

# Department of Mathematics

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## College of Arts and Sciences

### Faculty

**Troy Riggs** (1993, 2000). Associate Professor of Mathematics and Department Chair. B.S., University of South Dakota; M.A., and Ph.D., University of Nebraska-Lincoln.

**Bryan Dawson** (1998). Professor of Mathematics. B.S. and M.S., Pittsburg State University; Ph.D., University of North Texas.

**Richard Dehn** (1969). Associate Professor of Mathematics. B.S., University of Memphis; M.A.T., Purdue University; M.S., University of Arkansas, Additional study, University of Wisconsin, University of Arkansas, University of Missouri-Rolla.

**Chris Hail** (1995). Associate Professor of Mathematics. B.S., Campbellsville College; M.A., Morehead State University; Ed.D., University of Kentucky.

**Dwayne Jennings** (1981). Associate Professor of Mathematics and Computer Science. B.S., Union University; M.S. (Mathematics) and M.S. (Computer Science), University of Memphis.

**Matt Lunsford** (1993). Professor of Mathematics. B.G.S., Louisiana Tech University; M.S., University of Nebraska; Ph.D., Tulane University.

**Don Rayburn Richard** (1983). Associate Professor of Mathematics. B.S., University of Memphis; M.A., University of Missouri; M.B.A., University of Colorado.

### 124 Mission Statement

Union's mathematics program seeks to further students in their quest for increased understanding of Creation and the created order and to equip students to serve God, church and society through excellence in thinking and the use of mathematics. We do this through a curriculum that develops the student's ability to think logically, analytically, and abstractly; to pursue a body of knowledge whose basis is independent of both empirical observation and culture; and to learn humility and a sense of wonder at the complexity, beauty, and applicability of mathematics.

### Student Awards

A **Departmental Award** is given to the senior who places first in the Major Field Test for Mathematics as partial fulfillment of 498.

**The Wolfram Research Inc. Award** is awarded to a freshman calculus student chosen by The Department of Mathematics based upon demonstrated outstanding achievement, enthusiasm, ingenuity and creativity in mathematics.

### Curriculum

The department offers a major in mathematics and minors in mathematics, mathematics with emphasis in statistics, and actuarial science. Students majoring in mathematics may select from the following tracks: mathematics, teacher licensure in mathematics for secondary education (grades 7-12), or actuarial science. The offerings of the major provide a foundation for beginning graduate study in mathematics, for entry into mathematics-related work fields, and for teaching mathematics at the secondary level. Students majoring or minoring in mathematics begin their academic credit towards the major or minor with courses numbered MAT 205 or above. Students having a four-year high school mathematics program that included trigonometry should be able to begin the calculus sequence in their first semester.

- I. Major in Mathematics—35 hours**
- A. MAT 205, 208, 211, 212, 213, 315 and 498 are required.
  - B. Select one: MAT 411, MAT 415.
  - C. Select 9 hours from junior or senior MAT courses.
  - D. Independent Study (MAT 495) or Departmental Special Study (MAT 395) may be used for 3 of the 9 hours required in C.
  - E. Prerequisites: PHY 231 and CSC 115
- II. Teacher Licensure in Mathematics (Grades 7-12)**
- A. Major requirements as shown above to include MAT 413.
  - B. Professional Education: EDU 150, 250, 326, 422, 433; PSY 213, 318; SE 225.
  - C. Completion of applicable portions of the Praxis II.
  - D. For additional information, see the Assistant Dean.
- III. Minor in Mathematics—21 hours**
- A. MAT 211 and 212 are required and one of: MAT 208, 205, 213; CSC 115.
  - B. At least 6 hours of upper-level work is required with no more than one departmental special study allowed and no independent study allowed.
  - C. The remaining must be 205 or higher.
- IV. Minor in Mathematics with an Emphasis in Statistics—20 or 21 hours**
- A. MAT 211 and 212, 208, 305, and 405
  - B. One of: MAT 213, 314, 315; CSC 115.
- V. Minor in Actuarial Science as earned with a Math Major—19 hours**
- A. Prerequisites (applicable to major): MAT 211, 212, 213, 305, 315, 401, 402.
  - B. ACC 211, 212; ECF 211, 212, 320.
  - C. ECF 411 or 412.
  - D. MAT 400.
- VI. Minor in Actuarial Science as earned with a Business Major and BSBA—21 hours**
- A. Prerequisites (applicable to other requirements): ACC 211, 212; ECF 211, 212, 320; ECF 411 or 412; MAT 208, 211; CSC 115. Note: In the BSBA core MAT 208 substitutes for MAT 114 and CSC 115 for 105.
  - B. MAT 212, 213, 305, 315.
  - C. MAT 400, 401, 402.

