Glendale College

# Course Outline of Record Report

Course ID 003250

Cyclical Review - March 2025

## MATH107H : Honors Linear Algebra

### General Information

| | |
|---|---|
| **Author:** | • Suzanne Palermo |
| **Attachments:** | DE Addendum_MATH_107H_COR_3:26:25_CoDE_5:27:25.pdf<br>DE_Addendum_MATH_107H_COR_9:8:21_Code_9:28:21.pdf |
| **Course Code (CB01) :** | MATH107H |
| **Course Title (CB02) :** | Honors Linear Algebra |
| **Department:** | MATH |
| **Proposal Start:** | Spring 2026 |
| **TOP Code (CB03) :** | (1701.00) Mathematics, General |
| **CIP Code:** | (27.0101) Mathematics, General. |
| **SAM Code (CB09) :** | E - Non-Occupational |
| **Distance Education Approved:** | Yes |
| **Will this course be taught asynchronously?:** | No |
| **Course Control Number (CB00) :** | CCC000578445 |
| **Curriculum Committee Approval Date:** | 03/26/2025 |
| **Board of Trustees Approval Date:** | 06/17/2025 |
| **Last Cyclical Review Date:** | 03/26/2025 |
| **Course Description and Course Note:** | MATH 107H introduces vector spaces, linear transformations and matrices, matrix algebra, determinants, eigenvalues and eigenvectors, and solutions of systems of equations. Students explore solution techniques that include row operations, Gaussian elimination and matrix algebra. Students will also learn specific topics in vector spaces and matrix theory that include inner products, norms, orthogonality, eigenvalues, eigenspaces, linear transformations and applications. The honors section of this course features more theory and proof, and one or more projects related to the topics of this course. |
| **Justification:** | Mandatory Revision |
| **Academic Career:** | • Credit |
| **Mode of Delivery:** | • In-Person<br>• Remote<br>• Hybrid<br>• Proctored Online |
| **Author:** | No value |
| **Course Family:** | No value |

## Academic Senate Discipline

**Primary Discipline:** • Mathematics

**Alternate Discipline:** No value

**Alternate Discipline:** No value

## Course Development

**Basic Skill Status (CB08)**

Course is not a basic skills course.

☐ Allow Students to Gain Credit by Exam/Challenge

**Course Special Class Status (CB13)**

Course is not a special class.

**Pre-Collegiate Level (CB21)**

Not applicable.

**Grading Basis**

• Grade with Pass / No-Pass Option

**Course Support Course Status (CB26)**

Course is not a support course

## General Education and C-ID

**General Education Status (CB25)**

GE Status (CSU) B4, (UC) 2

**Transferability**

Transferable to both UC and CSU

**Transferability Status**

Approved

| Cal-GETC | Area | Status | Approval Date | Comparable Course |
|---|---|---|---|---|
| Area 2: Mathematical Concepts and Quantitative Reasoning | Mathematical Concepts and Quantitative Reasoning | Approved | 09/02/2025 | No Comparable Course defined. |

| GCC General Education Requirements | Area | Status | Approval Date | Comparable Course |
|---|---|---|---|---|
| Area 2: Mathematical Concepts and Quantitative Reasoning | Mathematical Concepts and Quantitative Reasoning | Approved | 09/02/2025 | No Comparable Course defined. |

| C-ID | Area | Status | Approval Date | Comparable Course |
|---|---|---|---|---|
| MATH | Mathematics | Approved | 08/29/2016 | MATH 250 - Introduction to Linear Algebra |

## Units and Hours

## Summary

| | |
|---|---|
| **Minimum Credit Units (CB07)** | 5 |
| **Maximum Credit Units (CB06)** | 5 |
| **Total Course In-Class (Contact) Hours** | 90 |
| **Total Course Out-of-Class Hours** | 180 |
| **Total Student Learning Hours** | 270 |

## Credit / Non-Credit Options

**Course Type (CB04)**

Credit - Degree Applicable

**Noncredit Course Category (CB22)**

Credit Course.

**Noncredit Special Characteristics**

No Value

**Course Classification Code (CB11)**

Credit Course.

**Funding Agency Category (CB23)**

Not Applicable.

