

A minimum of eight credits in Latin American history and in Spanish for this minor must be completed at Whitman, and none of these credits may be taken P-D-F or as independent study or directed reading.

The Latin American Studies minor for Spanish majors: Twenty credits as follows:

Twelve credits: Three courses in Latin American history.

Eight credits from among the following supporting courses: Anthropology 250, 259, History 283, 287, 381, 382, 383, 384, 387, 389, 495, Spanish 431, 432, 433, 434, plus 440-449 and 467, 468 when the topic is Spanish American cinema or literature (not to be duplicated in major requirement credit), and other courses by consent of the adviser(s) in Latin American studies.

A minimum of eight credits in Latin American history for this minor must be completed at Whitman, and none of these credits may be taken P-D-F or as independent study or directed reading.

Library

100 Use of the Library
1, 1

Frazier

The use of print and electronic resources and library services. Instruction designed to teach students to conduct library research more effectively. One seminar per week. Graded credit/no credit. *Open* to first and second year students, others by consent.

Linguistics

Celia Weller, *Chair, Foreign Languages and Literatures*

Linguistics

Gary Esarey

Christine Moritz

110 Introduction to Linguistics
4; not offered 2003-04

Formal aspects of the structure of human languages. Principal topics in linguistics and the basic techniques of linguistic analysis. The focus will be on phonetics, phonology, morphology, syntax, and historical linguistics. Frequent homework exercises, mid-term, project, and final. Knowledge of a foreign language is not required.

149-152 Special Topics in Linguistics
x, 1-4

Courses which examine special topics in linguistics. Distribution area: humanities.

150 Applied Linguistics and Language Teaching

x, 3

Moritz

An overview of theoretical perspectives and current issues in second language acquisition, this course also includes an examination of different models, approaches, and resources available to teachers in the field of second language acquisition and foreign language teaching, with an aim towards developing the students' own personal teaching practices. Intended for students preparing to teach English abroad after graduation (Whitman in China; French Ministry of Education, JET, etc.), and/or those thinking of a career in language teaching. Evaluation methods may include position papers, oral presentations on individual readings and portfolios. Distribution area: humanities.

Mathematics and Computer Science

David Guichard, *Chair*

Barry Balof

James Cotts

Robert A. Fontenot

Russell A. Gordon

Douglas Hundley

Patrick W. Keef

Albert W. Schueller (*on sabbatical, 2003-04*)

Laura M. Schueller (*on sabbatical, 2003-04*)

Mathematics courses provide an opportunity to study mathematics for its own sake (often called pure mathematics) and as a tool for the physical, social, and life sciences (applied mathematics). Most courses mix the two points of view to some extent, though some deal almost exclusively with one or the other. The department offers two separate major programs corresponding to these two areas.

All or part of the calculus sequence is required or recommended by several majors at Whitman and calculus is the most common mathematics course taken by students. However, the department offers other courses (Mathematics 108, 128, 167) that are intended

for students who wish to take mathematics but are not interested in or not prepared for calculus. Courses in computer science, or with an emphasis on computing, are 167, 235, 236, 250, 270, 467, 478.

The Pure Mathematics major: 225; 235; 236; 260; 300; any two of 385, 386, 455, 456; 495 and 496; twelve additional credits in mathematics courses numbered above 200, for a total of thirty-six credits. A grade of C (2.0) or better in Mathematics 260 is required and grades of B (3.0) or better in Mathematics 225 and 260 are strongly recommended for any student considering mathematics as a major. The following are strongly recommended: computer programming experience and the use of a variety of technical software packages; applied mathematics courses, such as Mathematics 250, 338, 339 and 467; and a minor in a subject which makes substantial use of mathematics; for example, a physical science or economics. Students planning graduate study should take Mathematics 386 and 456 and should acquire a reading knowledge of at least one of French, German, and Russian.

The Applied Mathematics major: 167; 225; 235; 236; 244; 300; one of 367, 368, 467; one of 250, 338, 339; 495 and 496; nine additional credits in mathematics courses numbered above 200, for a total of thirty-four credits; a minor in a related discipline, approved by the department. Students planning graduate study should acquire a reading knowledge of at least one of French, German, and Russian.