### Assessment of Majors

All senior mathematics majors must take the Major Field Test in mathematics as one requirement for MAT 498 (see below). Those majors completing a teacher licensure program are required to take the PRAXIS II.

### Student Organizations

**Kappa Mu Epsilon**, honor society in Mathematics, selects students who have achieved standards of scholarship, professional merit, and academic distinction. A student must have completed 3 semesters' rank in the upper 35%, completed 3 courses in MAT, to include calculus, and have a minimum 3.0 Math GPA.

**Sigma Zeta** is a national honorary science society for those who have completed 15 hours in natural science and math with a minimum GPA of 3.0 in these courses.

### Course Offerings in Mathematics (MAT)

( ) Hours Credit

#### @101. Fundamental Concepts (3)

This course is designed to introduce the student to problem solving strategies and the real number system. Topics will include the whole numbers, integers, fractions and decimals, ratio and proportion, percents and functions.

**@107. Mathematics for the Liberal Arts (3)**

This course is designed to introduce the student to the basic concepts of several areas of mathematics including algebra, geometry, trigonometry, probability, and descriptive statistics.

**@\*111. College Algebra (3)**

Prerequisite: Two years of high school algebra or MAT 100.

Topics include equations in two variables, functions, graphing techniques, systems of equations and inequalities, exponential and logarithmic functions, matrices, and the theory of polynomial equations.

**@\*112. Plane Trigonometry (3)**

Prerequisite: MAT 111.

Topics include the definition of the trigonometric functions, radian measure, linear and angular velocity, graphing techniques, trigonometric identities and equations, the inverse trigonometric functions, and solving triangles.

**@114. Introduction to Statistics and Probability (3)**

Prerequisite: Two years of high school algebra or MAT 100.

Descriptive statistics with introduction to inferential statistics. Topics include organization of data into frequency distribution tables and histograms, measures of central tendency, standard deviation, basic probability, continuous distributions through the normal distribution, introduction to sampling theory and hypothesis testing.

**@\*116. Precalculus (3)**

Prerequisites: Two years of high school algebra and one of geometry.

An introduction to polynomial, exponential, logarithmic, and trigonometric functions and basic analytic geometry. This course is intended for students planning to take MAT 211, and is not recommended for students who have taken MAT 111 and/or 112.

**@201. Calculus for Business/Social Sciences (3)**

Prerequisite: MAT 111 or its equivalent.

Topics include a review of algebra principles, development of differential calculus with an emphasis on applications of the derivative to business and social sciences, and a brief introduction to integral calculus with elementary applications of the definite integral. Is not recommended for students that have taken MAT 211-12.

**205. Discrete Mathematics (3)**

Prerequisite: MAT 111 or its equivalent.

Topics include elementary logic, sets, proof techniques including induction, relations and graphs, recurrence relations, basic counting techniques, equivalence relations, Boolean algebra, and algebraic structures.

**208. Statistics (3)**

Prerequisite: MAT 111.

Topics include descriptive and inferential statistics, probability theory, binomial and normal distributions, hypothesis testing, linear correlation and regression.

**211. Calculus and Analytic Geometry I (4)**

Prerequisite: MAT 111 and 112, or 116.

Topics include basic concepts of plane analytic geometry, functions, limits, differentiation of algebraic and trigonometric functions, applications of the derivative, the indefinite and the definite integral, and the fundamental theorem of calculus.

**212. Calculus and Analytic Geometry II (4)**

Prerequisite: MAT 211.

Topics include integration by substitution, numeral integration, applications of the definite integral, the calculus of transcendental functions, techniques of integration, and the calculus of parametrized curves.

