Courses

MATH 41 BEGINNING ALGEBRA  4 Units
A course for those who need to strengthen their basic algebra skills. Topics include properties of the real numbers, linear and quadratic equations, linear inequalities, exponents, polynomials, rational and radical expressions, and systems of linear equations. The course credits count towards the semester credit load and GPA, but are not included in the 120 credit graduation requirement.
PREREQ: APPROPRIATE SCORE ON THE UW MATH PLACEMENT TEST

MATH 49 WORKSHOP Repeatable 1-3 Units
Variable credit course offering with a defined topic. Repeatable with a change of topic.

MATH 139 QUANTITATIVE REASONING  3 Units
A quantitative reasoning course which includes topics from college algebra (such as functions, linear, exponential and logarithmic models), statistics, and probability. Emphasizes modeling, problem-solving and applications. Designed for students whose programs do not require further coursework in pre-calculus or calculus. Appropriate for students majoring and minoring in areas such as the arts, humanities, social sciences, and education.
PREREQ: MATH 41 WITH A GRADE OF C OR BETTER OR WAIVER
CROSS-LISTED: MATH 139/MATH 139W

MATH 140 MATHEMATICAL IDEAS  3 Units
Designed to give students a broad understanding and appreciation of mathematics. Includes topics not usually covered in a traditional algebra course. Topics encompass some algebra, problem solving, counting principles, probability, statistics, and consumer mathematics. This course is designed to meet the University Proficiency Requirement for students who do not wish to take any course having MATH 141 as a prerequisite.
PREREQ: MATH 41 WITH A GRADE OF C OR BETTER OR WAIVER
CROSS-LISTED: MATH 140, MATH 140W

MATH 141 FUNDAMENTALS OF COLLEGE ALGEBRA  4 Units
A functional approach to algebra with emphasis on applications to different disciplines. Topics include linear, exponential, logarithmic, quadratic, polynomial and rational equations and functions, systems of linear equations, linear inequalities, radicals and rational exponents, complex numbers, variation. Properties of exponents, factoring, and solving linear equations are reviewed.
PREREQ: MATH 41 WITH A GRADE OF C OR BETTER OR WAIVER

MATH 142 COLLEGE ALGEBRA  4 Units
Study of polynomial, radical, rational, piecewise, exponential, and logarithmic functions, including basic graphs, transformations, inverses, and combining functions; solving equations and inequalities both algebraically and graphically is explored. Applications to other disciplines are used to enhance conceptual understanding.
PREREQ: MATH 41 WITH A C OR BETTER OR PLACEMENT INTO MATH 142 UNREQ: MATH 152

MATH 143 FINITE MATHEMATICS FOR BUSINESS AND SOCIAL SCIENCES  3 Units
Mathematical preparation for the understanding of quantitative methods in management and social sciences. Topics include sets, relations, linear functions, interest, annuities, matrices, solution of linear systems by graphical, algebraic, Gauss-Jordan, and inverse methods, linear programming by graphical and simplex methods, counting and probability. College of Business and Economics majors must take this course on a conventional grade basis.
PREREQ: MATH 139 WITH A GRADE OF C OR BETTER, OR MATH 141 WITH A GRADE OF C OR BETTER

MATH 147 MATHEMATICS IN EARLY CHILDHOOD LEARNING  4 Units
A study of topics in early childhood mathematics, including sets, numbers, operations, measurement, data, and geometry. The focus is on increasing conceptual understanding of mathematics, highlighting connections, and developing the ability to communicate mathematical knowledge. Problem-solving methods used by children will also be explored. Manipulatives, cooperative learning activities, and problem solving strategies are used throughout the course.
PREREQ: MATH 139 WITH A GRADE OF C OR BETTER, OR MATH 141 WITH A GRADE OF C OR BETTER, OR WAIVER

MATH 148 MATHEMATICS FOR THE ELEMENTARY TEACHER I  3 Units
A study of topics in early childhood mathematics, including sets, fundamental operations of arithmetic, fundamental algorithms, and structural properties of arithmetic. The focus is on increasing conceptual understanding of mathematics, highlighting connections, and developing the ability to communicate mathematical knowledge. Problem-solving methods used by children will also be explored. Manipulatives, cooperative learning activities, and problem solving emphasized.
PREREQ: MATH 139 WITH A GRADE OF C OR BETTER, OR MATH 141 WITH A GRADE OF C OR BETTER, OR WAIVER

