Mathematics

Chairperson of Department: Daniel Grayson
Department Office: 273 Altgeld Hall, 1409 West Green, Urbana
Phone: 333-3350
www.math.uiuc.edu

MATH 012  Algebra  credit: 3 hours.
Rapid review of basic techniques of factoring, rational expressions, equations and inequalities; functions and graphs; exponential and logarithm functions; systems of equations; matrices and determinants; polynomials; and the binomial theorem. Students who need both algebra and trigonometry should enroll in MATH 016. Credit is not given for both MATH 012 and MATH 016. Credit not applicable toward graduation in certain curricula. Prerequisite: 1.5 units of high school algebra, and 1 unit of high school geometry.

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<th>CRN</th>
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Restricted to students in the transition/bridge program.

MATH 016  Algebra and Trigonometry  credit: 5 hours.
Unified treatment of algebra and trigonometry. Credit is not given for both MATH 016 and MATH 012. Credit not applicable toward graduation in certain curricula. Prerequisite: 1.5 units of high school algebra; 1 unit of high school geometry.

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### MATH 103  Theory of Arithmetic  credit: 4 hours.
Analyses of the mathematical issues and methodology underlying elementary mathematics in grades K-5. Topics include sets, arithmetic algorithms, elementary number theory, rational and irrational numbers, measurement, and probability. There is an emphasis on problem solving. Priority registration will be given to students enrolled in teacher education programs leading to certification in elementary or childhood education. Prerequisite: MATH 012 or equivalent.

This course satisfies the General Education Criteria for a:
Quantitative Reasoning I

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Quant Reasoning I course.

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Quant Reasoning I course.
Restricted to Education General or Special Education or Early Childhood Education or Pre-Early Child/Elem Ed/Spec Ed major(s).

### MATH 117  Elementary Mathematics  credit: 4 hours.
Analyses of the mathematical issues and methodology underlying elementary mathematics in grades 6-8. Topics include the Real number system and field axioms, sequences and series, functions and math modeling with technology, Euclidean and non-Euclidean geometry, probability and statistics. Priority registration will be given to students enrolled in teacher education programs leading to certification in elementary education. Prerequisite: MATH 012 or equivalent.

This course satisfies the General Education Criteria for a:
Quantitative Reasoning I

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Quant Reasoning I course.
MATH 118  **A Mathematical World**  credit: 3 hours.
Introduction to selected areas of mathematical sciences through application to modeling and solution of problems involving networks, circuits, trees, linear programming, random samples, regression, probability, inference, voting systems, game theory, symmetry and tilings, geometric growth, comparison of algorithms, codes and data management. Prerequisite: Three years of high school mathematics, including two years of algebra and one year of geometry.
This course satisfies the General Education Criteria for a:
Quantitative Reasoning I

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MATH 119  **Ideas in Geometry**  credit: 3 hours.

General education course in mathematics, for students who do not have mathematics as a central part of their studies. The goal is to convey the spirit of mathematical thinking through topics chosen mainly from plane geometry. Prerequisite: Two units of high school algebra; one unit of high school geometry; or equivalent.

This course satisfies the General Education Criteria for a: Quantitative Reasoning I

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MATH 124  **Finite Mathematics**  credit: 3 hours.

Introduction to finite mathematics for students in the social sciences; introduces the student to the basic ideas of logic, set theory, probability, vectors and matrices, and Markov chains. Problems are selected from social sciences and business. Prerequisite: MATH 012, or an adequate ACT score.

This course satisfies the General Education Criteria for a: Quantitative Reasoning I

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Quant Reasoning I course.
MATH 125  **Elementary Linear Algebra**  credit: 3 hours.
Basic concepts and techniques of linear algebra: includes systems of linear equations, matrices, determinants, vectors in n-space, and eigenvectors, together with selected applications, such as Markov processes, linear programming, economic models, least squares, and population growth. Credit is not given for both MATH 125 and MATH 225. Prerequisite: MATH 012, or an adequate ACT score.

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Restricted to students in the transition/bridge program.

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MATH 161  **Statistics**  credit: 3 hours.
Same as STAT 100. See STAT 100.
This course satisfies the General Education Criteria for a:
Quantitative Reasoning I

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Quant Reasoning I course.

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Quant Reasoning I course.

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Quant Reasoning I course.
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Quant Reasoning I course.

**MATH 198  Freshman Seminar**  credit: 3 hours.
Guides the student in the study of selected topics not considered in standard courses. Prerequisite: Enrollment in the mathematics honors program; consent of department.

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Special Topic: Hypergraphics, 3 hours. This section for Chancellor's Scholars only (not restricted by major or year); other students may only enroll with consent of instructor and the Campus Honors Program.

**MATH 199  Undergraduate Open Seminar**  credit: 1 TO 5 hours.
Approved for both letter and S/U grading. May be repeated.

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Instructor Approval Required

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Credit Hours: 3 hours
Camp Honors/Chanc Schol course.
Special Topic: Mathematics in Music and Art, 3 hours. This section for Chancellor's Scholars only (not restricted by major or year); other students may only enroll with consent of instructor and the Campus Honors Program.

**MATH 210  Theory of Interest**  credit: 3 hours.
Study of compound interest and annuities; applications to problems in finance. Prerequisite: MATH 230 or equivalent.
This course satisfies the General Education Criteria for a: Quantitative Reasoning II

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page 6 - Mathematics, Spring 2006
MATH 213  Basic Discrete Mathematics  credit: 3 hours.
Beginning course on discrete mathematics, including sets and relations, functions, basic counting techniques, recurrence relations, graphs and trees, and matrix algebra; emphasis throughout is on algorithms and their efficacy. Credit is not given for both MATH 213 and CS 173. Prerequisite: MATH 220 or equivalent.
This course satisfies the General Education Criteria for a:
Quantitative Reasoning II

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Quant Reasoning II course.
Restricted to freshmen and sophomores.

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Quant Reasoning II course.
Restricted to freshmen and sophomores.

MATH 220  Calculus I  credit: 5 hours.
First course in calculus and analytic geometry; basic techniques of differentiation and integration with applications including curve sketching; antidifferentiation, the Riemann integral, fundamental theorem, exponential and circular functions. Credit is not given for both MATH 220 and MATH 234. Prerequisite: MATH 016 or equivalent; or an adequate ACT score.
This course satisfies the General Education Criteria for a:
Quantitative Reasoning I

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Quant Reasoning I course.
Quant Reasoning I course.

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Quant Reasoning I course.
Quant Reasoning I course.
Small group learning lab.

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MATH 225  **Introductory Matrix Theory**  credit: 2 hours.

 Systems of linear equations, matrices and inverses, determinants, and a glimpse at vector spaces, eigenvalues and eigenvectors.  Credit is not given for both MATH 225 and either MATH 125 or MATH 415. Prerequisite: MATH 220 or equivalent.

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page 10 - Mathematics, Spring 2006
MATH 230  **Calculus II**  credit: 3 hours.
Second course in calculus and analytic geometry: techniques of integration, conic sections, polar coordinates, and infinite series. Prerequisite: MATH 220.
This course satisfies the General Education Criteria for a: Quantitative Reasoning I

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Quant Reasoning I course.  
Uses small group learning methods. See [http://www.math.uiuc.edu/timetable](http://www.math.uiuc.edu/timetable) for details. Must also sign up for 37779.

