MATHEMATICS (MATH)

MATH 1010 Applied Finite Mathematics 3 cr
(Lab required) For students needing to fill the requirement of a university level mathematics course. Introduces students to modern applications of discrete mathematics. Topics include: mathematics of finance, linear programming and graph theory. This course may not be used as a prerequisite for other Mathematics courses. This course cannot be used as part of an Honours, Major, General or Minor program in the mathematical sciences. Not available to any student already holding a grade of "C" or better in any Mathematics course with the exception of MATH 1018, MATH 1020, FA 1020, MATH 1080, MATH 1090, the former MATH 1190 or MATH 1191. Not to be taken concurrently with any other Mathematics course with the exception of MATH 1018, MATH 1020, FA 1020, MATH 1080, MATH 1090 or MATH 1191.
Mutually Exclusive: MATH 1200, MATH 1201, MATH 1210, MATH 1211, MATH 1220, MATH 1230, MATH 1232, MATH 1240, MATH 1241, MATH 1300, MATH 1301, MATH 1310, MATH 1500, MATH 1501, MATH 1510, MATH 1520, MATH 1524, MATH 1690, MATH 1700, MATH 1701, MATH 1710
Attributes: Mathematics Requirement, Science, Recommended Intro Courses

MATH 1018 Pre-Calculus in Practice 3 cr
(Lab required) Essential topics in pre-calculus, with an emphasis on applications and elementary mathematical modelling in the sciences. This course is intended primarily for students who do not have credit for Pre-calculus Mathematics 40S (60%) and wish to continue in a subsequent course in Mathematics. May not be used for credit in a Mathematics Honours, Joint Honours, or Major program. Not available to students who have previously obtained credit (grade of C or better) in MATH 1200, MATH 1201, MATH 1210, MATH 1211, MATH 1220, MATH 1230, MATH 1240, MATH 1241, MATH 1300, MATH 1301, MATH 1310, MATH 1500, MATH 1501, MATH 1510, the former MATH 1520, MATH 1524, or MATH 1525.
Mutually Exclusive: MATH 1200, MATH 1201, MATH 1210, MATH 1211, MATH 1220, MATH 1232, MATH 1240, MATH 1241, MATH 1300, MATH 1301, MATH 1310, MATH 1500, MATH 1501, MATH 1510, MATH 1520, MATH 1524, MATH 1525, MATH 1690, MATH 1700, MATH 1701, MATH 1710
Attributes: Mathematics Requirement, Science, Recommended Intro Courses

MATH 1020 Mathematics in Art 3 cr
Specific theory, structuring systems, and mathematical methods and principles used in works of art from various historical periods and contexts will be explored in relation to Euclidean and non-Euclidean geometries. Topics include: linear perspective; shapes, patterns, balance and symmetry; ratio, proportion and harmony; and order, dynamics, and chaos. The course will be one half art and one half mathematics, team-taught by faculty from the School of Art and the Department of Mathematics. This course is also offered by the School of Art as FA 1020. This course may not be used as a prerequisite for other Mathematics courses. This course cannot be used as part of an Honours, Major, General or Minor program in the mathematical sciences. Not available to any student already holding a grade of "C" or better in any Mathematics course with the exception of MATH 1010, MATH 1018, MATH 1080, MATH 1090, the former MATH 1190, or MATH 1191. Not to be taken concurrently with any other Mathematics course with the exception of MATH 1010, MATH 1018, MATH 1080, MATH 1090 or MATH 1191.
Equiv To: FA 1020
Mutually Exclusive: MATH 1200, MATH 1201, MATH 1210, MATH 1211, MATH 1220, MATH 1230, MATH 1232, MATH 1240, MATH 1241, MATH 1300, MATH 1301, MATH 1310, MATH 1500, MATH 1501, MATH 1510, MATH 1520, MATH 1524, MATH 1690, MATH 1700, MATH 1701, MATH 1710
Attributes: Mathematics Requirement, Science, Recommended Intro Courses

MATH 1080 Fundamentals of Mathematical Reasoning 3 cr
(Lab required) Logic, reasoning, problem solving, introduction to set theory, mathematical induction, introduction to number theory, bases of arithmetic and the standard algorithms, working with fractions and functions. The course is recommended for students intending to become early or middle years school teachers. This course cannot be used as part of an Honours, Major, General or Minor program in the mathematical sciences.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: One of Pre-Calculus Mathematics 40S (50%), the former Mathematics 40S (300) (50%), Applied Mathematics 40S (65%), MATH 1018 (C+), or MSKL 0100.
Attributes: Mathematics Requirement, Science, Recommended Intro Courses