☐ Cooperative Work Experience Education Status (CB10)

☐ Variable Credit Course

## Weekly Student Hours

| | In Class | Out of Class |
|---|---|---|
| Lecture Hours | 5 | 10 |
| Laboratory Hours | 0 | 0 |
| Studio Hours | 0 | 0 |

## Course Student Hours

| | |
|---|---|
| **Course Duration (Weeks)** | 18 |
| **Hours per unit divisor** | 54 |
| **Course In-Class (Contact) Hours** | |
| Lecture | 90 |
| Laboratory | 0 |
| Studio | 0 |
| **Total** | 90 |
| **Course Out-of-Class Hours** | |
| Lecture | 180 |
| Laboratory | 0 |
| Studio | 0 |
| **Total** | 180 |

## Time Commitment Notes for Students

No value

## Units and Hours - Weekly Specialty Hours

| Activity Name | Type | In Class | Out of Class |
|---|---|---|---|

| | | | |
|---|---|---|---|
| No Value | No Value | No Value | No Value |

## Prerequisites, Corequisites, Recommended Corequisites, and Recommended Preparation

### Prerequisite

MATH104E - Calculus and Analytic Geometry II

**Objectives**

- Evaluate definite and indefinite integrals using a variety of techniques, including integration by parts, trigonometric substitution, and partial fractions.
- Evaluate improper integrals.
- Model differential equations.
- Solve separable differential equations.
- Work with exponential and logistic models of growth and decay.
- Graph conic sections.
- Determine divergence or convergence of infinite sequences and series by applying convergence tests.
- Differentiate and integrate power series.
- Find Taylor and Maclaurin series for a function.
- Graph equations in polar and parametric form.

**OR**

### Prerequisite

MATH104EH - Honors Calculus and Analytic Geometry II

**Objectives**

- Evaluate definite and indefinite integrals using a variety of techniques, including integration by parts, trigonometric substitution, and partial fractions.
- Evaluate improper integrals.
- Model differential equations.
- Solve separable differential equations.
- Work with exponential and logistic models of growth and decay.
- Graph conic sections.
- Determine divergence or convergence of infinite sequences and series by applying convergence tests.
- Differentiate and integrate power series.
- Find Taylor and Maclaurin series for a function.
- Graph equations in polar and parametric form.

### AND

### Advisory

MATH105 - Multivariable and Vector Calculus

**Objectives**

- Perform basic vector algebra operations.

## Entry Standards

| Entry Standards | Description |
|---|---|
| No value | No value |

## Course Limitations

| Cross Listed or Equivalent Course | Description |
|---|---|
| MATH 107 | No Value |

## Specifications

### Methods of Instruction

| Methods of Instruction | |
|---|---|
| Methods of Instruction | Lecture |
| Methods of Instruction | Discussion |
| Methods of Instruction | Multimedia |
| Methods of Instruction | Collaborative Learning |
| Methods of Instruction | Demonstrations |

### Out of Class Assignments

- Homework (e.g. problem sets related to course content)
- Group assignments and projects (e.g. prove a theorem stated in the textbook and present to proof to the instructor)
- Honors enhancement
    - Applications of topics taught (projects or problem sets)
    - Proofs of more advanced topics/theorems.

| Methods of Evaluation | Description of Activity/Interaction |
|---|---|
| Exam/Quiz/Test | Quizzes |
| Exam/Quiz/Test | Four or more regularly scheduled exams are required |
| Exam/Quiz/Test | A comprehensive final examination is required |

### Textbook Rationale

No Value

**Textbooks**

| Author | Title | Publisher | Date | ISBN |
|---|---|---|---|---|
| Anton, Howard | Elementary Linear Algebra | Wiley | 2020 | 978-1-119-40677-8 |

**Other Instructional Materials (i.e. OER, handouts)**

No Value

## Learning Outcomes

**Course Objectives**

Perform matrix arithmetic.

Find the inverse of a matrix.

Solve a linear system of equations using matrix operations (Gaussian and Gauss Jordan elimination)

Evaluate determinants by raw reduction and cofactor expansion.

Identify vector spaces and subspaces.