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Quant Reasoning I course. Departmental Approval Required
Quant Reasoning I course. Restricted to Freshmen James Scholars. Requires department approval and concurrent registration in Math 249 P1H.
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Quant Reasoning I course.
Quant Reasoning I course.

### Lecture-Discussion

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Quant Reasoning I course.
Quant Reasoning I course.

### Lecture-Discussion

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Quant Reasoning I course.
Quant Reasoning I course.
For Students in Unit One and other University Residence Hall Living-Learning Communities.

### Lecture-Discussion

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Quant Reasoning I course.
Departmental Approval Required
Quant Reasoning I course.
For Merit Workshop students only. Departmental approval required. For further information see http://www.math.uiuc.edu/timetable/.

### Lecture-Discussion

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Quant Reasoning I course.
Departmental Approval Required
Quant Reasoning I course.
For Merit Workshop students only. Departmental approval required. For further information see http://www.math.uiuc.edu/timetable/.

### MATH 234  Calculus for Business I  credit: 4 hours.

Introduction to the concept of functions and the basic ideas of the calculus. Credit is not given for both MATH 234 and MATH 220.
Prerequisite: MATH 012.
This course satisfies the General Education Criteria for a:
Quantitative Reasoning I

<table>
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Quant Reasoning I course.

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Quant Reasoning I course.

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Quant Reasoning I course.

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Quant Reasoning I course.

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Quant Reasoning I course.

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Quant Reasoning I course.

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Quant Reasoning I course.

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Quant Reasoning I course.

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Quant Reasoning I course.

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**MATH 242  Calculus of Several Variables**  credit: 3 hours.

Third course in calculus and analytic geometry: three dimensional space, functions of several variables, partial derivatives, and multiple integrals. Credit is not given for both MATH 242 and MATH 243. Prerequisite: MATH 230.

This course satisfies the General Education Criteria for a:
Quantitative Reasoning II

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<thead>
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Quant Reasoning II course.

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Quant Reasoning II course.
For Students in Unit One and other University Residence Hall Living-Learning Communities.
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Quant Reasoning II course.

Departmental Approval Required
For Merit Workshop students only. Departmental approval required. For further information see http://www.math.uiuc.edu/timetable/.
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MATH 243  **Calculus III Plus**  credit: 4 hours.
Third course in calculus and analytic geometry including vector analysis: Euclidean space, partial differentiation, multiple integrals, line
integrals and surface integrals, the integral theorems of vector calculus. Credit is not given for both MATH 243 and either MATH 242 or
MATH 244. Prerequisite: MATH 230.

This course satisfies the General Education Criteria for a:
Quantitative Reasoning II

<table>
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Quant Reasoning II course.

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Quant Reasoning II course.
Departmental Approval Required
Restricted to Freshmen James Scholars. Requires department approval.

MATH 249  **Honors Course in Mathematics**  credit: 1 hours.
Prerequisite: Concurrent registration in an honors section of MATH 220, MATH 230, or MATH 242; consent of department. Enrollment
is strictly limited to students with superior mathematical talents.

<table>
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Requires concurrent registration in Math 230 D1H.

MATH 257  **Numerical Methods**  credit: 3 hours.
Same as CS 257. See CS 257.

This course satisfies the General Education Criteria for a:
Quantitative Reasoning II

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Computer Laboratory

Quant Reasoning II course.

MATH 290  **Symbolic Computation Lab**  credit: 1 hours.
Laboratory component to courses using a symbolic programming package. Prerequisite: Consent of department; concurrent registration
in a designated section of a mathematics course with symbolic computation component. May be taken only once for credit.

<table>
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<tr>
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Students from Math 220 Mathematica sections may enroll in this section.
Students from Math 230 Mathematica sections may enroll in this section.

Students from Math 242 Mathematica sections may enroll in this section.

Students from Math 380 Mathematica sections may enroll in this section.

Students from Math 385 Mathematica sections may enroll in this section.

Students from Math 225 Mathematica sections may enroll in this section.

Students from Math 415 Mathematica sections may enroll in this section.

Students from Math 461 Mathematica sections may enroll in this section.

MATH 347  **Fundamental Mathematics**  credit: 3 hours.
Fundamental ideas used in many areas of mathematics. Topics will include: techniques of proof, mathematical induction, binomial coefficients, rational and irrational numbers, the least upper bound axiom for real numbers, and a rigorous treatment of convergence of sequences and series. This will be supplemented by the instructor from topics available in the various texts. Students will regularly write proofs emphasizing precise reasoning and clear exposition. Credit is not given for both MATH 347 and 348. Prerequisite: MATH 230.

This course satisfies the General Education Criteria for a: Quantitative Reasoning II

<table>
<thead>
<tr>
<th>CRN</th>
<th>Type</th>
<th>Section</th>
<th>Time</th>
<th>Days</th>
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<td>10:00 AM - 10:50 AM</td>
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Quant Reasoning II course.

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Quant Reasoning II course.

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Quant Reasoning II course.

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Quant Reasoning II course.

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Quant Reasoning II course.

MATH 348  **Fundamental Mathematics-ACP**  credit: 4 hours.
Course is identical to MATH 347 except for the additional writing component. Approved for both letter and S/U grading. Credit is not given for both MATH 348 and MATH 347. Prerequisite: MATH 230 and completion of the campus COMPOSITION I general education requirement.

This course satisfies the General Education Criteria for a:
Quantitative Reasoning II
Advanced Composition

<table>
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<tr>
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Advanced Composition, and Quant Reasoning II course.

MATH 370  **Actuarial Problem Solving**  credit: 1 TO 2 hours.
Methods and techniques of solving problems in actuarial mathematics for advanced students intending to enter the actuarial profession. Approved for S/U grading only. May be repeated to a maximum of 4 hours. Prerequisite: Consent of instructor.

<table>
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For students who will take Course 1 of the National Actuarial Exam. 1 hour credit only.

<table>
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Instructor Approval Required
Instructor approval required.

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</table>
MATH 380  **Advanced Calculus**  credit: 3 hours.
Introductory study of vector calculus and functions of several variables; topics include directional derivatives; Jacobians; change of variables in multiple integrals; maxima and minima; line and surface integrals; theorems of Gauss, Green, and Stokes; infinite series; and uniform convergence. Prerequisite: MATH 242 or MATH 243, or equivalent.

This course satisfies the General Education Criteria for a:
Quantitative Reasoning II

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<tr>
<th>CRN</th>
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Quant Reasoning II course.
Section Z8 will be taught asynchronously using Mathematica courseware. See http://www.math.uiuc.edu/timetable/ for further details.

MATH 385  **Intro Differential Equations**  credit: 3 hours.
Intended for engineering students and others who require a working knowledge of differential equations; included are techniques and applications of ordinary differential equations and an introduction to partial differential equations. Credit is not given for both MATH 385 and either MATH 386 or MATH 441. Prerequisite: MATH 242 or MATH 243, or equivalent.

This course satisfies the General Education Criteria for a:
Quantitative Reasoning II

<table>
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<tr>
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Quant Reasoning II course.

