

quarters, not counting summers. If such an interruption occurs, students may have to meet different EOU graduation requirements. **Continuous enrollment begins with enrollment in the first EOU course, after admission to EOU.**

## COURSE DESCRIPTIONS

### LS 401 - Sr Proj/Capstone Credits: 4.00

Individualized capstone project conducted with a teaching faculty capstone adviser in student's main subject area. Prerequisite: Approval of capstone proposal form.

Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

## Eastern Oregon University

# Mathematics

## PROGRAM OBJECTIVES

The program in mathematics has three primary objectives:

- To provide a major in mathematics that develops the attitude of mind and analytical skills required for effective use and understanding of mathematics.
- To prepare highly qualified teachers of mathematics for elementary, middle, and secondary schools.
- To provide the necessary mathematical and statistical support courses for students in other disciplines, including computer science, physical and biological sciences, social science, business and economics, and health.

## LEARNING OUTCOMES

Students in mathematics will:

- Demonstrate an understanding of the fundamental areas of mathematics: discrete mathematics, calculus, linear algebra, probability and statistics, applications of mathematics, algebraic structures, and real analysis.
- Develop and employ skills in logical reasoning and mathematical rigor.
- Develop and employ skills in problem solving and modeling.
- Develop and employ skills in computer programming and effective use of mathematical software.

## MEANS OF ASSESSMENT

Means of outcomes assessment include midterm and comprehensive final examinations, homework exercises and quizzes, individual and group projects, classroom presentations, term papers and a capstone project. For example, students generally

demonstrate their mastery of fundamental areas of mathematics through performance on examinations. Skills in logical reasoning are demonstrated by constructing rigorous proofs of mathematical theorems, or constructing counterexamples if applicable. In addition to regular course work, problem solving skills may be demonstrated by participation in the Mathematical Contest in Modeling. Classroom presentations encourage students to develop skills in communicating mathematical ideas and subtleties to an audience of their peers. Finally, every graduating senior completes a capstone project in which the student's development in multiple areas is demonstrated.

## REQUIREMENTS FOR THE BACHELOR OF ARTS OR THE BACHELOR OF SCIENCE IN MATHEMATICS

1. Completion of a minimum of 66 credit hours in mathematics.
2. To be admitted, you must complete Math 251, 252, 253, with a grade of "C-" or better in each course, and file a School of Arts and Sciences program admission form in the school office.
3. Complete EOU graduation requirements. (The computer literacy requirement for mathematics is completion of at least 7 hours of computer science courses.)
4. Complete the University Writing Requirement.
5. Complete each of the following courses with a "C-" or better:

**MATH 231** Discrete Mathematics (4)

**MATH 251** Calculus I (4)

**MATH 252** Calculus II (4)

**MATH 253** Calculus III (4)

**MATH 261** Linear Algebra I (3)

**MATH 262** Linear Algebra II (3)

**STAT 315** Principles of Statistics (4)  
**STAT 316** Statistical Computing (1)  
**MATH 382** Structure of Number Systems (4)  
**MATH 415** Real Analysis (4)  
**MATH 447** Abstract Algebra (4)  
**MATH 407** Capstone Seminar (3)

6. In addition to the courses above, complete 24 hours of mathematics courses numbered 254 or above with at least a 2.00 GPA. At least one of these courses must be identified as writing intensive.

## Typical Math Program Beginning with Calculus

### TYPICAL FIRST YEAR CURRICULUM

#### Fall

**MATH 251** Calculus (4)  
General Education or Elective Courses (10-12)

#### Winter

**MATH 252** Calculus (4)  
Computer Science Electives (3)  
General Education or Elective Courses (6-9)

#### Spring

**MATH 231** Discrete Mathematics (4)  
**MATH 253** Calculus (4)  
Computer Science Electives (3)  
General Education or Elective Courses (2-5)

### TYPICAL SECOND YEAR CURRICULUM

#### Fall

**MATH 261** Linear Algebra (3)  
MATH Electives (5-9)  
General Education or Elective Courses (3-6)

#### Winter

**MATH 262** Linear Algebra (3)  
MATH Electives (3-5)  
General Education or Elective Courses (10-13)

#### Spring

**STAT 315** Principles of Statistics (4)  
**STAT 316** Introduction to Stat. Comp. (1)  
MATH Electives (3)  
General Education or Elective Courses (7-10)

