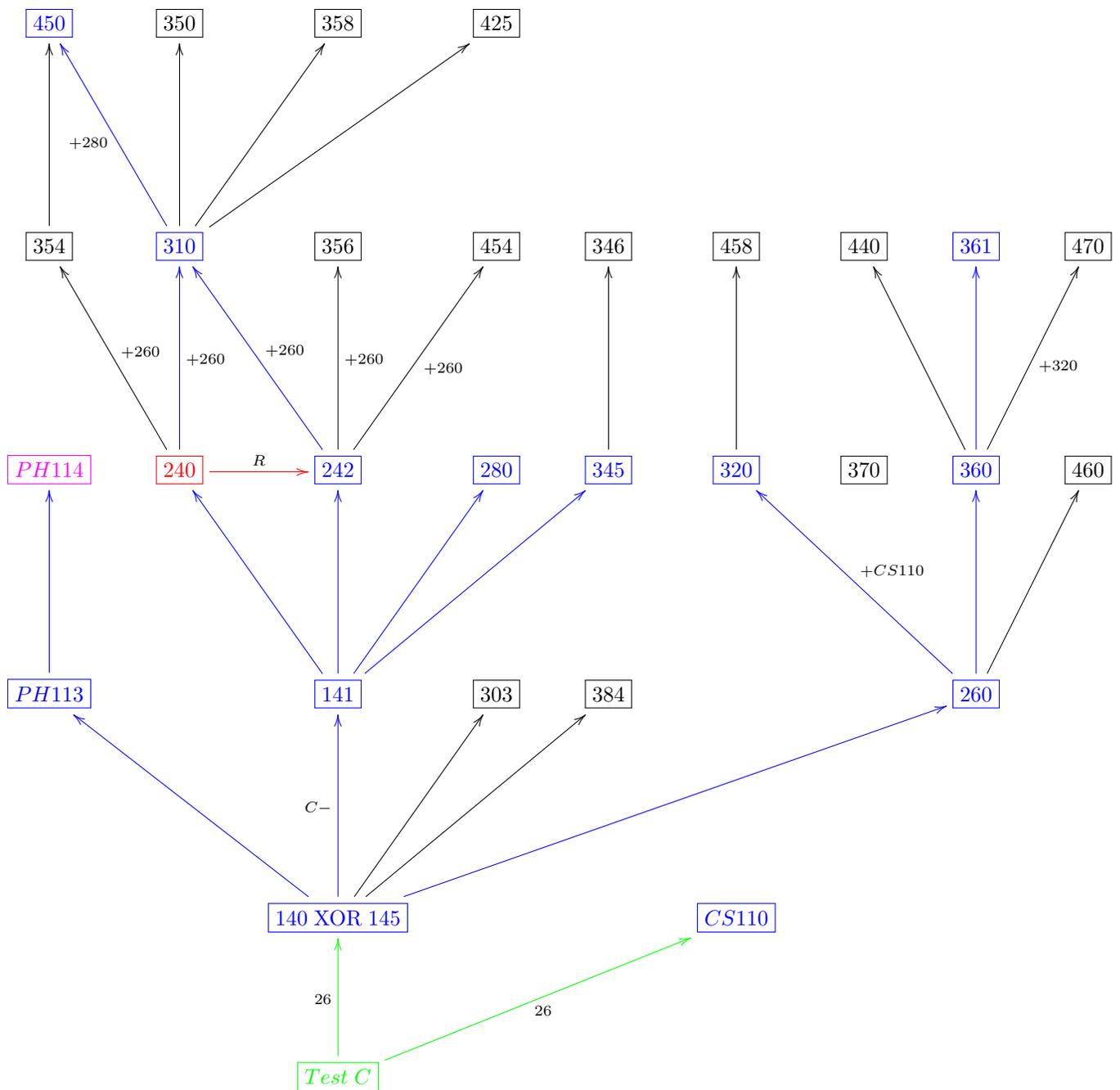


Course required or counting for MATH-BS/BA/minor degrees at UMass Boston  
 June 18, 2012

- Courses with no area shown are MATH courses.
- Courses in blue are required for both MATH-BS and MATH-BA degrees.
- PH 114 required for the MATH-BS degree only.
- MATH 240 accepted for the MATH-MINOR degree only.
- Courses in black count as MATH electives.
- The sequence CS114+CS115 can be used to replace CS110.



