ELAC MATHEMATHETICS

Course Detail Sheets

UPDATED: FALL 2024

List of Math Classes

NON-STEM Math Classes

Math 215: Mathematical Concepts for Teachers I

This is intended for those who plan to teach mathematics in elementary schools.

The course covers

- the language of sets
- elementary logic
- systems of numeration
- numbers
- fundamental operations
- functions
- integers
- rational numbers
- real numbers
- algorithms used in calculations.

Who Should Take This Course?

- **Future Elementary/Middle School Teachers:** This course is designed for students who are training to become teachers, especially those focusing on early childhood or elementary education.
- **Educators Seeking a Strong Math Foundation:** Any educator who wants to deepen their understanding of foundational math concepts and improve their ability to teach math in the classroom.

Prerequisites: Conditions of Enrollment: Completion of intermediate algebra or the equivalent.

Math 216: Mathematical Concepts for Teachers II

Math 216 is the second in the sequence intended for those who plan to teach elementary school mathematics. Topics include

- basic probability
- introductory statistics
- introductory geometry including
    - constructions
    - congruence and similarity
    - measurement
    - motion geometry
    - tessellations

Who Should Take This Course?

- **Future Elementary and Middle School Teachers:** This course is essential for prospective teachers who will be teaching upper elementary or middle school math, as it provides the advanced content knowledge, they will need in the classroom.
- **Educators Seeking Advanced Pedagogical Skills:** Teachers who want to strengthen their ability to teach more advanced math topics and improve their classroom teaching techniques.

Prerequisites: Mathematics 215

Math 227/227s: Statistics

This course is an introduction to

- probability
- measures of central tendency and dispersion
- descriptive and inferential statistics including
- sampling
- estimation
- hypothesis testing
- analysis of variance
- chi-square and student t-distributions
- linear correlation
- regression analysis

Who Should Take This Course?

- **Business and Economics Students:** Statistics is essential for business students, particularly in fields such as marketing, finance, and economics, where data analysis plays a critical role.
- **Social Sciences Majors:** Students in psychology, sociology, and political science use statistics to analyze research data and interpret survey results.
- **Health Sciences Majors:** Nursing, public health, and other medical-related fields rely on statistics for understanding clinical trials and medical research data.
- **Anyone Interested in Data Science:** With the growing importance of data science and analytics, statistics is an important course for anyone interested in working with data.

Prerequisites: Conditions of Enrollment: Completion of intermediate algebra or the equivalent.

Math 230: Mathematics for Liberal Arts Students

Math 230 is an introduction to the spirit and style of mathematics and its pursuit as a human endeavor. Topics are chosen from a variety of mathematical fields including

- Logic
- set theory
- systems of numeration
- number theory
- algebra
- the metric system
- voting and apportionment
- geometry
- mathematical systems
- consumer mathematics
- probability
- statistics
- graph theory

All topics are intended to illustrate the nature of mathematical discovery, the utility of mathematical applications, and the beauty of geometrical design.

Who Should Take This Course?

- **Liberal Arts Majors:** This course is designed for students majoring in non-STEM fields like literature, history, philosophy, art, and music, who want to gain a foundational understanding of mathematical ideas.
- **Students Seeking Quantitative Literacy:** It is ideal for students who want to improve their quantitative reasoning skills without taking more technically demanding courses like calculus or algebra.
- **General Education Requirement:** This course may be taken to satisfy general education mathematics requirements, ensuring that all students, regardless of major, develop some proficiency in mathematics.

Prerequisites: Conditions of Enrollment: Completion of intermediate algebra or the equivalent.

Math 235: Finite Mathematics

Math 235 covers topics in finite mathematics with applications to business and social sciences. Topics include

- Systems of linear equations
- Inequalities
- linear programming
- mathematics of finance
- matrix algebra
- probability
- statistics
- game theory

Who Should Take This Course?