MATH 149 MATHEMATICS FOR THE ELEMENTARY TEACHER II  3 Units
Topics in probability and statistics, with emphasis on descriptive techniques. Investigations in geometric figures, measurement, construction, transformations, congruent and similar geometric figures. Problem solving strategies, manipulatives, and cooperative learning activities are emphasized throughout the course.
PREREQ: MATH 147 WITH A GRADE OF C OR BETTER OR MATH 148 WITH A GRADE OF C OR BETTER

MATH 150 TRIGONOMETRY  3 Units
Study of trigonometric functions including basic graphs, transformations, and inverses; trigonometric functions are studied through the unit circle and right triangle approaches. Also studied are trigonometric identities, equations, and applications, including Law of Sines and Law of Cosines, as well as polar coordinates.
PREREQ: MATH 141 WITH A C OR BETTER OR MATH 139 WITH A B OR BETTER COREQ: MATH 150 OR CONSENT OF INSTRUCTOR UNREQ: MATH 152

MATH 151 PRECALCULUS  5 Units
Study of polynomial, radical, rational, piecewise, exponential, logarithmic, and trigonometric functions, including basic graphs, transformations, inverses, and combining functions; solving equations and inequalities both algebraically and graphically is explored. In addition, trigonometric functions are studied through the unit circle and right triangle approaches. Also studied are vectors, trigonometric identities, trigonometric equations, and polar coordinates.
PREREQ: MATH 141 WITH A GRADE OF C OR BETTER UNREQ: MATH 150 AND MATH 151
MATH 177  THE LOGIC OF CHESS  1 Units
A study of logic particularly as it is used in the game of chess and, most particularly, in chess strategy and the end game of chess. The rules are taught to those who are not already acquainted with the game.

MATH 200  MATHEMATICS: FORM AND FUNCTION  1 Units
An introduction to abstract and applied mathematical thinking, including exploration of career opportunities in the mathematical sciences. Centered around the dual question of "What is mathematics, and what is it good for?", this course serves as an introduction to the mathematics major and minor and includes an overview of the different emphases within the major.
COREQ: MATH 253

MATH 230  INTRODUCTION TO STATISTICAL REASONING AND ANALYSIS  3 Units
A course on the principles, procedures and concepts surrounding the production, summarization and analysis of data. Emphasis on critical reasoning and interpretation of statistical results. Content includes: probability, sampling, and research design; statistical inference, modeling and computing; practical application culminating in a research project.
PREREQ: MATH 139 WITH A GRADE OF C OR BETTER, OR MATH 141 WITH A GRADE OF C OR BETTER, OR WAIVER

MATH 243  CALCULUS FOR BUSINESS AND SOCIAL SCIENCES  4 Units
A survey of calculus emphasizing business and social science applications. Topics covered include related algebra concepts and skills, limits, differentiation, max-min theory, exponential and logarithmic functions, and integration. Other topics included at instructor discretion.
PREREQ: MATH 142 WITH A GRADE OF C OR BETTER OR MATH 143 WITH A GRADE OF C OR BETTER OR MATH 152 WITH A GRADE OF C OR BETTER

MATH 250  APPLIED CALCULUS SURVEY FOR BUSINESS AND SOCIAL SCIENCES  5 Units
An applied calculus course covering elementary analytic geometry, limits, differentiation, max-min theory, exponential and logarithmic functions, integration, functions of several variables, and elementary differential equations. Some computer topics may be included. A student may earn credit for only one of MATH 243, MATH 250, and MATH 253.
PREREQ: MATH 143 OR MATH 150 OR MATH 152, EACH WITH A GRADE OF C OR BETTER UNREQ: MATH 253

MATH 253  CALCULUS AND ANALYTIC GEOMETRY I  5 Units
Review of algebraic and trigonometric functions, transcendental functions, limits, study of the derivative, techniques of differentiation, continuity, applications of the derivative, L' Hopital's Rule and indeterminate forms, the Riemann integral, Fundamental Theorem of Calculus, the substitution rule, and applications of the integral, including volumes of revolution and average value.
PREREQ: (MATH 152 WITH A GRADE OF C OR BETTER) OR (MATH 150 AND MATH 151, BOTH WITH A GRADE OF C OR BETTER) UNREQ: MATH 250