### TYPICAL THIRD YEAR CURRICULUM

#### Fall

**MATH 382** Structure of Number Systems (4)  
MATH Electives (3)  
General Education or Elective Courses (10-13)

#### Winter

**MATH 447** Abstract Algebra (4)  
MATH Electives (3-5)  
General Education or Elective Courses (8-11)

#### Spring

**MATH 415** Real Analysis (4)  
General Education or Elective Courses (6-9)

### TYPICAL FOURTH YEAR CURRICULUM

#### Fall

MATH Electives (3-8)  
General Education or Elective Courses (7-10)

#### Winter

MATH Electives (5-8)  
MATH 407 Capstone Seminar (1)  
General Education or Elective Courses (7-10)

#### Spring

MATH Electives (3-9)  
MATH 407 Capstone Seminar (2)  
General Education or Elective Courses

## Typical Math Program Beginning with College Algebra

### TYPICAL FIRST YEAR CURRICULUM

#### Fall

**MATH 111** College Algebra (4)  
General Education or Elective Courses (11-14)

#### Winter

**MATH 112** Precalculus (4)  
General Education or Elective Courses (11-14)

#### Spring

**MATH 231** Discrete Mathematics (4)  
**MATH 251** Calculus (4)  
General Education or Elective Courses (6-10)

### TYPICAL SECOND YEAR CURRICULUM

#### Fall

**MATH 252** Calculus (4)  
Computer Science Electives (3)  
General Education or Elective Courses (8-11)

#### Winter

Computer Science Electives (3)  
General Education or Elective Courses (8-11)

#### Spring

**MATH 253** Calculus (4)  
**STAT 315** Principles of Statistics (4)

**STAT 316** Introduction to Stat. Comp. (1)  
General Education or Elective Courses (6-9)

## TYPICAL THIRD YEAR CURRICULUM

### Fall

**MATH 261** Linear Algebra (3)  
MATH Electives (7)  
General Education or Elective Courses (4-7)

### Winter

**MATH 262** Linear Algebra (3)  
MATH Electives (3-5)  
General Education or Elective Courses (7-10)

### Spring

MATH Electives (8)  
General Education or Elective Courses (7-10)

## TYPICAL FOURTH YEAR CURRICULUM

### Fall

**MATH 382**  
Structure of the Number System (4)  
MATH Electives (3-5)  
General Education or Elective Courses (10-13)

### Winter

**MATH 407** Capstone Seminar (1)  
**MATH 447** Abstract Algebra (4)  
MATH Electives (3-5)  
General Education or Elective Courses (8-11)

### Spring

**MATH 415** Real Analysis (4)  
**MATH 407** Capstone Seminar (2)  
General Education or Elective Courses (3-6)

Note: MATH electives must include at least 24 hours of mathematics courses number 254 or higher. See **STATISTICS**

## REQUIREMENTS FOR THE MINOR IN MATHEMATICS

1. Completion of a minimum of 33 credits in mathematics.
2. Complete the calculus sequence (MATH 251, 252, 253), Linear Algebra (MATH 261, 262), and Structure of the Number System (MATH 382).
3. Complete an additional 11 hours of mathematics courses number 231, 254 or upper division.
4. Earn a grade of "C-" or better in MATH 251, 252, 253 and a minimum GPA of 2.00 in all other courses counting toward the minor.
5. A minimum of 10 credits applied toward the minor must be completed at Eastern.

## REQUIREMENTS FOR THE MINOR IN MATHEMATICAL STUDIES

(multidisciplinary studies majors only)

1. Complete the following courses:

**MATH 211, 212, 213**, Foundations of Elementary Mathematics I, II, III (12) **or**

**MATH 111, 112, 211** College Algebra, Precalculus, Foundations of Math I (12)

**MATH 251** Calculus I (4)

**MATH 252** Calculus II (4)

**STAT 315** Principles of Statistics (4)

**STAT 316** Intro to Statistical Computing (1)

**MATH 337** Modern Geometry (3)

**CS 161** Intro to Structured Programming (4)

**MTHE 333** Mathematics in the Elem School (5)

One mathematics course numbered 231, 254, or above 300 (3-5)

**Total (minimum) 40 CREDITS**

2. Complete each of the courses counting toward the minor with a grade of "C-" or better.

3. A minimum of 10 credits applied toward the minor must be completed at EOU.

## MATHEMATICS COURSE DESCRIPTIONS

**MATH 040 - Arithmetic Skill Credits: 1.00 to 3.00**  
Designed for students who need review in basic computational skills. The course will deal with whole numbers, fractions, decimals, percentages, ratios, and introductory geometry. The class will require independent student effort, and students will have to motivate themselves to attend help sessions when needed. (Not applicable toward baccalaureate degree.)