- **Business and Economics Majors:** The course is often required or recommended for students in business, economics, management, and related fields, where mathematical modeling and decision-making are essential.
- **Social Science Majors:** Students in psychology, sociology, political science, and similar fields may take finite mathematics to learn quantitative methods applicable to research and data analysis.
- **General Education Requirement:** This course may be taken to satisfy general education mathematics requirement for non-STEM majors, as it emphasizes practical applications of math.
- **Anyone Interested in Applied Mathematics:** The course is ideal for students interested in learning how to apply mathematical concepts to solve real-world problems without the rigor of calculus-based courses.

Prerequisites: Conditions of Enrollment: Completion of intermediate algebra or the equivalent.

Math 236: Calculus for Business and Social Sciences

Math 236 consists of

- elementary differential and integral calculus of
    - algebraic functions
    - exponential functions
    - logarithmic functions
- partial derivatives
- the method of Lagrange multipliers
- applications to business and the social sciences are emphasized.

Who Should Take This Course?

- **Business Majors:** This course is often required for students majoring in business, economics, finance, or management, where calculus is used to model business outcomes and optimize decision-making.
- **Social Science Majors:** Students in social sciences like sociology, psychology, or political science may also take this course to understand quantitative models of population growth, resource allocation, and trends.
- **Anyone Interested in Applied Calculus:** The course is ideal for students who want to learn calculus with a focus on practical applications, especially in fields that do not require a more rigorous theoretical understanding of the subject.

Prerequisites: Conditions of Enrollment: Completion of intermediate algebra or the equivalent.

Math 245: College Algebra

This college algebra course includes the

- theory of equations
- polynomial and rational functions and their graphs
- systems of equations
- matrices
- determinants
- permutations
- combinations
- sequences and series
- the Binomial Theorem

Who Should Take This Course?

- **Students Needing a Math Foundation:** College Algebra is for students who need a strong foundation in mathematics for their degree programs, particularly in business, economics, computer science, engineering, and other technical fields.
- **General Education Requirement:** For many students, College Algebra fulfills a general education math requirement, helping them develop essential quantitative reasoning skills.

Prerequisites: Conditions of Enrollment: Completion of intermediate algebra or the equivalent.

STEM Math Classes

Math 241s: Trigonometry with Vectors

This course includes the study of the

- trigonometric functions
- trigonometric inverses
- measurement of angles in degrees and in radians
- evaluating triangles
- solutions of trigonometric equations
- verification of trigonometric identities
- vectors
- complex numbers
- graphing trigonometric functions
- graphing polar curves

A college trigonometry course provides a solid foundation in mathematical reasoning and problem-solving, preparing students for higher-level math courses, especially calculus.

Who Should Take This Course?

Trigonometry is typically taken by:

- **STEM Majors:** Students in mathematics, engineering, physics, computer science, architecture, and other technical disciplines.
- **Pre-Calculus Students:** It is often part of or a prerequisite for a precalculus course, preparing students for calculus.
- **Education Majors:** Future math teachers who will be instructing students on trigonometry and its applications.
- **Students in Applied Fields:** Those in fields like architecture, astronomy, or construction that frequently involve trigonometric calculations.

Prerequisites: Conditions of Enrollment: Completion of intermediate algebra or the equivalent.

Math 260/260s: Precalculus

This course covers topics in college algebra including

- polynomial and rational functions
- exponential and logarithmic functions
- systems of equations and inequalities
- conic sections
- sequences and series
- matrices.

A college precalculus course is critical in preparing students for the rigors of calculus and other advanced mathematics, equipping them with the tools necessary for problem-solving in various STEM disciplines.

Who Should Take This Course?

Precalculus is for students pursuing degrees in **science, technology, engineering, and mathematics (STEM)** fields. It is also necessary for:

- **Engineering and Physics students**: who need a solid understanding of functions and trigonometry before moving into calculus and physics courses.
- **Economics or Business majors**: who need strong analytical skills for data analysis, financial calculations, and optimization.
- **Health and Life Sciences majors**: who may encounter calculus or other math-intensive courses.
- **Students preparing for Calculus**: Precalculus provides a thorough review and introduction to concepts that are essential for calculus.