## MATH COURSES

- **Math 140: Calculus I**  
This course is an introduction to differential and integral calculus. It begins with a short review of basic concepts surrounding the notion of a function. Then it introduces the important concept of the limit of a function, and uses it to study continuity and the tangent problem. The solution to the tangent problem leads to the study of derivatives and their applications. Then it considers the area problem and its solution, the definite integral. The course concludes with the calculus of elementary transcendental functions.
- **Math 140R: Calculus I, Reduced credit**  
Same as Math 140, for students with credit for Math 134, Math 135, or Math 260.
- **Math 145: Calculus I for the Life and Environmental Sciences**  
The course is the first in the sequence of calculus courses for science and math majors. The topics covered in this course parallel the topics covered in the other Math 140 sections; however, the applications presented in this course have origins in biological systems. The course begins with the basic concepts of functions, discrete time models and limits in the context of population models. Further topics covered include: derivatives along with their applications to biological modeling and definite and indefinite integrals with applications to geometric and biological problems.
- **Math 145R: Calculus I for the Life and Environmental Sciences, Reduced credit**  
Same as Math 145, for students with credit for Math 134, Math 135, or Math 260.
- **Math 141: Calculus II**  
Continuation of MATH 140. Topics include transcendental functions, techniques of integration, applications of the integral, improper integrals, l'Hospital's rule, sequences, and series.
- **Math 141R: Calculus II, Reduced credit**  
Same as Math 141, for students with credit for Math 146.
- **Math 240: Multivariable Calculus**  
Differential and integral calculus of functions of several variables and of vector fields. Topics include Euclidean, polar, cylindrical, and spherical coordinates; dot product, cross-product, equations of lines and planes; continuity, partial derivatives, directional derivatives, optimization in several variables; multiple integrals, iterated integrals, change of coordinates, Jacobians, general substitution rule.
- **Math 242: Multivariable and Vector Calculus**  
Differential and integral calculus of functions of several variables and of vector fields. Topics include Euclidean, polar, cylindrical, and spherical coordinates; dot product, cross-product, equations of lines and planes; continuity, partial derivatives, directional derivatives, optimization in several variables; multiple integrals, iterated integrals, change of coordinates, Jacobians, general substitution rule; curves and surfaces, parametrizations, line integrals, surface integrals; gradient, circulation, flux, divergence; conservative, solenoidal vector fields; scalar, vector potential; Green, Gauss, and Stokes theorems.
- **Math 242R: Multivariable and Vector Calculus, Reduced credit**  
Last quarter of Math 242, for students with credit for Math 240. Curves and surfaces, parametrizations, line integrals, surface integrals; gradient, circulation, flux, divergence; conservative, solenoidal vector fields; scalar, vector potential; Green, Gauss, and Stokes theorems.
- **Math 260: Linear Algebra**  
Elementary theory of vector spaces. Topics include linear independence, bases, dimension, linear maps and matrices, determinants, orthogonality, eigenvalues and eigenvectors.
- **Math 280: Introduction to Proofs**  
The course is designed to aid students in making the transition from calculus, differential equations and linear algebra to the more advanced and more abstract mathematics courses, such as abstract algebra and real analysis. The course will cover mathematical logic, mathematical proofs, mathematical induction, set theory, relations, functions, cardinality and applications of proofs in the study of such areas as number theory, calculus and group theory, as time permits.