### MATH 386  Intro to Differential Eq Plus  credit: 4 hours.

Intended for engineering students and others who require a working knowledge of differential equations, included are techniques and applications of ordinary differential equations, linear systems of differential equations, and an introduction to partial differential equations. Credit not given for both MATH 386 and either MATH 385 or MATH 441 Prerequisite: MATH 242 or MATH 243, or equivalent.

This course satisfies the General Education Criteria for a:
Quantitative Reasoning II

<table>
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### MATH 390  Individual Study  credit: 0 TO 3 hours.

Guided individual study of advanced topics not covered in other courses. May be repeated to a maximum of 8 hours. Prerequisite: Consent of instructor.

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<th>Days</th>
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</table>

Instructor approval required.

### MATH 402  Non Euclidean Geometry  credit: 3 OR 4 hours.

Historical development of geometry; includes tacit assumptions made by Euclid; the discovery of non-Euclidean geometries; geometry as a mathematical structure; and an axiomatic development of plane geometry. 3 undergraduate hours. 3 or 4 graduate hours. 4 hours of credit requires approval of the instructor and completion of additional work of substance. Prerequisite: MATH 242 or MATH 243; MATH 347 or MATH 348 or equivalent experience; or consent of instructor.

This course satisfies the General Education Criteria for a:
Quantitative Reasoning II

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<th>CRN</th>
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Credit Hours: 3 hours
Quant Reasoning II course.
Open to both undergraduate and graduate students.

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Credit Hours: 4 hours
Quant Reasoning II course.
Instructor Approval Required
Not intended for Undergrad - Urbana-Champaign.
Instructor approval forms available in 313 Altgeld Hall.

<table>
<thead>
<tr>
<th>CRN</th>
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Credit Hours: 3 hours
Quant Reasoning II course.
Open to both undergraduate and graduate students.

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</table>

Credit Hours: 4 hours
Quant Reasoning II course.
Instructor Approval Required
Not intended for Undergrad - Urbana-Champaign.
Instructor approval forms available in 313 Altgeld Hall.

MATH 403  **Euclidean Geometry**  credit: 3 OR 4 hours.
Selected topics from geometry, including the nine-point circle, theorems of Cera and Menelaus, regular figures, isometries in the plane, ordered and affine geometries, and the inversive plane. 3 undergraduate hours. 3 or 4 graduate hours. 4 hours of credit requires approval of the instructor and completion of additional work of substance. Prerequisite: MATH 242 or MATH 243, or consent of instructor.

This course satisfies the General Education Criteria for a:
Quantitative Reasoning II

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Credit Hours: 3 hours
Quant Reasoning II course.
Open to both undergraduate and graduate students.

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</table>

Credit Hours: 4 hours
Quant Reasoning II course.
Instructor Approval Required
Not intended for Undergrad - Urbana-Champaign.
Instructor approval forms available in 313 Altgeld Hall.

MATH 405  **Teacher's Course**  credit: 3 OR 4 hours.
Presents selected topics in mathematics that are related to the content of secondary school mathematics programs; provides background for enrichment topics for secondary school students. Subject matter varies with the instructor. 3 undergraduate hours. 3
or 4 graduate hours. 4 hours of credit requires approval of the instructor and completion of additional work of substance. Prerequisite: MATH 242 or MATH 243; MATH 347 or MATH 348 or equivalent experience; or consent of instructor.

This course satisfies the General Education Criteria for a:
Quantitative Reasoning II

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Credit Hours: 3 hours
Quant Reasoning II course.
Open to both undergraduate and graduate students.

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</table>

Credit Hours: 4 hours
Quant Reasoning II course.
Instructor Approval Required
Not intended for Undergrad - Urbana-Champaign.
Instructor approval forms available in 313 Altgeld Hall.

MATH 408  Actuarial Statistics I  credit: 4 hours.
Same as STAT 408. See STAT 408.

<table>
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<th>CRN</th>
<th>Type</th>
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MATH 412  Graph Theory  credit: 3 OR 4 hours.
Examines basic concepts and applications of graph theory, where graph refers to a set of vertices and edges that join some pairs of vertices; topics include subgraphs, connectivity, trees, cycles, vertex and edge coloring, planar graphs and their colorings. Draws applications from computer science, operations research, chemistry, the social sciences, and other branches of mathematics, but emphasis is placed on theoretical aspects of graphs. 3 undergraduate hours. 3 or 4 graduate hours. 4 hours of credit requires approval of the instructor and completion of additional work of substance. Prerequisite: MATH 347 or MATH 348 or equivalent experience or CS 273.

This course satisfies the General Education Criteria for a:
Quantitative Reasoning II

<table>
<thead>
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<th>CRN</th>
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MATH 413  **Intro to Combinatorics**  credit: 3 OR 4 hours.

Permutations and combinations, generating functions, recurrence relations, inclusion and exclusion, Polya's theory of counting, and block designs. Same as CS 413. 3 undergraduate hours. 3 or 4 graduate hours. 4 hours of credit requires approval of the instructor and completion of additional work of substance. Prerequisite: MATH 347 or MATH 348 or equivalent experience.

This course satisfies the General Education Criteria for a:
Quantitative Reasoning II

<table>
<thead>
<tr>
<th>CRN</th>
<th>Type</th>
<th>Section</th>
<th>Time</th>
<th>Days</th>
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Credit Hours: 3 hours
Quant Reasoning II course.
Open to both undergraduate and graduate students.

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</table>

Credit Hours: 4 hours
Quant Reasoning II course.
Open to both undergraduate and graduate students.

MATH 414  **Mathematical Logic**  credit: 3 OR 4 hours.

Introduction to the formalization of mathematics and the study of axiomatic systems; expressive power of logical formulas; detailed treatment of propositional logical and predicate logic; compactness theorem and Godel completeness theorem, with applications to specific mathematical theories; algorithmic aspects of logical formulas. Proofs are emphasized in this course, which can serve as an introduction to abstract mathematics and rigorous proof; some ability to do mathematical reasoning required. 3 undergraduate hours. 3 or 4 graduate hours. 4 hours of credit requires approval of the instructor and completion of additional work of substance. Prerequisite: MATH 347 or MATH 348 or equivalent experience.

This course satisfies the General Education Criteria for a:
Quantitative Reasoning II

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Credit Hours: 3 hours
Quant Reasoning II course.
Open to both undergraduate and graduate students.

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</table>

Credit Hours: 4 hours
Quant Reasoning II course.
Instructor Approval Required
Not intended for Undergrad - Urbana-Champaign.
Instructor approval forms available in 313 Altgeld Hall.

MATH 415  Linear Algebra  credit: 3 OR 4 hours.
Introductory course emphasizing techniques of linear algebra; topics include matrix operations, determinants, linear equations, vector spaces, linear transformations, eigenvalues, and eigenvectors. 3 undergraduate hours. 3 or 4 graduate hours. 4 hours of credit requires approval of the instructor and completion of additional work of substance. Credit not given for both MATH 225 and either MATH 125 or MATH 415. Prerequisite: MATH 242 or MATH 243.
This course satisfies the General Education Criteria for a:
Quantitative Reasoning II

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Credit Hours: 3 hours
Quant Reasoning II course.
Open to both undergraduate and graduate students.