**MATH 070 - Elem Algebra Credits: 4.00**  
Fundamental concepts of algebra. This course is equivalent to first year high school algebra. Concepts include solving equations, graphing equations and inequalities, and solving systems of equations. (Not applicable toward baccalaureate degree.) Prerequisite: MATH 040 or equivalent.

**MATH 095 - Algebraic Foundations Credits: 4.00**

This course examines fundamental concepts of algebra and is equivalent to second year high school algebra. Concepts include polynomial expressions and factoring, rational expressions, radical expressions, and quadratic expressions. (Not applicable toward a baccalaureate degree.) Prerequisite: MATH 070 or equivalent.

**MATH 105 - Lotteries & Loans\*L/QR Credits: 3.00  
Gen Ed-Language & Logic****New Gen Ed-Quantitative Reason**

This course is an introduction to certain areas of mathematics whose applications are important and whose study will help develop critical thinking skills. Two major topics are covered. One topic is the mathematics of finance, or "loans," which includes borrowing, saving, mortgages, leases and amortization. The other topic is "lotteries," which includes the elementary counting techniques including permutations and combinations, finite sample space probability theory, and games of chance.

**MATH 110 - MATH 110 Credits: 1.00 to 6.00**

Topics of current interest to students and faculty.

**MATH 111 - College Algebra Credits: 4.00**

Topics examined in this course include equations and inequalities in one variable, a careful treatment of the function concept, and an examination of the properties and applications of several important families of functions: polynomial, rational, exponential and logarithmic. Prerequisite: MATH 095 or equivalent.

**MATH 112 - Precalculus Credits: 4.00**

In this course students experience a detailed treatment of exponential, logarithmic, trigonometric and inverse trigonometric functions designed to prepare them for calculus. Prerequisite: MATH 111 or equivalent.

**MATH 208 - Workshop Credits: 1.00 to 6.00**

A workshop emphasizing exchange of ideas by students working in a specific area of mathematics or a related discipline. Sessions are scheduled in blocks of times where attendance is mandatory. Outside reading, papers, and/or projects may be expected as pre- and post-assignments to the workshop.

**MATH 209 - Field Placement Credits: 1.00 to 15.00**

A planned and supervised work experience involving mathematics at an introductory level, this course offers students an opportunity to examine career goals through a work experience with approved learning objectives.

**MATH 210 - Selected Topics Credits: 1.00 to 6.00**

Topics of current interest to students and faculty.

**MATH 211 - Found Elem Math I\*L Credits: 4.00  
Gen Ed-Language & Logic**

Introduction to basic concepts of elementary

mathematics designed to initiate the building of an understanding and appreciation of the nature, structure, philosophy, and history of mathematics. Prerequisite: MATH 095

**MATH 212 - Found Elem Math II\*L/QR Credits: 4.00  
Gen Ed-Language & Logic****New Gen Ed-Quantitative Reason**

Introduction to basic concepts of elementary mathematics designed to initiate the building of an understanding and appreciation of the nature, structure, philosophy, and history of mathematics. Prerequisite: MATH 095

**MATH 213 - Found Elem Mth III\*L/QR Credits: 4.00  
Gen Ed-Language & Logic****New Gen Ed-Quantitative Reason**

Introduction to basic concepts of elementary mathematics designed to initiate the building of an understanding and appreciation of the nature, structure, philosophy, and history of mathematics. Prerequisite: MATH 095

**MATH 231 - Discrete Mathematics Credits: 4.00**

This course provides an introduction to several topics from Discrete Mathematics, including mathematical induction, Boolean logic and set operations, counting theory (combinatorics), and graph theory. Prerequisite: MATH 111 or equivalent.