A student who enters Whitman College without a good working knowledge of the material in Mathematics 125 and 126 will have to complete forty-two mathematics credits to fulfill the requirements for the pure mathematics major, forty credits for the applied mathematics major; both totals include six credits for Mathematics 125, 126.

Twenty-seven mathematics credits are required for the mathematics-physics major, thirty-one mathematics credits for the economics-mathematics major, and twenty-seven mathematics credits for the 3-2 mathematics-computer science major.

Courses in mathematics apply to the physical science and mathematics (pre-fall semester, 2002), and quantitative analysis (post-fall semester, 2002) distribution areas.

The Mathematics minor: Fifteen credits or more in mathematics courses numbered 200 or above.

The Computer Science minor: A minimum of fifteen credits including: 167, 270, and three courses chosen from 250, 339, 358, 467, and 478.

The Economics-Mathematics combined major: Mathematics 167, 225, 235, 236, 244, (250 or 339), 300, 338, and three additional credits chosen from mathematics courses numbered above 200. Economics 107, 307, 308, 327, 428 plus two additional courses in economics, at least one of which is numbered 310 through 490. For economics-mathematics majors, Economics 107 and Mathematics 338 are the prerequisites for Economics 327, and Economics 227 does not apply toward the minimum major requirements. Courses completed in this major apply to the social science and physical science and math (pre-fall semester, 2002); and the social science, science, and quantitative analysis (selected courses, post-fall semester, 2002) distribution areas.

The Mathematics-Physics combined major: Mathematics 225, 235, 236, 244, 300, and nine additional credits in mathematics courses numbered above 200; Physics 155, 156, 245, 246, 255, 256, 335, (325 or 347), and five credits from physics courses numbered from 300-480, or from BBMB 324 and BBMB 334. Courses completed in this major apply to the physical science and math (pre-fall semester, 2002); and the science, and quantitative analysis (post-fall semester, 2002) distribution areas.

The 3-2 Mathematics-Computer Science major. Please see the *Combined Plans* section of this Catalog.

Choosing a Calculus Course

Students who wish to take calculus should note the following: students with a strong background in high school mathematics not including calculus start with Mathematics 125. Students who have taken a high school course in calculus, but who have not taken the BC calculus Advanced Placement Test

(see the statement below regarding college credit for the Advanced Placement Test) should take the Advisory Calculus Placement exam offered by the department of mathematics.

Students should note that several programs require the calculus labs, Mathematics 235 and 236, in addition to Mathematics 225. Because the lab courses teach skills that are useful in other mathematics and science courses, it is strongly recommended that students take Mathematics 235 and 236 as early as possible in their programs. Programs that require the calculus labs are the mathematics major, the economics-mathematics major, the mathematics-physics major, the physics major, the 3-2 engineering program, and the 3-2 mathematics-computer science major.

Advanced Placement

The policy for advanced standing and credit for the College Board Advanced Placement program is as follows:

1. Students with a 4 or 5 on the BC calculus test are considered to have completed the equivalent of Mathematics 125 and 126 and receive six credits in mathematics.
2. Students with a 4 or 5 on the AB calculus test (or on the AB subtest of the BC test) are considered to have completed the equivalent of Mathematics 125 and receive three credits in mathematics. These students should take the placement test offered by the department of mathematics to determine whether they should enroll in Mathematics 126 or Mathematics 225.
3. Students with a 4 or 5 on the computer science (A) test are considered to have completed the equivalent of Mathematics 167 and receive three credits in mathematics. Students with a 4 or 5 on the computer science (AB) test are considered to have completed the equivalent of Mathematics 167 and 270 and receive six credits in mathematics.

A student has the option of repeating a course for which AP credit has been granted, but with a commensurate reduction in advanced placement credit.

108 Introduction to Mathematical Thinking 3, x Guichard

This course will introduce students to mathematical thinking by studying a variety of mathematical topics. Topics may include problem solving strategies, recreational mathematics and puzzles, mathematics of finance, voting power, and game theory. This course is not designed to prepare

students for calculus and is intended primarily for the non-math major. *Prerequisite*: two years of high school mathematics.

125 Calculus I 3, 3 Fall: Balof, Gordon, and Hundley Spring: Balof, Cotts, and Gordon

A brief review of some precalculus topics followed by limits, continuity, a discussion of derivatives, and applications of the derivative. *Prerequisites*: two years of high school algebra; one year of plane geometry; and knowledge of trigonometry and conic sections or consent of the instructor.