MATH 254  CALCULUS AND ANALYTIC GEOMETRY II  4 Units
Techniques of integration, introduction to differential equations, parametric equations, and infinite sequences and series.
PREREQ: MATH 253 OR (MATH 250 AND MATH 151) OR (MATH 250 AND MATH 152), EACH WITH A GRADE OF C OR BETTER

MATH 255  CALCULUS AND ANALYTIC GEOMETRY III  4 Units
A course in multivariable calculus. Topics include: solid analytic geometry; vectors and vector functions; functions of several variables, including limits, continuity, partial and directional derivatives, gradient vectors, and Lagrange multipliers; multiple integrals in rectangular, cylindrical, and spherical coordinates; line and surface integrals; Green's Theorem, Stokes' Theorem, and the Divergence Theorem.
PREREQ: MATH 254 WITH A C OR BETTER

MATH 263  INTRODUCTION TO R  1 Units
This course will cover basic topics in R, a statistical computing framework. Topics include writing R functions, manipulating data in R, accessing R packages, creating graphs, and calculating basic summary statistics.
COREQ: MATH 250 OR MATH 253

MATH 280  DISCRETE MATHEMATICS  3 Units
This course provides an introduction to mathematical proof, beginning with a discussion of formal logic. Topics include sets, functions, relations, number theory, combinatorics, and probability.
PREREQ: MATH 250 WITH A GRADE OF B OR BETTER OR MATH 253 WITH A GRADE OF C OR BETTER

MATH 281  PUTNAM COMPETITION AND PROBLEM SOLVING Repeateable  1 Units
Preparation for the William Lowell Putnam Competition. Includes advanced problem solving techniques in pure mathematics. Review of previous examination problems and related material. May be repeated for a total of four credits. Satisfactory/No Credit only.
PREREQ: MATH 253 OR CONSENT OF INSTRUCTOR COREQ: MATH 280 OR CONSENT OF INSTRUCTOR

MATH 298  INDEPENDENT STUDY Repeateable 1-3 Units
Study of a selected topic or topics under the direction of a faculty member. Repeatable. Department Consent required.

MATH 301  INTRODUCTION TO ANALYSIS  3 Units
A first course in real analysis. Topics include properties of the real numbers, convergence of sequences, monotone and Cauchy sequences, continuity, differentiation, the Mean Value Theorem, and the Riemann integral. Emphasis is placed on proof-writing and communicating mathematics.
PREREQ: MATH 254 WITH A GRADE OF C OR BETTER, AND MATH 280

MATH 324  APPLIED STATISTICS  3 Units
This course will cover the basics of statistical testing, regression analysis, experimental design, analysis of variance, and the use of computers to analyze statistical problems. This course contains a writing component.
PREREQ: (MATH 250 OR MATH 253) WITH A GRADE OF C OR BETTER AND (MATH 263 OR COMPSCI 172 OR COMPSCI 174)

MATH 342  APPLIED PROBABILITY: THEORY AND PRACTICE  3 Units
Sets and counting, probability spaces, discrete and continuous random variables, mathematical expectation, discrete and continuous distributions with applications and probabilistic computing using R.
PREREQ: (MATH 250 OR MATH 253) WITH A GRADE OF C OR BETTER AND (MATH 263 OR COMPSCI 172 OR COMPSCI 174)

MATH 346  THEORY OF INTEREST  3 Units
This course will cover the topics of interest theory listed in the Society of Actuaries/Casualty Actuarial Society syllabus for Exam FM/2. Topics include the time value of money, annuities, loans, bonds, general cash flows and portfolios, and immunization schedules.
PREREQ: MATH 254 WITH A C OR BETTER
MATH 352  INFINITE PROCESSES FOR THE ELEMENTARY TEACHER  3 Units
This course is primarily for pre-service elementary and middle school teachers. Students will be introduced to the concepts of calculus, which include infinite processes, limits, and continuity. In addition, derivatives and integrals and their relationships to change and area will be covered. PREREQ: (MATH 152 WITH A GRADE OF C OR BETTER) OR (MATH 150 AND 151, BOTH WITH A GRADE OF C OR BETTER)