MATH 1090 Mathematical Reasoning in Euclidean Geometry 3 cr
(Lab required) Introduction to Euclidean geometry with emphasis on mathematical reasoning. Perimeter, area, volume, triangle congruence, parallel lines and quadrilaterals, similarity, circles, coordinate geometry or transformation geometry. The course is recommended for students intending to become early or middle years school teachers. This course cannot be used as part of an Honours, Major, General or Minor program in the mathematical sciences.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: MATH 1080.
Attributes: Mathematics Requirement, Science, Recommended Intro Courses

MATH 1200 Elements of Discrete Mathematics 3 cr
(Lab Required) Sequences and series, trigonometry, complex numbers, algebra of polynomials, approximation of zeros of functions, linear difference equations. Not to be held with MATH 1210, MATH 1211 or MATH 1201. Not available to any student holding credit in any Mathematics course numbered 2000 or higher, unless MATH 1200 is a required course in a student's program.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: a minimum grade of 60% in Pre-calculus 40S or the former Mathematics 40S (300), or a grade of 60% or better in the MSKL 0100 offered by Extended Education.
Equiv To: MATH 1201
Mutually Exclusive: FA 1020, MATH 1010, MATH 1018, MATH 1020, MATH 1191, MATH 1210, MATH 1211
Attributes: Mathematics Requirement, Science, Recommended Intro Courses

MATH 1210 Techniques of Classical and Linear Algebra 3 cr
(Lab required) To introduce a variety of practical algebraic concepts and skills necessary for the study of calculus and advanced engineering mathematics. The emphasis of this course is in the development of methodology and algebraic skill necessary for successful completion of subsequent engineering mathematics courses. This course is intended for Engineering and Geophysics students. May not be held with MATH 1200, MATH 1201, MATH 1211, MATH 1220, MATH 1300, MATH 1301, or MATH 1310.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: One of Pre-calculus Mathematics 40S (60%), the former Mathematics 40S (300) (60%), MATH 1018 (C+), or MSKL 0100.
Equiv To: MATH 1211
Mutually Exclusive: FA 1020, MATH 1010, MATH 1018, MATH 1020, MATH 1191, MATH 1200, MATH 1201, MATH 1220, MATH 1300, MATH 1301, MATH 1310
Attributes: Mathematics Requirement, Science, Recommended Intro Courses

MATH 1220 Linear Algebra 1 3 cr
(Lab required) This course is intended for students in mathematically rich disciplines including those planning to enter an Honours or Major program in Mathematics or Statistics. An introduction to vectors, matrices, systems of linear equations and three-dimensional geometry. May not be held with MATH 1210, MATH 1211, MATH 1300, MATH 1301, MATH 1310, or the former MATH 1680.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: One of Pre-calculus Mathematics 40S (70%), the former Mathematics 40S (300) (70%), MATH 1018 (B), or MSKL 0100 (B).
Mutually Exclusive: FA 1020, MATH 1010, MATH 1018, MATH 1020, MATH 1191, MATH 1210, MATH 1211, MATH 1300, MATH 1301, MATH 1310, MATH 1680
Attributes: Mathematics Requirement, Science, Recommended Intro Courses

MATH 1230 Differential Calculus 3 cr
(Lab required) The course is intended for students in mathematically rich disciplines including those planning to enter an Honours or Major program in Mathematics or Statistics. Rigorous treatment of limits, continuity, and differentiation (with epsilon-delta proofs), applications in optimization problems, related rates, l'Hopital's rule, curve sketching, Taylor polynomials. May not be held with MATH 1500, MATH 1501, MATH 1510, the former MATH 1520, MATH 1524, MATH 1525, or the former MATH 1680.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: One of Pre-calculus Mathematics 40S (70%), the former Mathematics 40S (300) (70%), MATH 1018 (B), or MSKL 0100 (B).
Mutually Exclusive: FA 1020, MATH 1010, MATH 1018, MATH 1020, MATH 1191, MATH 1500, MATH 1510, MATH 1520, MATH 1524, MATH 1525, MATH 1680, MATH 1690
Attributes: Mathematics Requirement, Science, Recommended Intro Courses