126 Calculus II 3, 3 Fontenot

A continuation of Mathematics 125, covering integration, techniques for computing antiderivatives, applications of the definite integral, and infinite series.

128 Elementary Statistics x, 3 Cotts

Probability and statistics including methods for exploring data and relationships in data, methods for producing data, an introduction to probability and distributions, confidence intervals, and hypothesis testing. *Prerequisite*: two years of high school mathematics.

167 Programming in C++ 3, x Guichard

An introduction to programming techniques applicable to most languages. Emphasis is placed on the C++ language; frequent programming projects are required.

203, 204 Special Topics in Introductory Level Mathematics 1-3

On occasion, the mathematics department will offer courses on introductory topics in mathematics that are not generally covered in other introductory courses. Possible topics include Introduction to Number Theory, Chaos and Applied Discrete Probability.

203 History of Mathematics 3, x Gordon

This course will focus on some of the historical roots of selected mathematical ideas. Some historical readings and summaries of the lives of famous mathematicians will be considered, but the main focus will be solving problems using the tools and ideas available to mathematicians of a given time period. *Prerequisite*: Mathematics 126.

225 Calculus III 4, 4 Fall: Cotts; Spring: Fontenot

Topics include partial derivatives, gradients, extreme value theory for functions of more than one

variable, multiple integration, line integrals and various topics in vector analysis.

235, 236 Calculus Laboratory

1, 1

Hundley

A laboratory to investigate ways in which the computer can help in understanding the calculus and in dealing with problems whose solutions involve calculus. No programming required; a variety of existing programs will be used. *Prerequisite or corequisite* for Mathematics 235: Mathematics 225; *Prerequisite* for Mathematics 236: Mathematics 235.

244 Differential Equations

x, 3

Hundley and Gordon

This course includes first and second order linear differential equations and applications. Other topics may include systems of differential equations and series solutions of differential equations. *Prerequisite*: Mathematics 225.

250 Mathematical Modeling I

3, x

Hundley

This course explores the process of building, analyzing, and interpreting mathematical descriptions of real-world processes. The course introduces basic techniques, which may include such topics as data fitting, differential equations, discrete dynamics, and probabilistic modeling. *Prerequisite*: Mathematics 225.

260 An Introduction to Higher Mathematics

x, 3

Guichard

An introduction to some of the concepts and methodology of advanced mathematics. Emphasis is on the notions of rigor and proof. This course is intended for students interested in majoring in mathematics; students should plan to complete it not later than the spring semester of the sophomore year. *Prerequisite*: Mathematics 225.

270 Data Structures with C++

x, 3

Guichard

We study fundamental methods used to store, access, and manipulate data in computers. Storage structures to be covered include files, lists, tables, graphs, and trees. We will discuss and analyze methods of searching for and sorting data in these structures. *Prerequisite*: Mathematics 167 or consent of instructor.

300 Linear Algebra

3, 3

Balof

This course first considers the solution set of a system of linear equations. The ideas generated from systems of equations are then generalized and studied in a more abstract setting, which considers topics such as matrices, determinants, vector spaces, inner products, linear transformations, and eigenvalues. *Prerequisite*: Mathematics 225.

337 Geometry

3; not offered 2003-04

Essential for prospective high school mathematics teachers, this course includes a study of Euclidean geometry, a discussion of the flaws in Euclidean geometry as seen from the point of view of modern axiomatics, a consideration of the parallel postulate and attempts to prove it, and a discussion of the discovery of non-Euclidean geometry and its philosophical implications. *Prerequisite*: Mathematics 126.

338 Probability and Statistics

4, x

Cotts

Topics include discrete and continuous probability spaces, distribution functions, the central limit theorem, estimation, tests of hypothesis, regression, and correlation. *Prerequisite*: Mathematics 225.

339 Operations Research

3; not offered 2003-04

Operations research is a scientific approach to determining how best to operate a system, usually under conditions requiring the allocation of scarce resources. This course will consider several subfields of operations research, including linear programming, dynamic programming, inventory theory, and queuing theory. Emphasis will be placed on applications as well as on basic concepts. *Prerequisite*: Mathematics 300.