**MATH 241 - Survey Calculus\*L/QR Credits: 4.00  
Gen Ed-Language & Logic****New Gen Ed-Quantitative Reason**

(General Education: Language and Logic) An introductory look at the calculus of a small family of functions primarily those encountered in high school algebra. Both differentiation and integration will be discussed together with applications of each. Prerequisite: MATH 111 or equivalent.

**MATH 251 - Calculus\*L/QR Credits: 4.00****Gen Ed-Language & Logic****New Gen Ed-Quantitative Reason**

Topics from elementary real analysis, i.e., limit concept, continuity, differentiation, integration, infinite sequences, series, multi-variate calculus and applications. Prerequisite: MATH 112 or the equivalent.

**MATH 252 - Calculus\*L/QR Credits: 4.00****Gen Ed-Language & Logic****New Gen Ed-Quantitative Reason**

Topics from elementary real analysis, i.e., limit concept, continuity, differentiation, integration, infinite sequences, series, multi-variate calculus and applications. Prerequisite: MATH 251 or the equivalent.

**MATH 253 - Calculus\*L Credits: 4.00****Gen Ed-Language & Logic**

Topics from elementary real analysis, i.e., limit concept, continuity, differentiation, integration, infinite sequences, series, multi-variate calculus and applications. Prerequisite: MATH 252 or the equivalent.

**MATH 254 - Calculus\*L Credits: 4.00**

**Gen Ed-Language & Logic**

Topics from elementary real analysis, i.e., limit concept, continuity, differentiation, integration, infinite sequences, series, multi-variate calculus and applications. Prerequisite: MATH 253 or the equivalent.

**MATH 261 - Linear Algebra Credits: 3.00**

This is the first course of a two-course sequence that examines the fundamental topics in linear algebra. Topics for the first course typically include systems of linear equations, matrices, determinants, and Euclidean n-space. Applications are discussed throughout the course. Prerequisite: MATH 252.

**MATH 262 - Linear Algebra Credits: 3.00**

This course is a continuation of the study of linear algebra started in Math 261. Topics for the second course typically include general vector spaces, dimension, inner product, linear transformations, eigenvalues, and eigenvectors. Applications are discussed throughout the course. Prerequisite: MATH 261

**MATH 310 - Selected Topics Credits: 1.00 to 6.00**

Topics of current interest to students and faculty.

**MATH 311 - Elementary Analysis Credits: 4.00**

This course is an introduction to the theory of mathematical analysis on the real numbers. Topics covered include completeness, convergence of sequences and series and continuity. The focus is on developing skill with analytical arguments in the context of theory development. Prerequisite: MATH 261

Restrictions: May not be enrolled in one of the following Class(es): Freshman

**MATH 321 - Differential Equations Credits: 5.00**

This course examines techniques of solution for ordinary differential equations including first order differential equations, linear differential equations of higher order, operator methods, LaPlace transforms, numerical methods, series solutions, and applications. Prerequisite: MATH 252

Restrictions: May not be enrolled in one of the following Class(es): Freshman

**MATH 322 - Fourier Analysis Credits: 3.00**

A first course in Fourier analysis includes an introduction to orthogonal functions, Fourier series, Fourier transforms, Dirichlet's theorem, the Fourier integral, Bessel's inequality, and Parseval's theorem. Prerequisite: MATH 321

Restrictions: May not be enrolled in one of the following Class(es): Freshman

**MATH 337 - Modern Geometry Credits: 4.00**

**(Writing Intensive)** A consideration of Euclid's parallel postulate and an introduction to non-Euclidean geometry. Prerequisite: MATH 251 and 252.

Restrictions: May not be enrolled in one of the following Class(es): Freshman

**MATH 347 - Adv Top Discrete Math Credits: 4.00**

This course examines topics in discrete mathematics at an advanced level. Topics include set theory, relations, graph theory, analysis of algorithms, and enumeration. Prerequisite: MATH 252.

Restrictions: May not be enrolled in one of the following Class(es): Freshman

**MATH 355 - Intro Math Modeling Credits: 4.00**

**(Writing Intensive)** An introduction to the techniques of building and analyzing mathematical models. Discrete and continuous models in both scalar and vector systems are examined. Prerequisite: MATH 252 or equivalent. MATH 261, 262 and STAT 315 are recommended.