MATH 1232 Integral Calculus 3 cr
(Lab required) This course is intended for students in mathematically rich disciplines including those planning to enter an Honours or Major program in Mathematics or Statistics. Integral calculus: theory and techniques of integration, curve sketching (parametric and polar), volume, arc length, surface area and partial derivatives. Sequences and series. May not be held with MATH 1700, MATH 1701, or MATH 1710.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: One of MATH 1230, MATH 1500 (B), MATH 1501 (B), or MATH 1510 (B).
Mutually Exclusive: FA 1020, MATH 1010, MATH 1018, MATH 1020, MATH 1191, MATH 1690, MATH 1700, MATH 1710
Attributes: Mathematics Requirement, Science, Recommended Intro Courses

MATH 1240 Elementary Discrete Mathematics 3 cr
(Lab required) The course is intended for students in mathematically rich disciplines including those planning to enter an Honours or Major program in Mathematics or Statistics. An introduction to mathematical ideas, proof, techniques, and mathematical writing, explored through topics in discrete mathematics. May not be held with MATH 1241, MATH 2136 or the former MATH 3120.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: One of Pre-calculus Mathematics 40S (60%), the former Mathematics 40S (300) (60%), MATH 1018 (B), or MSKL 0100.
Equiv To: MATH 1241
Mutually Exclusive: MATH 2136, MATH 3120
Attributes: Mathematics Requirement, Science, Recommended Intro Courses

MATH 1300 Vector Geometry and Linear Algebra 3 cr
(Lab required) An introduction to vectors, matrices, systems of linear equations and three-dimensional geometry. May not be held for credit with MATH 1210, MATH 1211, MATH 1220, MATH 1310, MATH 1301, or the former MATH 1680.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: One of Pre-calculus Mathematics 40S (60%), Applied Mathematics 40S (70%), the former Mathematics 40S (300) (60%), MATH 1018 (C+), or MSKL 0100.
Equiv To: MATH 1301, MATH 1310
Mutually Exclusive: FA 1020, MATH 1010, MATH 1018, MATH 1020, MATH 1191, MATH 1210, MATH 1211, MATH 1220, MATH 1680
Attributes: Mathematics Requirement, Science, Recommended Intro Courses

MATH 1310 Matrices for Management and Social Sciences 3 cr
(Lab Required) Matrix methods with examples relevant to the Management and Social Sciences. Topics include vectors, matrices, systems of linear equations, and determinants; applications include economic models, the simplex method for linear programming, Markov chains, and game theory. May not be held with MATH 1210, MATH 1211, MATH 1220, MATH 1300, MATH 1301, or the former MATH 1680.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: a minimum grade of 60% in Pre-calculus Mathematics 40S or the former Mathematics 40S (300), or MSKL 0100 offered by Extended Education. NOTE: A minimum grade of 70% in Applied Mathematics 40S may be used as a prerequisite to this course.
Equiv To: MATH 1300, MATH 1301
Mutually Exclusive: FA 1020, MATH 1010, MATH 1018, MATH 1020, MATH 1191, MATH 1210, MATH 1211, MATH 1220, MATH 1680
Attributes: Mathematics Requirement, Science, Recommended Intro Courses

MATH 1500 Introduction to Calculus 3 cr
(Lab required) Differentiation and integration of elementary functions, with applications to maxima and minima, rates of change, area, and volume. May not be held with MATH 1230, MATH 1501, MATH 1510, the former MATH 1520, MATH 1524, MATH 1525, or the former MATH 1680.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: One of Pre-calculus Mathematics 40S (60%), the former Mathematics 40S (300) (60%), MATH 1018 (C+), or MSKL 0100.
Equiv To: MATH 1501, MATH 1510, MATH 1520, MATH 1530
Mutually Exclusive: FA 1020, MATH 1010, MATH 1018, MATH 1020, MATH 1191, MATH 1230, MATH 1524, MATH 1525, MATH 1680, MATH 1690
Attributes: Mathematics Requirement, Science, Recommended Intro Courses

MATH 1510 Applied Calculus 1 3 cr
(Lab required) Functions and graphs; limits and continuity; differentiation of functions defined explicitly, implicitly and parametrically; applications of derivatives to velocity and acceleration, related rates, maxima and minima; differentials, indefinite and definite integrals, application of integration to area. Physical applications in this course make it especially suitable for students intending to take programs in engineering. May not be held with MATH 1230, MATH 1500, MATH 1501, the former MATH 1520, MATH 1524, MATH 1525, or the former MATH 1680.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: (One of Pre-calculus Mathematics 40S (60%), the former Mathematics 40S (300) (60%), MATH 1018 (C+), or MSKL 0100) and (one of Physics 40S (300) (50%), PHYS 1018, PHYS 0900 (P), or PSKL 0100 (P)).
Equiv To: MATH 1500, MATH 1501, MATH 1520, MATH 1530
Mutually Exclusive: FA 1020, MATH 1010, MATH 1018, MATH 1020, MATH 1191, MATH 1230, MATH 1524, MATH 1525, MATH 1680, MATH 1690
Attributes: Mathematics Requirement, Science, Recommended Intro Courses

