Theory Honors is a B-.

MATH 445 - Linear Algebra

Full credit, meets 4 days/week

Prerequisites: Precalculus (MATH 310), Precalculus with Theory (MATH 410), or Precalculus with Theory Honors (MATH 411H)

This course is designed for students with a serious interest in mathematics. Linear algebra is the study of systems of linear equations, properties of matrices, vector spaces and linear transformations. The course will focus on both theory and computation. Specific topics will include: Row reduction, matrix algebra, determinants, eigenvalues and eigenvectors, and orthogonality as well as a wide range of applications such as economic models, demographics, biology, networks, data analysis, signal processing, Markov chains, and
dynamical systems.

Approval requirements: A minimum grade of B+ in Precalculus with Theory Honors, a minimum grade of A- in Precalculus with Theory, or A in Precalculus and departmental approval. This is a senior-year course, though in certain exceptional circumstances, a junior who has previously completed precalculus may be considered for approval for this course.

MATH 450 - Math Seminar

Full credit, meets 4 days/week

Prerequisites: Precalculus with Theory (MATH 410) or Precalculus with Theory Honors (MATH 411H), departmental approval (see below)

This course is designed for students with a serious interest in pursuing higher mathematics. The course is problem-set based to give students the experience of working through complex material in an independent setting. The special topics offered vary from year to year and have, to date, included number theory, inversive geometry, linear algebra, multivariable calculus, finite calculus, continued fractions, game theory, and advanced problem-solving.

Approval requirements: A minimum grade of A- in Precalculus with Theory Honors and departmental approval are required. If a student has also taken Calculus with Theory Honors, a minimum grade of A- is required. In certain exceptional circumstances, a student who has completed Precalculus with Theory may be considered for approval for this course.

Courses Not Offered in 2024-25:

MATH 360 - Senior Math Electives
[*Course not offered 2024-25*]
Full credit, meets 4 days/week
Prerequisites: Precalculus (MATH 310), Precalculus with Theory (MATH 410), or Precalculus with Theory Honors (MATH 411H)
Senior Math Electives is a full-year course designed to give students the opportunity to study engaging mathematical fields that are outside of the traditional high-school syllabus. Project-based "learning by doing" will be an integral part of the experience. Students will be evaluated through their work on problem sets and projects. The course is divided into two distinct semesters, sometimes taught by two different teachers. Topics may change year-to-year, but past offerings are:
The Analysis of Games: In this course, we examine what mathematicians call *combinatorial game theory*. This field studies games like Tic- Tac-Toe, Checkers, or Dots and Boxes, in which there is no random chance and no hidden information. We play a lot of games, think about them, talk about them, and write about them, with an eye towards developing "best" and "worst" strategies from the ground up.
An Introduction to Discrete Mathematics: This course explores topics in discrete mathematics, computational linear algebra, and provides an introduction to approximation theory.

MATH 361 - Discrete Math
[*Course not offered 2024-25*]
Full credit, meets 4 days/week
Prerequisites: any Precalculus or Algebra II & Trigonometry course, departmental approval (see below)
This course studies the mathematics required to analyze problems of a discrete nature but does it through its applications to various disciplines outside of pure mathematics. The emphasis will be on developing and analyzing algorithms to model and implement in many areas of study. We will explore modeling problems such as election theory and determining group preferences, methods of comparing the dominance of one person over another in political situations, and fair-division methods, such as apportioning the House of Representatives; various models of population growth, such as invasive species and predator-prey systems; financial modeling of debt and investment; graph theory problems, such as map-coloring, the problem of scheduling, minimum spanning trees, Steiner trees, communication models and the effects of social networking and cliques, as well as the famous traveling salesman problem. No prior knowledge of computer science or programming is required. The emphasis will be on writing and explaining the algorithms

we study using plain English. The primary technology used will be pre-existing programs and spreadsheet software. Time permitting, we will also discuss the new and quickly growing area of the geometry of Gerrymandering. Students should expect to work independently and in group settings on problem-sets, give oral presentations on their work, and complete capstone projects each semester.
Approval requirements: For students who have completed a precalculus course: A year-end average of a B- or higher in Precalculus with Theory or Precalculus with Theory Honors. A year-end average of an A- or higher in Precalculus. Students who have successfully completed Algebra II & Trigonometry with a year-end average of an A- or higher or Algebra II & Trigonometry Honors with a year-end average of a B+ or higher are approved for this course if taken concurrently with a precalculus course.

MATH 362 - Introduction to Statistics and Probability
[*Course not offered* 2024-25]
Full credit, meets 4 days/week
Prerequisites: Precalculus with Theory (MATH 410) or Precalculus with Theory Honors (MATH 411H)
This course is a statistics workshop in which students explore data, combinatorics, and probability through activities, lab exercises, discussion, and research. This class makes extensive use of dynamic statistical data analysis software. Additionally, students learn to interpret the various statistical representations that we encounter in our daily lives.

MATH 440 – Advanced Euclidean Geometry
[*Course not offered* 2024-25]
Full credit, meets 4 days/week
Prerequisites: Precalculus with Theory (MATH 410) or Precalculus with Theory Honors (MATH 411H), departmental approval (see below)
This is an intensive seminar-style math course for students with a serious interest in math and advanced geometry. The course includes a study of complex construction techniques involving homothecy and similitude, investigations into some of the major discoveries related to various special points and lines in triangles, locus definitions of conic sections and other special curves, circle inversion, and many other geometric topics. In addition to discovering geometrical relationships and devising proofs for them, students will put significant work into, and be evaluated on, the quality of the presentations of their findings. Assessments will be in the forms of problem sets, class presentations, computer-based constructions (especially using Geometer's Sketchpad, used almost daily throughout the year), and multimedia presentations. Many assessments will be completed in autonomous groups working on their own unique material, so self-motivation and tenacity, along with enjoyment of the act of doing mathematics, are requisite.

Approval requirements: A minimum grade of B+ in Precalculus with Theory Honors or a minimum grade of A in Precalculus with Theory, and departmental approval. This is a senior-year course, though in certain exceptional circumstances, a junior who has previously completed precalculus may be considered for course approval.