Prerequisites: Mathematics 241 OR Mathematics 241S with a grade of C or higher.

Math 261: Calculus 1

This is the first of a three-course sequence in calculus.

Topics include

- limits and continuity
- rates of change
- derivatives
- applications of differentiation
- integrals
- the Fundamental Theorem of Calculus
- applications of integration.

Who Should Take This Course?

- **STEM Majors:** Students in mathematics, engineering, physics, chemistry, biology, economics, and computer science need calculus as a fundamental tool.
- **Pre-Med and Life Sciences Majors:** Some programs require calculus for understanding rates of biological processes or data analysis.
- **Business and Economics Majors:** Calculus is essential for understanding optimization, marginal analysis, and economic models.

Prerequisites: Mathematics 260 OR Mathematics 260S

- Note: Math 241 is a prerequisite for Math 260/Math 260S

Math 262: Calculus 2

This is the second in a three-course sequence in calculus.

Topics include

- differentiation and integration of
  - logarithmic functions
  - exponential function
  - circular and hyperbolic functions
  - and their inverses
- indeterminate forms
- improper integrals
- standard techniques of integration
- applications of integration
- parametric equations and polar coordinates
- arc length
- area of a surface of revolution
- infinite sequences and series
- representation of function.

Who Should Take This Course?

- **STEM Majors:** Students in mathematics, engineering, physics, chemistry, computer science, and economics need Calculus 2 to build on their foundational calculus knowledge.
- **Pre-Med and Life Sciences Majors:** Some programs require Calculus 2, particularly for fields that use models involving rates of change or series approximations.
- **Business and Economics Majors:** Calculus 2 is often required for those studying optimization, economic modeling, or financial analysis involving series and integration.

Prerequisites: Mathematics 261 with a grade of C or higher.

Math 263: Calculus 3

This is the third of a three-course sequence in calculus.

Topics include

- vectors in three-dimensional space
- vector calculus
- functions of several variables
- partial derivatives
- double and triple integrals
- applications to Stokes Theorem and Divergence Theorem.

Who Should Take This Course?

- **STEM Majors:** Students in mathematics, engineering, physics, chemistry, and economics, as it is essential for understanding real-world phenomena in multiple dimensions.
- **Computer Science Majors:** Those focusing on fields like machine learning, computer vision, or game development where multivariable calculus and 3D space are crucial.
- **Biology and Medicine:** Students working in fields like biophysics or bioengineering that involve modeling three-dimensional biological systems.

Prerequisites: Mathematics 262 with a grade of C or higher.

Math 270: Linear Algebra

This course includes the study of

- systems of linear equations and their solutions
- matrices
- determinants
- linear transformations and their matrix representations
- vector spaces
- orthogonality
- eigen value problems.

Who Should Take This Course?

- **STEM Majors:** Students in mathematics, physics, computer science, engineering, economics, and statistics must master linear algebra for its wide range of applications.
- **Data Science and Machine Learning Students:** Since matrices and vectors are central to algorithms in machine learning, anyone interested in data science should have a solid understanding of linear algebra.
- **Business and Economics Majors:** Linear algebra is important in optimization, economic modeling, and finance, where systems of equations and matrix representations are common.

Prerequisites: Mathematics 262 with a grade of C or higher.

Math 272: Discrete Math

This course

- introduces sets, relations, functions and logic
- formal methods of proof such as
    - contradiction
    - contrapositive
    - induction
    - diagonalization
    - recursion
    - the Pigeonhole principle.
- These ideas and methods are developed by looking at problems from
    - combinations and counting
    - elementary number theory
    - graph theory
- Topics from map coloring, complexity, and cryptography are also discussed.

Who Should Take This Course?

- **Computer Science Majors:** Discrete math is fundamental for understanding algorithms, data structures, and formal languages.
- **Engineering Majors:** Many engineering disciplines require a strong understanding of graph theory, logic circuits, and algorithms.
- **Mathematics Majors:** Discrete mathematics introduces topics that are crucial for theoretical math, especially in combinatorics, graph theory, and logic.
- **Anyone Interested in Data Science or Cryptography:** The combinatorial and number-theoretic methods covered are essential for areas like cryptography, machine learning, and network analysis.