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Credit Hours: 4 hours
Quant Reasoning II course.
Instructor Approval Required
Not intended for Undergrad - Urbana-Champaign.
Instructor approval forms available in 313 Altgeld Hall.

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Credit Hours: 3 hours
Quant Reasoning II course.
Open to both undergraduate and graduate students.

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<th>CRN</th>
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Credit Hours: 4 hours
Quant Reasoning II course.
Instructor Approval Required
Not intended for Undergrad - Urbana-Champaign.
Instructor approval forms available in 313 Altgeld Hall.

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Credit Hours: 3 hours
Quant Reasoning II course.
Open to both undergraduate and graduate students.

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Credit Hours: 4 hours
Quant Reasoning II course.
Instructor Approval Required
Not intended for Undergrad - Urbana-Champaign.
Instructor approval forms available in 313 Altgeld Hall.

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Credit Hours: 3 hours
Quant Reasoning II course.
Departmental Approval Required

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Credit Hours: 4 hours
Quant Reasoning II course.
Departmental Approval Required
Instructor approval forms available in 313 Altgeld Hall.

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Credit Hours: 3 hours
Quant Reasoning II course.
Uses Mathematica courseware. See http://www.math.uiuc.edu/timetable/ for details. Open to both undergraduate and graduate students.

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Credit Hours: 4 hours
Quant Reasoning II course.
Instructor Approval Required
Not intended for Undergrad - Urbana-Champaign.
Uses Mathematica courseware. See http://www.math.uiuc.edu/timetable/ for details. Instructor approval forms available in 313 Altgeld Hall.

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Credit Hours: 3 hours
Quant Reasoning II course.
Open to both undergraduate and graduate students.

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Credit Hours: 4 hours
Quant Reasoning II course.
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Credit Hours: 3 hours
Quant Reasoning II course.
Open to both undergraduate and graduate students.

Credit Hours: 4 hours
Quant Reasoning II course.
Instructor Approval Required
Not intended for Undergrad - Urbana-Champaign.
Instructor approval forms available in 313 Altgeld Hall.

Credit Hours: 4 hours
Quant Reasoning II course.
Section Z8 will be taught asynchronously using Mathematica courseware. See http://www.math.uiuc.edu/timetable/ for further details.

Credit Hours: 3 hours
Quant Reasoning II course.
Section Z8 will be taught asynchronously using Mathematica courseware. See http://www.math.uiuc.edu/timetable/ for further details.

MATH 417  **Intro to Abstract Algebra**  credit: 3 OR 4 hours.
Fundamental theorem of arithmetic, Congruencies, groups and group actions, Polya counting, rings, fields, and roots of polynomials. Emphasizes proofs. 3 undergraduate hours. 3 or 4 graduate hours. 4 hours of credit requires approval of the instructor and completion of additional work of substance. Prerequisite: MATH 415 and either MATH 347 or MATH 348; or consent of instructor.

This course satisfies the General Education Criteria for a: Quantitative Reasoning II

<table>
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<th>CRN</th>
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Credit Hours: 3 hours
Quant Reasoning II course.
Open to both undergraduate and graduate students.

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<th>CRN</th>
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Credit Hours: 4 hours
Quant Reasoning II course.
Instructor Approval Required
Not intended for Undergrad - Urbana-Champaign.
Instructor approval forms available in 313 Altgeld Hall.

<table>
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<tr>
<th>CRN</th>
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Credit Hours: 3 hours
Quant Reasoning II course.
Open to both undergraduate and graduate students.

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Credit Hours: 4 hours
Quant Reasoning II course.
Instructor Approval Required
Not intended for Undergrad - Urbana-Champaign.
Instructor approval forms available in 313 Altgeld Hall.

MATH 418 Intro to Abstract Algebra II credit: 3 OR 4 hours.

Vector spaces, ruler and compass constructions, finite fields, with application to Steiner systems. Linear codes or Groeber bases. Emphasizes proofs. 3 undergraduate hours. 3 or 4 graduate hours. 4 hours of credit requires approval of the instructor and completion of additional work of substance. Prerequisite: MATH 417 or consent of instructor

<table>
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Credit Hours: 3 hours
Open to both undergraduate and graduate students.

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Credit Hours: 4 hours
MATH 424  **Honors Real Analysis**  credit: 3 hours.
Set Theory, real number system, metric spaces, continuous functions, differentiation, and Riemann integration. Approved for honors grading. 3 undergraduate hours. Prerequisite: An honors section of MATH 347 and consent of the department.

<table>
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<tr>
<th>CRN</th>
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Requires department approval.

MATH 427  **Honors Abstract Algebra**  credit: 3 hours.
Group theory, counting formulae, factorization, modules with applications to Abelian groups and linear operators. Approved for honors grading. 3 undergraduate hours. Students may not receive credit for both this course and MATH 417. Prerequisite: MATH 426 and consent of the department.

<table>
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Requires department approval.

MATH 439  **Philosophy of Mathematics**  credit: 3 OR 4 hours.
Same as PHIL 439. See PHIL 439.

<table>
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<th>CRN</th>
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Credit Hours: 4 hours
Restricted to Graduate - Urbana-Champaign.

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Credit Hours: 3 hours
Restricted to Undergrad - Urbana-Champaign.

MATH 441  **Differential Equations**  credit: 3 OR 4 hours.
Basic course in ordinary differential equations; topics include existence and uniqueness of solutions and the general theory of linear differential equations; treatment is more rigorous than that given in MATH 385. 3 undergraduate hours. 3 or 4 graduate hours. 4 hours of credit requires approval of the instructor and completion of additional work of substance. Credit is not given for both MATH 441 and either MATH 385 or MATH 386. Prerequisite: MATH 242 or MATH 243, or equivalent; MATH 347 or MATH 348 recommended.
This course satisfies the General Education Criteria for a: Quantitative Reasoning II

<table>
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<tr>
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<th>Location</th>
<th>Instructor</th>
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</thead>
</table>
MATH 442  **Intro Partial Diff Equations**  credit: 3 OR 4 hours.
Introduces students to partial differential equations, emphasizing the wave, diffusion and potential (Laplace) equations. The focus is on understanding the physical meaning and mathematical properties of solutions of partial differential equations. Methods include fundamental solutions and transform methods for problems on the line, and separation of variables using orthogonal series for problems in regions with boundary. Convergence of Fourier series is covered in detail. 3 undergraduate hours. 3 or 4 graduate hours. 4 hours of credit requires approval of the instructor and completion of additional work of substance. Prerequisite: MATH 385 or MATH 386 or MATH 441.

<table>
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<tr>
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Credit Hours: 3 hours
Open to both undergraduate and graduate students.

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Credit Hours: 4 hours
Instructor Approval Required
Not intended for Undergrad - Urbana-Champaign.
MATH 444  Elementary Real Analysis  credit: 3 OR 4 hours.
Careful treatment of the theoretical aspects of the calculus of functions of a real variable; topics include the real number system, limits, continuity, derivatives, and the Riemann integral. 3 undergraduate hours. 3 or 4 graduate hours. 4 hours of credit requires approval of the instructor and completion of additional work of substance. Credit is not given for both MATH 444 and MATH 447. Prerequisite: MATH 242 or MATH 243; MATH 347 or MATH 348 or equivalent experience.
This course satisfies the General Education Criteria for a:
Quantitative Reasoning II

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Credit Hours: 3 hours
Quant Reasoning II course.
Open to both undergraduate and graduate students.