- **Math 303: Introduction to Mathematical Biology**  
 Mathematical models of population growth and other biological processes and  $n$ th order linear difference equations will be used to model propagation of annual plants; growth of segmental organisms; red blood cell production; and population growth and destiny dependence in single-species populations. Continuous models will be constructed from among several possibilities, including the logistic equation, simple exponential growth, the Chemostat, Michaelis-Menten kinetics, drug delivery, glucose-insulin kinematics, Gompertz growth in tumors, and the Fitzhugh-Magumo model for neural impulses. Appropriate software will be used throughout the course.
- **Math 310: Applied Ordinary Differential Equations**  
 A comprehensive study of the nature of ordinary differential equations. The course includes qualitative analysis of properties of solutions, as well as standard methods for finding explicit solutions to important classes of differential equations. It presents many applications, particularly for linear equations.
- **Math 320L: Applied Discrete Mathematics**  
 An introduction to the mathematical structures and concepts used in computing: sets, mathematical induction, ordered sets, Boolean algebras, predicate calculus, trees, relations and lattice theory. Formal and informal theories and corresponding mathematical proofs are taught.
- **Math 345: Probability and Statistics I**  
 This course presents the mathematical laws of random phenomena, including discrete and continuous random variables, expectation and variance, and common probability distributions such as the binomial, Poisson, and normal. Topics also include basic ideas and techniques of statistical analysis.
- **Math 346: Probability and Statistics II**  
 This is a statistics course for students with a firm mastery of calculus, emphasizing the mathematical and conceptual bases of statistics, with a view to understanding the proper application of standard methods. The course includes thorough treatments of the Central Limit Theorem, the theory of estimation, hypothesis testing, and regression.
- **Math 350: Applied Partial Differential Equations**  
 Applied Partial Differential Equations is an introduction to the basic properties of partial differential equations and to some of the techniques that have been developed to analyze the solutions to these equations. The equations that describe the dynamics of waves, diffusion, flow and vibrations will be the main focus of this course. Initial value and boundary value problems of first and second-order equations will be considered. A geometric and analytic analysis of the solutions to these equations will be explored. Specific topics covered include classification of partial differential equations, well posed problems, the maximum principles for the diffusion equation and Laplace's equation, Dirichlet, Neumann and Robin boundary conditions, the method of characteristic coordinates, and separation of variables. The theory of Fourier Series will be introduced to the student and used to approximate solutions to inhomogeneous boundary value problems using the expansion method. Additional topics specific to the instructors preference may be included in the course if time permits.
- **Math 354: Vector Calculus**  
 Differential and integral calculus of vector fields. Topics include line integrals, surface-area integrals, and smoothness; oriented curves and surfaces; circulation and flux of fields; Stokes' theorem; conservative, solenoidal fields; scalar, vector potentials; independence of path, surfaces, Maxwell's equations; and differential forms, exterior derivatives.
- **Math 356: Differential Geometry**  
 Differential geometry of curves and surfaces in Euclidean spaces, as an introduction to the geometry of Riemannian manifolds. The course presents intrinsic and extrinsic properties, both from a local and global point of view. Topics include; plane and space curves, surfaces, metrics on surfaces, Gaussian curvature, surfaces of constant curvature, shape operator, mean curvature and minimal surfaces, vector fields on surfaces.

- Math 358: An Introduction to Complex Analysis  
Complex numbers; complex functions; power series; trigonometric functions; Moebius transformations; differentiation and integration of analytic functions; Cauchy's theorem; residues; singularities; meromorphic functions.
- Math 360: Abstract Algebra I  
Review of set theory and introduction to mathematical proof. Introduction to concepts and techniques of group theory, including but not limited to: symmetric groups, axiomatic definitions of groups, important classes of groups, subgroups, group homomorphisms, coset theory, normal subgroups, quotient groups, direct products, Sylow theorems. Possible applications include number theory, geometry, physics and combinatorics.
- Math 361: Abstract Algebra II  
Introduction to ring and field theory. Topics include: commutative rings, ideals, integral domains, polynomial fields, the theory of extension fields, vector spaces, Galois groups, and the fundamental theorem of Galois theory. Applications include insolvability of certain higher degree polynomials, and other topics as time permits.
- Math 370: History of Mathematics  
This course traces the development of mathematics from ancient times up to and including 17th century developments in the calculus. Emphasis is on the development of mathematical ideas and methods of problem solving.
- Math 384L: Game Theory, Evolution and Ecology  
Fundamental concepts of evolutionary game theory and their application in biology. Topics include: the strategy and payoff matrix, the game tree, strategic and extensive form games, symmetric games, Nash equilibria. Evolutionary game theory concepts are discussed for two-strategy games (Prisoner's Dilemma, Hawk-Dove) and three-strategy games (Rock-Scissors-Paper). Biological examples are studied, such as blood sharing in vampire bats, competition in bacteria, or the evolution of altruistic punishment.
- Math 425: Numerical Analysis  
Approximations of roots. Finite differences. Interpolation. Numerical solutions of differential and algebraic equations. Numerical integration.
- Math 440: General Topology  
This course is an introduction to the abstract theory of continuity and convergence, otherwise known as general (or point-set) topology. Topics include metric spaces and topological spaces, continuity, subspaces, product and quotient spaces, sequences, nets and filters, separation and countability, compactness, connectedness, and the fundamental group.
- Math 450: An Introduction to Real Analysis  
A rigorous treatment of the calculus of functions of one real variable. Emphasis is on proofs. Includes discussion of topology of real line, limits, continuity, differentiation, integration and series.
- Math 454: Analysis on Manifolds  
This course is an introduction to the framework for modern advanced analysis. Topics include differentiable maps between Euclidean spaces, Implicit and Inverse Function Theorems, manifolds, differential forms, differentiation and integration on manifolds.
- Math 458: Theory of Numbers  
Prime numbers; congruences and residues; approximation of real numbers by rationals; diophantine equations; other topics as time permits.
- Math 460: Survey of Geometry  
Topics taken from classical Euclidean geometry and the non Euclidean geometries; projective geometry; lattices; finite geometries.
- Math 470: Mathematical Logic  
Syntax and semantics of propositional and first-order predicate logic. Axiomatic theories and completeness. Brief discussion of incompleteness results.