MATH 353  COLLEGE GEOMETRY  5 Units
This course is adapted for the prospective high school mathematics teacher. Topics include foundations of Euclidean geometry, Euclidean transformational geometry, modern synthetic geometry that builds on Euclidean geometry, selected finite geometries, and an introduction to non-Euclidean and projective geometry, including their relationship to Euclidean geometry. PREREQ: MATH 280

MATH 355  MATRICES AND LINEAR ALGEBRA  3 Units
Systems of linear equations, matrices and determinants, finite dimensional vector spaces, linear dependence, bases, dimension, linear mappings, orthogonal bases, and eigenvector theory. Applications stressed throughout. PREREQ: MATH 250 WITH A GRADE OF B OR BETTER OR MATH 253 WITH A GRADE OF C OR BETTER

MATH 359  PROBABILITY & STATISTICS FOR TEACHERS  4 Units
An introduction to probability and statistics for teachers. Topics covered include counting techniques, basic probability theory, exploratory data analysis, simulation, randomization, and statistical inference. This course contains a writing component. PREREQ: MATH 253 OR (MATH 250 AND MATH 151) OR (MATH 250 AND MATH 152). EACH WITH A GRADE OF C OR BETTER

MATH 361  DIFFERENTIAL EQUATIONS  3 Units
Ordinary differential equations: general theory of linear equations, special methods for nonlinear equations including qualitative analysis and stability, power series and numerical methods, and systems of equations. Additional topics may include transformation methods and boundary value problems. Applications stressed throughout. PREREQ: MATH 254 WITH A C OR BETTER

MATH 362  APPLIED NONPARAMETRIC STATISTICS  3 Units
This course covers theory and applications of commonly used distribution-free tests such as the sign test and the Wilcoxon signed rank test. Other topics include: the Kruskal-Wallis and Friedman tests for analysis of variance, nonparametric regression, and nonparametric bootstrapping. PREREQ: (MATH 342 WITH A GRADE OF C OR BETTER) OR (MATH 343 WITH A GRADE OF C OR BETTER)

MATH 370  PROBLEM SOLVING FOR THE ELEMENTARY TEACHER  3 Units
This course is primarily for pre-service elementary and middle school teachers. Students will learn a variety of problem solving strategies applicable in elementary and middle school. The applications will cover many different areas of mathematics. PREREQ: MATH 149 WITH C OR BETTER

MATH 375  DEVELOPMENT OF MATHEMATICS  3 Units
A study of the development of mathematical notation and ideas from prehistoric times to the present. Periods and topics will be chosen corresponding to the backgrounds and interests of the students. PREREQ: MATH 152 WITH A GRADE OF C OR BETTER, OR (MATH 150 AND MATH 151, BOTH WITH C OR BETTER), OR CONSENT OF INSTRUCTOR

MATH 381  MATHEMATICAL MODELING AND SIMULATION  3 Units
Modeling involving formulation of deterministic, stochastic and rule-based models and computer simulation in order to make predictions. Topics may include unconstrained and constrained growth models, equilibrium and stability, force and motion, predator-prey model, enzyme kinetics, data-driven models, probability distributions, Monte Carlo simulations, random walk, diffusion, cellular automaton simulations, and high performance computing. PREREQ: MATH 254 WITH A GRADE OF C OR BETTER AND MATH 355

MATH 415  MODERN ALGEBRA AND NUMBER THEORY FOR THE ELEMENTARY TEACHER  3 Units
An introduction to modern algebra with special emphasis on the number systems and algorithms which underlie the mathematics curriculum of the elementary school. Topics from logic, sets, algebraic structures, and number theory. PREREQ: MATH 370 OR CONSENT OF INSTRUCTOR

MATH 416  GEOMETRY FOR THE ELEMENTARY TEACHER  3 Units
A study of the intuitive, informal geometry of sets of points in space. Topics include elementary constructions, coordinates and graphs, tessellations, transformations, problem solving, symmetries of polygons and polyhedra, and use of geometry computer software. PREREQ: MATH 370 OR CONSENT OF INSTRUCTOR

MATH 417  NUMBER THEORY  3 Units
A study of the properties of integers, representation of integers in a given base, properties of primes, arithmetic functions, module arithmetic. Diophantine equations and quadratic residues. Consideration is also given to some famous problems in number theory. PREREQ: MATH 280 OR MATH 415 OR CONSENT OF INSTRUCTOR