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Credit Hours: 4 hours
Quant Reasoning II course.
Instructor Approval Required
Not intended for Undergrad - Urbana-Champaign.
Instructor approval forms available in 313 Altgeld Hall.

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Credit Hours: 3 hours
Quant Reasoning II course.
Open to both undergraduate and graduate students.

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Credit Hours: 4 hours
Quant Reasoning II course.
Instructor Approval Required
Not intended for Undergrad - Urbana-Champaign.
Instructor approval forms available in 313 Altgeld Hall.

MATH 446  Applied Complex Variables  credit: 3 OR 4 hours.
For students who desire a working knowledge of complex variables; covers the standard topics and gives an introduction to integration by residues, the argument principle, conformal maps, and potential fields. Students desiring a systematic development of the foundations of the subject should take MATH 448. 3 undergraduate hours. 3 or 4 graduate hours. 4 hours of credit requires approval of the instructor and completion of additional work of substance. Credit is not given for both MATH 446 and MATH 448. Prerequisite: MATH 243 or MATH 380 or consent of instructor.

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<th>Instructor</th>
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</table>
MATH 447  **Real Variables**  credit: 3 OR 4 hours.

Careful development of elementary real analysis including such topics as completeness property of the real number system; basic topological properties of n-dimensional space; convergence of numerical sequences and series of functions; properties of continuous functions; and basic theorems concerning differentiation and Riemann integration. 3 undergraduate hours. 3 or 4 graduate hours. 4 hours of credit requires approval of the instructor and completion of additional work of substance. Credit is not given for both MATH 447 and MATH 444. Prerequisite: MATH 242 or MATH 243 or equivalent, and junior standing; MATH 347 or MATH 348 or equivalent experience; or consent of instructor.

This course satisfies the General Education Criteria for a: Quantitative Reasoning II

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Credit Hours: 3 hours
Quant Reasoning II course.
Open to both undergraduate and graduate students.

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Credit Hours: 4 hours
Quant Reasoning II course.
Instructor Approval Required
Not intended for Undergrad - Urbana-Champaign.
Instructor approval forms available in 313 Altgeld Hall.

MATH 448  **Complex Variables**  credit: 3 OR 4 hours.

For students who desire a rigorous introduction to the theory of functions of a complex variable; topics include Cauchy's theorem, the residue theorem, the maximum modulus theorem, Laurent series, the fundamental theorem of algebra, and the argument principle. 3 undergraduate hours. 3 or 4 graduate hours. 4 hours of credit requires approval of the instructor and completion of additional work of substance. Credit is not given for both MATH 448 and MATH 446. Prerequisite: MATH 243 or MATH 380; MATH 447.

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Credit Hours: 3 hours
Open to both undergraduate and graduate students.

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Credit Hours: 4 hours
Instructor Approval Required
Not intended for Undergrad - Urbana-Champaign.
Instructor approval forms available in 313 Altgeld Hall.

MATH 450  **Intro to Numerical Analysis**  credit: 3 OR 4 hours.
Same as CS 450, CSE 401, and ECE 491. See CS 450.

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Credit Hours: 3 hours

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Credit Hours: 4 hours
Restricted to Graduate - Urbana-Champaign.

MATH 453  **Elementary Theory of Numbers**  credit: 3 OR 4 hours.
Topics covered include divisibility, primes, congruences, quadratic reciprocity, and Farey sequences. 3 undergraduate hours. 3 or 4 graduate hours. 4 hours of credit requires approval of the instructor and completion of additional work of substance. Prerequisite: MATH 242 or MATH 243, or equivalent.

This course satisfies the General Education Criteria for a:
Quantitative Reasoning II

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Credit Hours: 3 hours
Quant Reasoning II course.
Open to both undergraduate and graduate students.

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Credit Hours: 4 hours
Quant Reasoning II course.
Instructor Approval Required
Not intended for Undergrad - Urbana-Champaign.
Instructor approval forms available in 313 Altgeld Hall.

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Credit Hours: 3 hours
Quant Reasoning II course.
Open to both undergraduate and graduate students.

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Credit Hours: 4 hours
Quant Reasoning II course.
Instructor Approval Required
Not intended for Undergrad - Urbana-Champaign.
Instructor approval forms available in 313 Altgeld Hall.

MATH 455  Numerical Methods for PDEs  credit: 3 OR 4 hours.
Same as CS 455, and CSE 411. See CS 455.

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Credit Hours: 3 hours
Restricted to Graduate - Urbana-Champaign.

Credit Hours: 4 hours
Restricted to Graduate - Urbana-Champaign.

MATH 461  Probability Theory I  credit: 3 OR 4 hours.
Introduction to mathematical probability; includes the calculus of probability, combinatorial analysis, random variables, expectation, distribution functions, moment-generating functions, and central limit theorem. Prepares students for MATH 466. Same as STAT 451. 3 undergraduate hours. 3 or 4 graduate hours. 4 hours of credit requires approval of the instructor and completion of additional work of substance. Prerequisite: MATH 242 or MATH 243, or equivalent.

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Credit Hours: 3 hours
Open to both undergraduate and graduate students.

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**MATH 463  Statistics and Probability I**  credit: 4 hours.
MATH 464  **Statistics and Probability II**  credit: 3 OR 4 hours.
Same as STAT 410. See STAT 410.

<table>
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MATH 465  **Analysis of Variance**  credit: 3 OR 4 hours.
Same as STAT 424. See STAT 424.

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</table>

page 40 - Mathematics, Spring 2006
MATH 468  **Topics in Applied Statistics**  credit: 3 OR 4 hours.
Same as STAT 430. See STAT 430.

<table>
<thead>
<tr>
<th>CRN</th>
<th>Type</th>
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MATH 469  **Methods of Applied Statistics**  credit: 3 OR 4 hours.
Same as STAT 420. See STAT 420.

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MATH 472  **Actuarial Theory II**  credit: 3 OR 4 hours.
Continuation of MATH 471. Emphasis is on multiple-life functions. 3 undergraduate hours. 3 or 4 graduate hours. 4 hours of credit requires approval of the instructor and completion of additional work of substance. Prerequisite: MATH 471.

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<tr>
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</table>

Credit Hours: 3 hours
Instructor approval forms available in 313 Altgeld Hall.

MATH 473  **Algorithms**  credit: 3 OR 4 hours.
Same as CS 473, and CSE 414. See CS 473.
### MATH 478  **Actuarial Modeling**  
Credit: 3 OR 4 hours.  
Considers the specification and evaluation of various types of actuarial models. Examines severity, frequency, and compound distributions useful in modeling the insurance loss process. Credibility theory is also discussed. 3 undergraduate hours. 3 or 4 graduate hours. Prerequisite: MATH 408, MATH 461 or MATH 463; credit or concurrent registration in MATH 409 or MATH 464.