350 Mathematical Modeling II

x, 3

Hundley

This course explores the process of building, analyzing, and interpreting mathematical descriptions of physical processes. Topics may include feature extraction, partial differential equations, neural networks, statistical models. The course will involve some computer programming, so previous programming experience is helpful, but not required. *Prerequisite*: Mathematics 300.

358 Combinatorics and Graph Theory

3; not offered 2003-04

Topics in elementary combinatorics, including: permutations, combinations, generating functions, the inclusion-exclusion principle, and other counting techniques; graph theory; and recurrence relations. *Prerequisites*: Mathematics 260 or consent of instructor.

367 Engineering Mathematics

3; not offered 2003-04

An introduction to mathematics commonly used in engineering and physics applications. Topics may include: vector analysis and applications; matrices, eigenvalues, and eigenfunctions; boundary value problems and spectral representations; Fourier series and Fourier integrals; solution of partial differential equations of mathematical physics; differentiation

and integration of complex functions, residue calculus, conformal mapping. *Prerequisite:* Mathematics 244.

368 Complex Variables **3; not offered 2003-04**

Complex analysis is the study of functions defined on the set of complex numbers. This introductory course covers limits and continuity, analytic functions, the Cauchy-Riemann equations, Taylor and Laurent series, contour integration and integration theorems, and residue theory. *Prerequisite:* Mathematics 225.

385, 386 Abstract Algebra **4, x**

Guichard

The first semester is an introduction to groups and rings, including subgroups and quotient groups, homomorphisms and isomorphisms, subrings and ideals. Topics for the second semester may include fields, simple groups, Sylow theorems, Galois theory, and modules. *Prerequisite:* Mathematics 260.

455, 456 Real Analysis **4, 4**

Fontenot

First semester: a rigorous study of the basic concepts of real analysis, with emphasis on real-valued functions defined on intervals of real numbers. Topics include sequences, continuity, differentiation, integration, infinite series, and series of functions. Second semester: content varies from instructor to instructor but includes topics from metric spaces, the calculus of vector-valued functions, and more advanced integration theory. *Prerequisite:* Mathematics 260.

467 Numerical Analysis **3; not offered 2003-04**

An introduction to numerical approximation of algebraic and analytic processes. Topics include numerical methods of solution of equations, systems of equations and differential equations, and error analysis of approximations. *Prerequisite:* Mathematics 167; *prerequisite or corequisite:* Mathematics 300.

471, 472 Special Topics **1-3**

On occasion, the mathematics department will offer courses on advanced topics in mathematics that are not found in other course offerings. Possible topics include topology, number theory, and problem solving.

472A Computer Graphics **x, 3**

Guichard

Survey of computer graphics: image representation, formation, presentation, composition and manipulation. Modeling, transformation, and display of geometric objects in two and three

dimensions. Representation of curves and surfaces. *Prerequisite:* Mathematics 167, 300; 270 recommended.

478 Algorithm Design and Analysis **3; not offered 2003-04**

The design of good algorithms and the analysis of algorithms for worst case and average case efficiency. We will examine specific algorithms for searching and sorting; algorithms on graphs and digraphs; and algorithms for set manipulation. *Prerequisite:* Mathematics 270.

481, 482 Independent Study **1-3, 1-3**

Staff

A reading or research project in an area of mathematics not covered in regular courses. The topic is to be selected by the student in consultation with the staff. Maximum of six credits. *Prerequisite:* consent of supervising instructor.

495 Senior Project I **3; not offered 2003-04**

Preparation of the senior project required of all graduating mathematics majors. Aid will be given in choosing a senior project during the first two weeks. Once a project is defined, each student will be matched with a faculty mentor from the math department. Short oral reports will be given weekly for the remainder of the semester on the progress of the senior project.

496 Senior Project II **1; not offered 2003-04**

Finalization of the senior project for mathematics majors. A final written and oral report on the senior project is completed and submitted. During the semester drafts of the senior report are submitted regularly and evaluated for content and style. Proper mathematical writing will be emphasized.

498 Honors Thesis **3, 3**

Staff

Preparation of an honors thesis. *Required of* and limited to senior honors candidates in mathematics. *Prerequisite:* admission to honors candidacy.