**213. Calculus and Analytic Geometry III (4)**

Prerequisite: MAT 212.

Topics include infinite series, polar coordinates, vectors in three-space, functions of several variables, partial derivatives, multiple integrals, and line integrals.

**305. Statistical Methods (3)**

Prerequisite: MAT 208.

Parametric and non-parametric statistical methods with an emphasis on applications. Topics include correlation and regression, analysis of variance, Chi-square distribution, contingency tables, and applications to the social sciences, life sciences and business.

**310. History of Mathematics (3)**

Prerequisite: MAT 212.

A survey of the major developments in the history of mathematics with special emphasis to the areas usually discussed in high school and undergraduate mathematics courses: geometry, algebra, trigonometry and calculus.

**314. Differential Equations (3)**

Prerequisite: MAT 213.

Topics include linear first-order differential equations and applications, higher-order differential equations and applications.

**315. Linear Algebra (3)**

Prerequisite: MAT 212.

Topics include systems of linear equations, matrices, determinants, linear transformations, diagonalization of matrices, and major applications to business and the sciences.

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**320. Introduction to Complex Variables (3)**

Prerequisite: MAT 213.

Algebraic properties of the complex number system, complex transformations, analytic functions, complex integration, residues, and series representations of functions.

**360. Numerical Analysis (3)**

Prerequisite: CSC 115, MAT 205 and 213.

Numerical computations, roots of equations, simultaneous nonlinear and linear simultaneous equations, numerical integration and differentiation, and power series calculations.

**400. SOA Course I Exam Preparation (1)**

Prerequisite: MAT 213 and 305.

Application of calculus and statistics to risk management problems relevant to the Society of Actuaries Course I exam. Sitting for the SOA Course I exam is required for successful completion of the course. Pass/Fail.

**401. Actuarial Mathematics I (3)**

Prerequisite: MAT 400

Measures of interest, annuities-certain, amortization schedules, sinking funds and bonds. Introduction to life tables and life annuities.

**402. Actuarial Mathematics II (3)**

Prerequisite: 401.

Actuarial models, including survival models, stochastic processes and loss models. Applications to insurance and annuity contracts.

**405. Mathematical Statistics (3)**

Prerequisites: MAT 305 & 212.

A calculus-based introduction to the theory of probability and statistics. Topics include conditional probability and independence, random variables, mathematical expectations, discrete and continuous distributions, central limit theorem and sampling theory.

**411. Introduction to Analysis (3)**

Prerequisite: MAT 205 and 213.

A rigorous inquiry into sequences, limits, continuity, differentiation, and integration.

**413. College Geometry (3)**

Prerequisite: MAT 205 and 212.

Topics include axiomatic foundations of Euclidean and non-Euclidean geometry, models for incidence geometries, and development of theorems in the geometries of the Euclidean plane and the hyperbolic plane.

**415. Abstract Algebra (3)**

Prerequisite: MAT 205 and 212.

An introduction to number theory, group theory, and ring theory. Topics include divisibility in the integers, permutation groups, homomorphisms, normal subgroups and quotient groups, LaGrange's Theorem, ideals, and polynomial rings.

**498. Mathematics Seminar (2)**

**128** Prerequisite: 20 hours of MAT course work and Senior standing.

The setting for administering the Major Field Test, for addressing those areas of mathematics for which prior assessment indicates the need for improvement, for providing seniors an opportunity to demonstrate their awareness of the abstract nature of mathematics and its unifying principles through oral and written presentations, and for discussion of current mathematical research. The course may be modified at the discretion of the department.

\* Six hours maximum may be applied toward graduation from MAT 111-2, 116.

@ Does not apply toward the major or minor.

**180-280-380-480. Study Abroad Programs (1-4)**

All courses and their application must be defined and approved prior to travel.

**195-6-7. Special Studies (1-4)**

**295-6-7. Special Studies (1-4)**

Lower-level group studies which do not appear in the regular departmental offerings.

**395-6-7. Special Studies (1-4)**

Upper-level group studies which do not appear in the regular departmental offerings.

**495-6-7. Independent Study (1-4)**

Individual research under the guidance of a faculty member(s).

**497-8-9. Seminar (1-3)**

To be used at the discretion of the department.