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Credit Hours: 3 hours

### MATH 481  **Vector and Tensor Analysis**  
Credit: 3 OR 4 hours.  
Vector spaces, transformation properties, covariant and contravariant tensors, and differential geometry of surfaces; applications to relativity theory. 3 undergraduate hours. 3 or 4 graduate hours. 4 hours of credit requires approval of the instructor and completion of additional work of substance. Prerequisite: MATH 243 or MATH 380 or equivalent; or consent of instructor.

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Credit Hours: 3 hours  
Open to both undergraduate and graduate students.

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<th>CRN</th>
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<th>Time</th>
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<td>Alexander, S</td>
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</table>

Credit Hours: 4 hours  
Instructor Approval Required  
Not intended for Undergrad - Urbana-Champaign.
MATH 482  **Linear Programming**  credit: 3 OR 4 hours.
Rigorous introduction to a wide range of topics in optimization, including a thorough treatment of basic ideas of linear programming, with additional topics drawn from numerical considerations, linear complementarity, integer programming and networks, polyhedral methods. 3 undergraduate hours. 3 or 4 graduate hours. Four hours of credit requires approval of the instructor and completion of additional work of substance. Prerequisite: MATH 415.

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Credit Hours: 3 hours
Open to both undergraduate and graduate students.

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<th>Time</th>
<th>Days</th>
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<td>Hartke, S</td>
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Credit Hours: 4 hours
Instructor Approval Required
Not intended for Undergrad - Urbana-Champaign.
Instructor approval forms available in 313 Altgeld Hall.

MATH 489  **Differential Equations II**  credit: 3 OR 4 hours.
Continuation of MATH 385. The course treats systems of linear differential equations (and includes the necessary matrix theory), and then concentrates on nonlinear systems, studying their dynamics by means of phase plane analysis and other methods. Applications of nonlinear systems to physics and biology will be given. 3 undergraduate hours. 3 or 4 graduate hours. 4 hours of credit requires approval of the instructor and completion of additional work of substance. Prerequisite: MATH 385 or MATH 386 or MATH 441.

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Credit Hours: 3 hours
Open to both undergraduate and graduate students.

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</table>

Credit Hours: 4 hours
Instructor Approval Required
Not intended for Undergrad - Urbana-Champaign.
Instructor approval forms available in 313 Altgeld Hall.

MATH 490  **Topics in Mathematics**  credit: 1 TO 4 hours.
Deals with topics in the application of mathematics to the physical, biological, and social sciences; see Class Schedule or department office for current topics. May be repeated with approval. Prerequisite: Consent of instructor.
### MATH 491  **Logic Design**  credit: 3 hours.
Same as CS 462, and ECE 462. See ECE 462.

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<tr>
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### MATH 493  **Statistical Computing**  credit: 3 OR 4 hours.
Same as STAT 428. See STAT 428.

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<td>Chen, Y</td>
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</table>

### MATH 496  **Honors Seminar**  credit: 3 hours.
Careful study of a selected area of mathematics, carried out either deductively from axioms or inductively through problems; subject matter varies with instructor. 3 undergraduate hours. No graduate credit. May be repeated to a maximum of 6 hours. Prerequisite: Consent of Mathematics Honors Committee.

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</table>
MATH 499  **Introduction Graduate Research**  credit: 1 hours.
Seminar is required of all first-year graduate students in Mathematics. It provides a general introduction to the courses and research work in all of the areas of mathematics that are represented at the University of Illinois at Urbana-Champaign. May be repeated to a maximum of 2 hours. Prerequisite: Graduate standing or consent of instructor.

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MATH 500  **Abstract Algebra I**  credit: 4 hours.
Isomorphism theorems for groups, centers of p-groups, simplicity of Aₙ, Jordan-Holder Theorem; Commutative Rings and Fields, PIDs, UFDs, Gauss's Lemma, splitting fields, Hilbert Basis Theorem, Zariski topology; Modules over Commutative Rings, structure theorem for finitely generated modules over PIDs, with applications to abelian groups and canonical forms for matrices; Zorn's lemma and applications, existence and uniqueness of algebraic closures; Categories and Functors, universal mapping properties, natural transformations, limits and colimits. Prerequisite: MATH 417 and MATH 418.

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</table>

MATH 501  **Abstract Algebra II**  credit: 4 hours.
Solvable groups, finite p-groups, semidirect products, Sylow's theorem; Galois Theory, transcendental extensions, separable and normal extensions, finite Galois groups, Theorem of the Primitive Element, Fundamental Theorem of Galois Theory, symmetric Function Theorem, examples, cyclotomic, cyclic and radical extensions; Modules over Arbitrary Rings, exact sequences, projective and injective modules, Tensor products, Matrix rings, Schur's lemma, Wedderburn's theorem on semisimple rings, group algebras, Maschke's theorem; Algebraic Geometry, varieties, morphisms of varieties, Noetherian properties, Irreducible varieties and prime ideals. Prerequisite: MATH 500.

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<th>CRN</th>
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MATH 503  **Group Theory**  credit: 4 hours.
Structure of groups, derived groups, nilpotence and solvability, and extensions and products. Prerequisite: MATH 501 or equivalent.

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</table>
MATH 505  **Homological Algebra**  credit: 4 hours.
Definition and properties of the functors Ext and Tor; projective, injective, and flat modules; group extensions; dimensions of rings, and Hilbert theorem on syzygies Prerequisite: MATH 501 or equivalent

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<th>CRN</th>
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MATH 511  **Algebraic Geometry**  credit: 4 hours.
Properties of affine and projective varieties defined over algebraically closed fields; rational mappings, birational geometry and divisors, especially on curves and surfaces; introduction to the language of schemes; and Riemann-Roch theorem for curves. Prerequisite: MATH 501.

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<th>CRN</th>
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MATH 524  **Linear Analysis on Manifolds**  credit: 4 hours.
Study of topological invariants of differentiable and complex manifolds. Prerequisite: MATH 520 and MATH 526, or consent of instructor.

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MATH 526  **Algebraic Topology**  credit: 4 hours.
CW-complexes, relative homeomorphism theorem, cellular homology, cohomology, Kunneth theorem, Eilenberg-Zilber theorem, cup products, Poincare duality, examples. Prerequisite: MATH 525, MATH 500; or consent of instructor. MATH 501 is recommended but not required.

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MATH 530  **Algebraic Number Theory**  credit: 4 hours.
Further development of the theory of fields covering topics from valuation theory, ideal theory, units in algebraic number fields, ramification, function fields, and local class field theory. Prerequisite: MATH 500 or equivalent.

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MATH 535  **General Topology**  credit: 4 hours.
Study of topological spaces and maps, including Cartesian products, identifications, connectedness, compactness, uniform spaces, and function spaces. Prerequisite: Consent of instructor.

<table>
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<tr>
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MATH 540  **Real Analysis I**  credit: 4 hours.
Lebesgue measure on the real line; integration and differentiation of real valued functions of a real variable; and additional topics at discretion of instructor. Prerequisite: MATH 447 or equivalent

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MATH 541  **Real Analysis II**  credit: 4 hours.
Abstract measure theory; integration on general measure spaces; and introduction to functional analysis. Prerequisite: MATH 540.