Determine if a set of vectors is linearly independent.

Find a base for and the dimension of a vector space.

Use the Gram-Schmidt process to find an orthonormal basis for an inner product space.

Find the kernel and range of a linear transformation.

Find matrix representations of linear transformations.

| |
|---|
| Find the eigenvalues and eigenvectors of a matrix. |
| Diagonalize a matrix. |
| Determine eigenvalues and eigenspaces of matrices and linear transformations. |
| Use quadratic forms to obtain graphs of conic sections and quadratic surfaces. |
| Prove basic results in linear algebra using appropriate proof-writing techniques such as linear independence of vectors; properties of subspaces; linearity, injectivity and surjectivity of functions; and properties of eigenvectors and eigenvalues. |
| Use bases and orthonormal bases to solve problems in linear algebra. |
| Find the dimension of spaces such as those associated with matrices and linear transformations. |

**SLOs**

**Analyze vector spaces, subspaces, linear independence, span, bases, dimension, and linear transformations by applying definitions and proving theorems.**
Expected Outcome Performance: 70.0

| | |
|---|---|
| *ILOs*<br>Core ILOs | Analyze and solve problems using critical, logical, and creative thinking; ask questions, pursue a line of inquiry, and derive conclusions; cultivate creativity that leads to innovative ideas. |
| | Use quantitative and/or analytical mathematical skills to solve problems and to interpret, evaluate, and process information and data to draw logical conclusions and support claims. |
| *MATH*<br>Mathematics AS-T Degree | Analyze, synthesize and evaluate theorems in Linear Algebra |
| | Solve application problems in math and science using calculus, differential equations, and linear algebra. |
| | Solve applications in math and science using derivatives, integrals, differential equations and linear algebra |
| *MATH*<br>Mathematics A.S. Degree | Analyze, synthesize and evaluate theorems in Linear Algebra |
| | Solve applications in math and science using derivatives, integrals, differential equations and linear algebra |
| *MATH*<br>Mathematics - A.A. Degree Major | Analyze, synthesize and evaluate theorems in Linear Algebra. |
| | solve applications in math and science using derivatives, integrals, differential equations and linear algebra. |
| *ST DV*<br>Liberal Arts: Science and Mathematics Emphasis A.A. Degree | Apply mathematical and scientific ideas to analyze real-world situations. |
| *MATH*<br>Data Science for Mathematics AS Degree | Interpret and evaluate data trends, qualitative research, or patterns in complex data sets using statistical techniques, analytic methods, and tools. |
| *MATH*<br>Mathematics - A.S. Degree Major | analyze, synthesize and evaluate theorems in Linear Algebra. |
| | solve applications in math and science using derivatives, integrals, differential equations and linear algebra. |

| | |
|---|---|
| *MATH*<br>Mathematics - AS-T | analyze, synthesize and evaluate theorems in Linear Algebra. |
| | solve applications in math and science using derivatives, integrals, differential equations and linear algebra. |
| *ILOs*<br>General Education | apply techniques of analysis and critical thinking to critique real world and theoretical topics and issues |

**Perform matrix and vector operations and apply properties of linear systems, inverses, determinants, eigenvalues/eigenvectors, and inner products to solve problems and prove theorems.** Expected Outcome Performance: 70.0