Prerequisites: Mathematics 262 with a grade of C or higher.

Math 275: Ordinary Differential Equations

This course

- Provides a basic understanding of the theory and content of ordinary differential equations
- Various methods of solving these equations, especially first and second order, are emphasized as are solutions to physical applications problems.
- Other topics covered include
    - existence and uniqueness theorems
    - systems of linear differential equations
    - numerical and graphical methods using computers
    - the Laplace transform.

Who Should Take This Course?

- **STEM Majors:** Students in mathematics, engineering, physics, chemistry, biology, and economics, as ODEs are widely applicable across these disciplines.
- **Anyone Interested in Modeling:** ODEs are essential for students looking to understand how to mathematically model dynamic processes that change over time or space.

Prerequisites: Mathematics 263 with a grade of C or higher.

Programming Classes

Math 173: Object-Oriented Programming and Design

This course covers major programming concepts including

- theory, applications, and object-oriented programming, primarily in C++
- Variables and basic data types
- Operators
- bitwise arithmetic
- control structures
- input and output
- arrays
- multidimensional arrays
- strings
- an introduction to the Standard Template Library
- functions
- recursion
- structures
- pointers
- references
- dynamic memory management
- file handling
- casting operators
- namespaces
- operator overloading
- preprocessor directives
- exception handling
- Classes and object-oriented programming including constructors and destructors
- inheritance
- virtual functions
- polymorphism
- interfaces through abstract base classes
- data encapsulation and modeling principles are also covered in detail
- Differences between the Java language and C++ are discussed
- Commenting of code and debugging are emphasized throughout the course

Examples from mathematics are included as well as a significant project requiring object-oriented design. Students gain practice in utilizing outside code via practice with a graphics API.

Who Should Take This Course?

- **Computer Science and Engineering Majors:** Essential for students pursuing careers in software development, system architecture, or technology fields.
- **Aspiring Software Developers:** Anyone interested in building applications, whether for web, mobile, or desktop platforms, will need strong OOP skills.
- **Game Developers:** Students aiming to work in game development where object-oriented paradigms help model game entities and behaviors.

Prerequisites: Mathematics 260

Math 273: Introduction to Data Structures and Algorithms

Math 273 is an introduction to the study of data structures and algorithms as well as an introduction to software development primarily in C++. The course begins with a short review of object-oriented programming, emphasizing utilizing and extending existing code through inheritance and interfaces. The review leads into more advanced topics including

- multiple inheritance
- virtual inheritance
- the diamond problem
- templates
- multithreading
- Complexity analysis, including
    - Big-O notation
    - best case
    - worst case
    - average case
    - amortized analysis
- Data structures and algorithms are covered in a language-independent manner.
- Linked lists, stacks, queues, trees, heaps, and graphs are covered in detail along with associated implementation and memory management techniques.
- Algorithms for searching and sorting, including hashing, are covered in detail.
- Recursion, which was introduced in the previous course, is analyzed rigorously.
- The Standard Template Library is discussed in reference to each data structure and algorithm covered in the course.
- Software development is explored in the context of event-driven programming and video game programming.

A large-scale project requiring significant planning, collaboration, and documentation is required.

Who Should Take This Course?

- **Computer Science Majors:** This course is essential for students studying computer science, software engineering, or information technology, as it lays the groundwork for advanced courses in algorithms, databases, and systems design.
- **Aspiring Software Developers:** Students interested in software development should take this course to learn how to design efficient, scalable programs.
- **Data Scientists and Engineers:** Anyone pursuing a career in data science, machine learning, or related fields will benefit from understanding how to manage large datasets and optimize algorithms.
- **Students Preparing for Technical Interviews:** Mastering data structures and algorithms is crucial for students aiming to succeed in technical job interviews, especially for roles in software development at companies like Google, Amazon, and Facebook.

Prerequisites: Mathematics 173