Restrictions: May not be enrolled in one of the following Class(es): Freshman

**MATH 358 - Numerical Analysis Credits: 3.00**

In this course students examine numerical techniques for solutions of equations, series, integration, differentiation and matrices. Error analysis. Prerequisite: MATH 253

Restrictions: May not be enrolled in one of the following Class(es): Freshman

**MATH 382 - Structure of Number Systems Credits: 4.00**

In this course students proceed through an axiomatic construction of the real number system beginning with Peano's Postulates. Topics include relations, functions, induction, methods of proof and ideas from groups, rings, fields and real analysis. Prerequisite: MATH 253

Restrictions: May not be enrolled in one of the following Class(es): Freshman

**MATH 405 - Reading and Conf. (Arranged) Credits: 1.00 to 15.00**

Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

**MATH 407 - Seminar/Capstone (arranged) Credits: 1.00 to 15.00**

Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

**MATH 408 - Workshop Credits: 1.00 to 6.00**

Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

**MATH 409 - Field Placement Credits: 1.00 to 15.00**

A planned and supervised work experience involving mathematics at an advanced level, this course offers students an opportunity to examine career goals through a work experience with approved learning objectives.

Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

**MATH 410 - Selected Topics Credits: 1.00 to 6.00**

Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

**MATH 415 - Real Analysis Credits: 4.00**

This course is a careful examination of the calculus of functions of a single variable. Topics include limits, sequences, continuity, the derivative and the Riemann integral. Prerequisite: MATH 382

Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

**MATH 417 - Complex Variable Credits: 3.00**

An introduction to analytic functions, elementary functions, infinite series with complex terms and integration in the complex domain. Prerequisite: MATH 253.

Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

**MATH 447 - Abstract Algebra Credits: 4.00**

**(Writing Intensive)** An introduction to modern algebra including the study of groups, rings, and fields. Development of proof techniques and understanding axiomatic methods are also important parts of this course. Prerequisite: MATH 382

Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

**MATH 452 - Operations Research Credits: 4.00**

**(Writing Intensive)** In this course, students examine linear optimization methods in mathematics. Topics include linear programming models, solution techniques, and sensitivity analysis. Prerequisite: MATH 252 and 261

Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

**MATH 453 - Operations Research Credits: 4.00**

**(Writing Intensive)** In this course, students examine nonlinear optimization methods in mathematics. Topics include dynamic programming, integer programming, nonlinear programming, queuing models, and inventory models. Prerequisite: STAT 315, 316, and Math 254.

Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

**MATH 461 - Probability & Statistics Credits: 4.00**

In this course, students examine the foundation of elementary probability theory and statistics in both the discrete and continuous cases. Topics include

probability density functions, moments and moment generating functions, random variables, samples and sampling distributions, estimation of parameters, and applications. Prerequisite: MATH 253, STAT 315  
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

**MATH 462 - Applied Regression Analysis Credits: 4.00**

**(Writing Intensive)** An introduction to statistical methods in regression and analysis of variance through the unifying theme of the general linear model Prerequisite: STAT 315, 316; and MATH 262.  
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

**MATH 501 - Research (arranged) Credits: 1.00 to 15.00**

Restrictions: May not be enrolled in one of the following Level(s): Denied Adm Undergraduate, Non-Admitted Undergraduate, Undergraduate. Must be enrolled in one of the following Class(es): Graduate, Non-Admitted Graduate, Post-Baccalaureate

**MATH 505 - Reading and Conf (arranged) Credits: 1.00 to 15.00**

Restrictions: May not be enrolled in one of the following Level(s): Denied Adm Undergraduate, Non-Admitted Undergraduate, Undergraduate. Must be enrolled in one of the following Class(es): Graduate, Non-Admitted Graduate, Post-Baccalaureate

**MATH 507 - Seminar Credits: 1.00 to 15.00**

Restrictions: May not be enrolled in one of the following Level(s): Denied Adm Undergraduate, Non-Admitted Undergraduate, Undergraduate. Must be enrolled in one of the following Class(es): Graduate, Non-Admitted Graduate, Post-Baccalaureate

**MATH 708 - Workshop Credits: 1.00 to 6.00**

Restrictions: May not be enrolled in one of the following Level(s): Denied Adm Undergraduate, Non-Admitted Undergraduate, Undergraduate