| | |
|---|---|
| *ILOs*<br>Core ILOs | Analyze and solve problems using critical, logical, and creative thinking; ask questions, pursue a line of inquiry, and derive conclusions; cultivate creativity that leads to innovative ideas. |
| | Use quantitative and/or analytical mathematical skills to solve problems and to interpret, evaluate, and process information and data to draw logical conclusions and support claims. |
| *MATH*<br>Mathematics AS-T Degree | Analyze, synthesize and evaluate theorems in Linear Algebra |
| | Solve application problems in math and science using calculus, differential equations, and linear algebra. |
| | Solve applications in math and science using derivatives, integrals, differential equations and linear algebra |
| *MATH*<br>Mathematics A.S. Degree | Analyze, synthesize and evaluate theorems in Linear Algebra |
| | Solve applications in math and science using derivatives, integrals, differential equations and linear algebra |
| *MATH*<br>Mathematics - A.A. Degree Major | Analyze, synthesize and evaluate theorems in Linear Algebra. |
| | solve applications in math and science using derivatives, integrals, differential equations and linear algebra. |
| *ST DV*<br>Liberal Arts: Science and Mathematics Emphasis A.A. Degree | Apply mathematical and scientific ideas to analyze real-world situations. |
| *MATH*<br>Data Science for Mathematics AS Degree | Interpret and evaluate data trends, qualitative research, or patterns in complex data sets using statistical techniques, analytic methods, and tools. |
| *MATH*<br>Mathematics - A.S. Degree Major | analyze, synthesize and evaluate theorems in Linear Algebra. |
| | solve applications in math and science using derivatives, integrals, differential equations and linear algebra. |
| *MATH*<br>Mathematics - AS-T | analyze, synthesize and evaluate theorems in Linear Algebra. |
| | solve applications in math and science using derivatives, integrals, differential equations and linear algebra. |
| *ILOs*<br>General Education | apply techniques of analysis and critical thinking to critique real world and theoretical topics and issues |

## Additional SLO Information

**Does this proposal include revisions that might improve student attainment of course learning outcomes?**

No

**Is this proposal submitted in response to learning outcomes assessment data?**

No

**If yes was selected in either of the above questions for learning outcomes, explain and attach evidence of discussions about learning outcomes.**

No Value

**SLO Evidence**

No Value

## Course Content

### Lecture Content

**Systems of Linear Equations and Matrices (17 hours)**
- Introduction to systems of linear equations
- Gaussian and Gauss-Jordan elimination
- Matrices and matrix operations Inverses; rules of matrix arithmetic
- Elementary matrices and finding the inverses of a matrix
- Results on systems of equations and invertibility
- Diagonal, triangular, and symmetric matrices

**Determinants (8 hours)**
- The determinant function
- Evaluating determinants by raw reduction
- Properties of the determinant function
- Cofactor expansion; Cramer's rule

**Vectors in R^n (10 hours)**
- Introduction to vectors (Geometric)
- Norm of a vector
- Vector arithmetic
- The dot product and projections
- The cross product
- Orthogonality of two vectors
- Lines and planes in 3-space

**Euclidean Vector Spaces (7 hours)**
- Euclidean n-space
- Linear transformations from Rn to Rm
- Properties of Linear transformations from Rn to Rm

**General Vector Spaces (10 hours)**
- Real vector spaces
- Subspaces
- Linear independence
- Basis and dimension
- Raw space, column space and nullspace
- Rank and Nullity

**Inner Product Spaces (10 hours)**
- Inner products
- Angle and orthogonality in inner product spaces
- Orthonormal bases; Gram-Schmidt process; QR-Decomposition
- Best approximation; least squares
- Orthogonal matrices; change of bases

**Eigenvalues and Eigenvectors (11 hours)**
- Eigenvalues and eigenvectors
- Diagonalization
- Orthogonal diagonalization

**Linear Transformations (11 hours)**
- General linear transformations
- Kernel and range
- Inverse linear transformations
- Matrix representations of general linear
- Transformations

- Similarity

**Applications (6 hours)**
- Fourier Series
- Quadratic Forms and their applications

**Total Hours: 90**

## Additional Information

**Repeatability**

Not Repeatable

**Justification (if repeatable was chosen above)**

No Value

**Is it possible this course will have a material fee?**

No

**I have contacted my library liaison (https://campusguides.glendale.edu/faculty/liaisons):**

No Value

**What term(s) will this course be offered?**

Fall/Winter/Spring/Summer

**Will any additional resources be needed for this course? (Click all that apply)**

- No

**If additional resources are needed, add a brief description and cost in the box provided.**

No Value

## Resources

**Did you contact your departmental library liaison?**

No

**If yes, who is your departmental library liason?**

No Value

**Did you contact the DEIA liaison?**

No

**Were there any DEIA changes made to this outline?**

No

**If yes, in what areas were these changes made:**

No Value

**Will any additional resources be needed for this course? (Click all that apply)**

- No

**If additional resources are needed, add a brief description and cost in the box provided.**

No Value