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MATH 542  **Complex Variables I**  credit: 4 hours.
Topics include the Cauchy theory, harmonic functions, entire and meromorphic functions, and the Riemann mapping theorem. Prerequisite: MATH 446 and MATH 447, or MATH 448.

<table>
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<tr>
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MATH 543  **Complex Variables II**  credit: 4 hours.
Continuation of MATH 542. Topics include subharmonic functions, Nevanlinna theory, analytic continuation and Riemann surfaces, and univalent functions. Prerequisite: MATH 542.

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<th>CRN</th>
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MATH 545  **Harmonic Analysis**  credit: 4 hours.
Harmonic analysis on the circle, the line, and the integers, i.e., Fourier series and transforms; locally compact Abelian groups; convergence and summability; conjugate functions; Hardy spaces; uniqueness; Tauberian theorems; almost-periodic functions; commutative Banach algebras. Prerequisite: MATH 448 and MATH 541; knowledge of Banach spaces.

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<th>CRN</th>
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<td>441 - Altgeld Hall</td>
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</tr>
</tbody>
</table>

**MATH 551  Dynamical Systems Theory  credit: 4 hours.**

Course is an introduction to the study of dynamical systems. Students who intend to do research in nonlinear dynamics are encouraged to take this course. Specific topics will be chosen to illustrate the theory and use of techniques from global analysis and nonlinear dynamics such as (1) discrete dynamical systems, (2) global theory of ordinary differential equations, (3) Hamiltonian systems, (4) KAM theory, (5) bifurcation and stability, (6) Hopf index theory of vector fields, (7) Morse theory of gradient vector fields, (8) Lyapunov theory, (9) infinite dimensional dynamical systems, (10) structural stability. Prerequisite: Consent of instructor.

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<tr>
<th>CRN</th>
<th>Type</th>
<th>Section</th>
<th>Time</th>
<th>Days</th>
<th>Location</th>
<th>Instructor</th>
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<tbody>
<tr>
<td>38181</td>
<td>Lecture-Discussion</td>
<td>B1</td>
<td>09:00 AM - 09:50 AM</td>
<td>MWF</td>
<td>347 - Altgeld Hall</td>
<td>Zharnitsky, V</td>
</tr>
</tbody>
</table>

**MATH 553  Partial Differential Equations  credit: 4 hours.**

Basic introduction to the study of partial differential equations; topics include: the Cauchy problem, power-series methods, characteristics, classification, canonical forms, well-posed problems, Riemann's method for hyperbolic equations, the Goursat problem, the wave equation, Sturm-Liouville problems and separation of variables, Fourier series, the heat equation, integral transforms, Laplace's equation, harmonic functions, potential theory, the Dirichlet and Neumann problems, and Green's functions. Prerequisite: Consent of instructor.

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<tr>
<th>CRN</th>
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<th>Section</th>
<th>Time</th>
<th>Days</th>
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<th>Instructor</th>
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<tbody>
<tr>
<td>39528</td>
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<td>F1</td>
<td>02:00 PM - 02:50 PM</td>
<td>MWF</td>
<td>447 - Altgeld Hall</td>
<td>Song, R</td>
</tr>
</tbody>
</table>

**MATH 557  Methods of Math Physics II  credit: 4 hours.**

Course covers several basic mathematical methods of wide use in physics and engineering. Topics will be selected from the following: integral equations, spectral theory and Hilbert spaces, inverse spectral theory, soliton and waterwave theory, asymptotic methods. Prerequisite: MATH 556 or consent of instructor.

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<tr>
<th>CRN</th>
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<th>Time</th>
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<tbody>
<tr>
<td>39530</td>
<td>Lecture-Discussion</td>
<td>D1</td>
<td>11:00 AM - 11:50 AM</td>
<td>MWF</td>
<td>141 - Altgeld Hall</td>
<td>Zharnitsky, V</td>
</tr>
</tbody>
</table>

**MATH 559  Asymptotic Methods  credit: 4 hours.**

Same as NPRE 559, PHYS 522, and TAM 549. See TAM 549.
MATH 561  **Theory of Probability I** credit: 4 hours.
Mathematical foundations of probability and stochastic processes; probability measures, random variables, distribution functions, convergence theory, the Central Limit Theorem, conditional expectation, and martingale theory. Same as STAT 551. Prerequisite: MATH 541 or consent of instructor.

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<th>CRN</th>
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<th>Time</th>
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<th>Instructor</th>
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<tbody>
<tr>
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<td>G1</td>
<td>03:00 PM - 03:50 PM</td>
<td>MWF</td>
<td>347 - Altgeld Hall</td>
<td>Laugesen, R</td>
</tr>
</tbody>
</table>

MATH 567  **Topics in Actuarial Theory I** credit: 4 hours.
Selected topics in advanced actuarial science. May be repeated up to 1 time(s). Prerequisite: Consent of instructor.

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<tr>
<th>CRN</th>
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<th>Section</th>
<th>Time</th>
<th>Days</th>
<th>Location</th>
<th>Instructor</th>
</tr>
</thead>
<tbody>
<tr>
<td>38188</td>
<td>Discussion/Recitation</td>
<td>D14</td>
<td>11:00 AM - 11:50 AM</td>
<td>MWF</td>
<td>1320 - Digital Computer Laboratory</td>
<td>Zhu, Y</td>
</tr>
<tr>
<td></td>
<td>Discussion/Recitation</td>
<td>D14</td>
<td>04:00 PM - 04:50 PM</td>
<td>R</td>
<td>141 - Altgeld Hall</td>
<td>Zhu, Y</td>
</tr>
</tbody>
</table>

MATH 568  **Topics in Actuarial Theory II** credit: 4 hours.
Topics in mathematical theory of actuarial science beyond basic life contingencies, such as graduation of mortality tables, survival models, mathematics of demography. See Class Schedule or department office for current topics. A paper will generally be required. May be repeated to a maximum of 8 hours. Prerequisite: STAT 409 or STAT 410 or equivalent; credit or concurrent registration in MATH 471.

<table>
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<tr>
<th>CRN</th>
<th>Type</th>
<th>Section</th>
<th>Time</th>
<th>Days</th>
<th>Location</th>
<th>Instructor</th>
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<tbody>
<tr>
<td>38193</td>
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<td>L14</td>
<td>08:30 AM - 09:50 AM</td>
<td>TR</td>
<td>213 - Gregory Hall</td>
<td>Gorvett, R</td>
</tr>
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</table>

MATH 571  **Model Theory** credit: 4 hours.
Techniques for constructing models, including compactness and Lowenheim-Skolem theorems, unions of elementary chains, and omitting types construction; categorical theories; ultraproducts; saturated models; quantifier elimination; applications to algebraically closed fields, real closed fields, and other fundamental structures of mathematics. Prerequisite: MATH 570, or consent of instructor.