MATH 420  APPLIED REGRESSION ANALYSIS  3 Units
This is a second course in regression analysis and its applications. Topics include correlation, simple and multiple linear regression, model assumptions, inference of regression parameters, regression diagnostics and remedial measures, categorical predictors, multicollinearity, and model selection. Real data re emphasized and analyzed using statistical software such as R or SAS. PREREQ: MATH 342 OR CONSENT OF INSTRUCTOR

MATH 421  MATHEMATICS FOR HIGH SCHOOL TEACHERS I  3 Units
The course revisits the high school curriculum from an advanced perspective. The focus is on deepening understanding of concepts, highlighting connections and solving challenging problems. The mathematical content includes number systems, functions, equations, integers, and polynomials. Connections to geometry are emphasized throughout the course. PREREQ: MATH 280, MATH 301 AND AT LEAST AN ADDITIONAL 3 CREDITS IN UPPER LEVEL MATH

MATH 422  MATHEMATICS FOR HIGH SCHOOL TEACHERS II  3 Units
The course continues the exploration of the high school curriculum from an advanced perspective that was started in MATH 421. The focus is on deepening understanding of concepts, highlighting connections and solving challenging problems. The mathematical content includes congruence, distance, similarity, trigonometry, area, and volume. Connections to algebra are emphasized throughout the course. PREREQ: MATH 353 AND MATH 421
MATH 423  EXPERIMENTAL DESIGN AND ANALYSIS OF VARIANCE  3 Units
An introduction to applied experimental design with emphasis on the construction of causal knowledge, analytical techniques, and statistical publication requirements. Topics include single and multiple factor, randomized block, and repeated measure designs; model selection, underlying assumptions, inference, diagnostics, multiple comparison procedures, confidence intervals, effect sizes, and difficulties in applied research settings. The R computing platform will be used.
PREREQ: MATH 342 WITH A GRADE OF C OR BETTER

MATH 430  SAMPLING, DESIGN, AND ANALYSIS OF SURVEY DATA  3 Units
Practical issues in sampling, applied survey research, analysis of complex survey data, and professional reporting are emphasized. Topics include random and non-random sampling, parameter estimation, bias, questionnaire design and wording, psychology of participant response, data imputation, weighting, finite population correction, analysis of categorical data and hierarchical linear models. Students will conduct survey research and complete a data analysis project.
PREREQ: MATH 342 WITH A GRADE OF C OR BETTER

MATH 431  TOPOLOGY  3 Units
An introduction to point-set topology, including such topics as topological spaces, mappings, connectedness, compactness, separation axioms, metric spaces, complete spaces, product spaces and function spaces.
PREREQ: MATH 255 AND EITHER MATH 280 OR CONSENT OF INSTRUCTOR

MATH 442  MATHEMATICAL STATISTICS  4 Units
This course will cover moment generating functions; multivariate probability distributions including moments of linear combinations of random variables and conditional expectation; functions of random variables; sampling distributions and the Central Limit Theorem; the theory and properties of estimation; confidence intervals; and the Neyman-Pearson Lemma, likelihood ratio tests and common tests of hypotheses.
PREREQ: MATH 255 WITH A GRADE OF C OR BETTER AND MATH 343 WITH A GRADE OF C OR BETTER

MATH 450  GRAPH THEORY  3 Units
This course will examine basic concepts and applications of graph theory. Topics covered will be selected from trees, connectivity, paths and cycles, coloring, matching and covering problems, digraphs, and network flows.
PREREQ: MATH 280 OR CONSENT OF INSTRUCTOR

MATH 452  INTRODUCTION TO ABSTRACT ALGEBRA  3 Units
An introductory survey of abstract algebra and number theory with emphasis on the development and study of the number systems of integers, integers mod n, rationals, reals, and complex numbers. These offer examples of and motivation for the study of the classical algebraic structures of groups, rings, integral domains and fields.
PREREQ: MATH 280 OR CONSENT OF INSTRUCTOR
UNREQ: MATH 415 AND MATH 452

MATH 453  ABSTRACT ALGEBRA  3 Units
This course is a continuation of MATH 452 with emphasis on ring and field theory. Topics include a review of group theory, polynomial rings, divisibility in integral domains, vector spaces, extension fields, algebraic extension fields, finite fields, etc.
PREREQ: MATH 355 AND MATH 452

MATH 458  APPLIED MATHEMATICAL ANALYSIS  3 Units
Selected topics in ordinary differential equations: series solutions, stability, transform methods, special functions, numerical methods, vector differential calculus, line and surface integrals.
PREREQ: MATH 361

MATH 459  PARTIAL DIFFERENTIAL EQUATIONS  3 Units
Fourier analysis, partial differential equations and boundary value problems, complex variables, and potential theory.
PREREQ: MATH 361

MATH 463  COMPLEX VARIABLES  3 Units
This course is a study of the algebra and geometry of complex numbers, the properties of analytic functions, contour integration, the calculus of residues and the properties of power series.
PREREQ: MATH 255

MATH 464  ADVANCED CALCULUS  3 Units
This course presents a rigorous treatment of the differential and integral calculus of single variable functions, convergence theory of numerical sequences and series, uniform convergence theory of sequences and series of functions, metric spaces, functions of several real variables, and the inverse function theorem. This course contains a writing component.
PREREQ: MATH 301 OR CONSENT OF INSTRUCTOR

MATH 471  NUMERICAL ANALYSIS  3 Units
Emphasis on numerical algebra. The problems of linear systems, matrix inversion, the complete and special eigenvalue problems, solutions by exact and iterative methods, orthogonalization, gradient methods. Consideration of stability and elementary error analysis. Extensive use of microcomputers and programs using a high level language. This course contains a writing component.
PREREQ: MATH 355 AND (COMPSCI 170 OR COMPSCI 171 OR COMPSCI 172 OR COMPSCI 174 OR COMPSCI 220 OR COMPSCI 222 OR COMPSCI 347)

MATH 474  DYNAMICAL SYSTEMS & CHAOS  3 Units
An analytic, geometric, and intuitive study of continuous and discrete low-dimensional nonlinear dynamical systems. The basic notions of stability, bifurcations, chaotic systems, strange attractors, and fractals are examined. Specific applications will be taken from diverse fields such as Biology, Chemistry, Economics, Engineering, and Physics.
PREREQ: MATH 361 WITH A C OR BETTER

MATH 490  WORKSHOP  Repeatable  1-3 Units
Variable topics. Group activity oriented presentations emphasizing ‘hands on’ and participatory instructional techniques.

MATH 492  FIELD STUDY  Repeatable  1-3 Units
A study for which data is obtained or observations are made outside the regular classroom. Repeatable. Instructor Consent required.

MATH 493  MATH INTERNSHIP  Repeatable  1-3 Units
Variable topics. Group activity oriented presentations emphasizing ‘hands on’ and participatory instructional techniques.

MATH 494  SEMINAR  Repeatable  1-3 Units
Variable topics. Group activity. An advanced course of study in a defined subject matter area emphasizing a small group in intense study with a faculty member. Repeatable. Instructor Consent required.

MATH 496  SPECIAL STUDIES  Repeatable  1-3 Units
Variable topics. Group activity. Not offered regularly in the curriculum but offered on topics selected on the basis of timeliness, need, and interest, and generally in the format of regularly scheduled Catalog offerings. Repeatable three times maximum in 6 years. Instructor Consent required.

MATH 497  EXCHANGE STUDY  Repeatable  1-12 Units
Variable topics
MATH 498  INDEPENDENT STUDY  Repeatable  1-5 Units
Study of a selected topic or topics under the direction of a faculty member. Repeatable. Department Consent required.

MATH 498R  INDEPENDENT STUDY - UNDERGRADUATE RESEARCH  Repeatable  1-3 Units
Study of a selected topic or topics under the direction of a faculty member. Repeatable. Department Consent required.

MATH 499  PROJECT FOR MAJORS  1 Units
This course is designed to give students experience and to improve their skill in reading, writing, and understanding mathematics by requiring them to research one or more mathematical topics and then write a report about their activities and discoveries. The focus is on the learning and communication of mathematics: how to read with understanding, write with clarity and precision, and in the process discover how writing can aid in understanding.
PREREQ: JUNIOR/SENIOR STATUS OR CONSENT OF INSTRUCTOR