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<tr>
<th>CRN</th>
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<th>Section</th>
<th>Time</th>
<th>Days</th>
<th>Location</th>
<th>Instructor</th>
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</thead>
<tbody>
<tr>
<td>38158</td>
<td>Lecture-Discussion</td>
<td>F1</td>
<td>02:00 PM - 02:50 PM</td>
<td>MWF</td>
<td>147 - Altgeld Hall</td>
<td>Henson, C</td>
</tr>
</tbody>
</table>
MATH 573  **Recursive Function Theory**  credit: 4 hours.
Various characterizations of the class of recursive (i.e., computable) functions; the Church-Turing thesis; unsolvability of the halting problem; the recursion theorem and the enumeration theorem; relative computability, the jump operation, and the arithmetical hierarchy; recursively enumerable sets; degrees of unsolvability; and the priority method. Prerequisite: MATH 570 or consent of instructor.

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<tr>
<th>CRN</th>
<th>Type</th>
<th>Section</th>
<th>Time</th>
<th>Days</th>
<th>Location</th>
<th>Instructor</th>
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<tbody>
<tr>
<td>43398</td>
<td>Lecture-Discussion</td>
<td>C1</td>
<td>10:00 AM - 10:50 AM</td>
<td>MWF</td>
<td>445 - Altgeld Hall</td>
<td>Van Den Dries, L</td>
</tr>
</tbody>
</table>

MATH 581  **Extremal Graph Theory**  credit: 4 hours.
Extremal problems and parameters for graphs. Distance and connectivity, matching and factors, vertex and edge colorings, perfect and imperfect graphs, intersection classes and intersection parameters, Turan's theorem, graph Ramsey theory, graph decomposition and other extremal problems. Same as CS 572. Prerequisite: MATH 580 or consent of instructor.

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<tr>
<th>CRN</th>
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<th>Section</th>
<th>Time</th>
<th>Days</th>
<th>Location</th>
<th>Instructor</th>
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<tbody>
<tr>
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<td>F1</td>
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<td>MWF</td>
<td>343 - Altgeld Hall</td>
<td>West, D</td>
</tr>
</tbody>
</table>

MATH 588  **Optimization in Networks**  credit: 4 hours.
Theory and methods for optimization over directed graphs; paths, cuts, flows, and potentials; matchings; PERT and CPM; max flow, min path, out-of-kilter, Hungarian, and other algorithms; nonlinear cost functionals; painting theory; and existence and duality. Prerequisite: MATH 242 or MATH 243.

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<th>CRN</th>
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<th>Section</th>
<th>Time</th>
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<th>Location</th>
<th>Instructor</th>
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<tbody>
<tr>
<td>38194</td>
<td>Lecture-Discussion</td>
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<td>MWF</td>
<td>147 - Altgeld Hall</td>
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</tbody>
</table>

MATH 595  **Advanced Topics in Math**  credit: 1 TO 4 hours.
May be repeated in the same or separate semesters. Prerequisite: Consent of instructor.

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<th>CRN</th>
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<th>Section</th>
<th>Time</th>
<th>Days</th>
<th>Location</th>
<th>Instructor</th>
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<tbody>
<tr>
<td>43503</td>
<td>Lecture-Discussion</td>
<td>AI</td>
<td>01:00 PM - 01:50 PM</td>
<td>MWF</td>
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<td>Lecture-Discussion</td>
<td>AI</td>
<td>05:00 PM - 05:50 PM</td>
<td>TR</td>
<td>159 - Altgeld Hall</td>
<td>Ford, K</td>
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<tr>
<th>CRN</th>
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<th>Time</th>
<th>Days</th>
<th>Location</th>
<th>Instructor</th>
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<tbody>
<tr>
<td>43501</td>
<td>Lecture-Discussion</td>
<td>CCG</td>
<td>01:00 PM - 01:50 PM</td>
<td>MWF</td>
<td>447 - Altgeld Hall</td>
<td>Furedi, Z</td>
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<tr>
<th>Course Code</th>
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<th>Days</th>
<th>Location</th>
<th>Instructor</th>
</tr>
</thead>
<tbody>
<tr>
<td>45479</td>
<td>Lecture-Discussion</td>
<td>09:00 AM - 10:20 AM</td>
<td>TR</td>
<td>154 - Henry Administration Bldg</td>
<td>Haesemeyer, C</td>
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</table>
|             | **Credit Hours**: 2 hours  
|             | **Meets**: 13-Mar-06 - 03-May-06.  
| 43500       | Lecture-Discussion    | 01:00 PM - 01:50 PM | MWF  | 347 - Altgeld Hall         | Solecki, S    |
|             |                       |                   |      |                            |                |
| 45480       | Lecture-Discussion    | 12:00 PM - 01:20 PM | TR   | 170 - Everitt Laboratory   | Muncaster, R  |
|             |                       |                   |      |                            |                |
|             | **Credit Hours**: 2 hours  
|             | **Meets**: 17-Jan-06 - 10-Mar-06.  
| 45481       | Lecture-Discussion    | 10:30 AM - 11:50 AM | TR   | 374 - Lincoln Hall          | Leininger, C  |
|             |                       |                   |      |                            |                |
|             | **Credit Hours**: 2 hours  
|             | **Meets**: 13-Mar-06 - 03-May-06.  
| 45484       | Lecture-Discussion    | 12:00 PM - 01:20 PM | TR   | 170 - Everitt Laboratory   | Hart, W       |
|             |                       |                   |      |                            |                |
|             | **Credit Hours**: 2 hours  
|             | **Meets**: 13-Mar-06 - 03-May-06.  
| 43505       | Lecture-Discussion    | 10:30 AM - 11:50 AM | TR   | 341 - Altgeld Hall          | Dutta, S      |
|             |                       |                   |      |                            |                |
| 43502       | Lecture-Discussion    | 11:00 AM - 11:50 AM | MWF  | 243 - Altgeld Hall          | Reznick, B    |
|             |                       |                   |      |                            |                |
| 45486       | Lecture-Discussion    | 09:00 AM - 10:20 AM | TR   | 154 - Henry Administration Bldg | Kerman, E Muncaster, R |
|             |                       |                   |      |                            |                |
|             | **Credit Hours**: 2 hours  
|             | **Meets**: 17-Jan-06 - 10-Mar-06.  
MATH 597  **Reading Course**  credit: 1 TO 8 hours.
May be repeated in the same or separate terms to a maximum of 8 hours. Prerequisite: Consent of instructor

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<th>Days</th>
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<tbody>
<tr>
<td>10556</td>
<td>Independent Study</td>
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<td>ARRANGED -</td>
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</tbody>
</table>

Instructor approval required.

MATH 598  **Literature Seminar in Math**  credit: 0 TO 4 hours.
Seminar on topics of current interest in mathematics. Students present seminars and discussions on various topics. See Class Schedule for current topics. Recommended for all Mathematics students. Prerequisite: Consent of instructor.

<table>
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<tr>
<th>CRN</th>
<th>Type</th>
<th>Section</th>
<th>Time</th>
<th>Days</th>
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<tbody>
<tr>
<td>45659</td>
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</tr>
<tr>
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<td>REN</td>
<td>ARRANGED -</td>
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<td>Berndt, B</td>
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</table>

Credit Hours: 2 hours

MATH 599  **Thesis Research**  credit: 0 TO 16 hours.
May be repeated. Approved for S/U grading only. Prerequisite: Consent of instructor.

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<th>CRN</th>
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<tbody>
<tr>
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Instructor approval required.