MATH 1524 Mathematics for Management and Social Sciences 3 cr
(Lab required) Differentiation and integration of functions of one variable. Solving systems of linear equations, introduction to matrices. Emphasizes applications in the areas of management and social sciences. May not be held with MATH 1230, MATH 1500, MATH 1501, MATH 1510, the former MATH 1520, MATH 1525, or the former MATH 1680.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: One of Pre-calculus Mathematics 40S (60%), the former Mathematics 40S (300) (60%), MATH 1018 (C+), or MSKL 0100.
Equiv To: MATH 1525
Mutually Exclusive: FA 1020, MATH 1010, MATH 1018, MATH 1020, MATH 1230, MATH 1500, MATH 1501, MATH 1510, MATH 1520, MATH 1680, MATH 1690
Attributes: Mathematics Requirement, Science, Recommended Intro Courses

MATH 1700 Calculus 2 3 cr
(Lab required) Theory and techniques of integration, curve sketching, volume, arc length, and surface area. May not be held with MATH 1232, MATH 1701, or MATH 1710.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: one of MATH 1230, MATH 1500, MATH 1501, MATH 1510, the former MATH 1520, MATH 1524, MATH 1525, or the former MATH 1680.
Equiv To: MATH 1701, MATH 1710, MATH 1730
Mutually Exclusive: FA 1020, MATH 1010, MATH 1018, MATH 1020, MATH 1191, MATH 1232, MATH 1690
Attributes: Mathematics Requirement, Science, Recommended Intro Courses

MATH 1710 Applied Calculus 2 3 cr
(Lab required) Applications of integration to volumes, centres of mass, moments of inertia, work and fluid pressure; differentiation of trigonometric, inverse trigonometric, exponential, and logarithmic functions; techniques of integration; polar coordinates. Physical applications in this course make it especially suitable for students intending to take programs in engineering. May not be held with MATH 1232, MATH 1700, or MATH 1701.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: one of MATH 1230, MATH 1500, MATH 1501, MATH 1510, the former MATH 1520, MATH 1524, MATH 1525, or the former MATH 1680. Pre-or corequisite: PHYS 1050 or PHYS 1051.
Equiv To: MATH 1700, MATH 1730
Mutually Exclusive: FA 1020, MATH 1010, MATH 1018, MATH 1020, MATH 1191, MATH 1232, MATH 1690
Attributes: Mathematics Requirement, Science, Recommended Intro Courses

MATH 2020 Algebra 1 3 cr
(Lab required) The course is intended for students in mathematically rich disciplines. Groups, rings, fields: elementary concepts and examples. May not be held with MATH 2021 or the former MATH 3350.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: MATH 2090 or MATH 2091 or the former MATH 2352 or the former MATH 2300 (B) or MATH 2301 (B).
Equiv To: MATH 2021
Mutually Exclusive: MATH 3350
Attributes: Mathematics Requirement, Science

MATH 2030 Combinatorics 1 3 cr
(Lab required) Introductory combinatorics, including basic counting, permutations and combinations, enumeration, inclusion-exclusion, pigeonhole principle, solving basic recursions, relations, and derangements. May not be held MATH 2031 or the former MATH 3400.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: MATH 1240 or MATH 1241 or (the former MATH 2202 and one of the former MATH 2350 or the former MATH 2352) or consent of instructor.
Equiv To: MATH 2031
Mutually Exclusive: MATH 3400
Attributes: Mathematics Requirement, Science

MATH 2040 Curves and Surfaces 3 cr
(Lab required) Curves and surfaces in the plane and space. Intrinsic geometry of curves and surfaces: Serret Frenet frames, first and second fundamental forms, curvature and the Gauss map. Geodesics and parallel transport. Theorema Egregium and Gauss-Bonnet theorems.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: [one of MATH 1232, MATH 1700 (B), MATH 1701 (B), or MATH 1710 (B)] and [one of MATH 1220, MATH 1210 (B), MATH 1211 (B), MATH 1300 (C+), or MATH 1301 (C+)]; or consent of instructor. Pre- or corequisite: one of MATH 2150, MATH 2151, MATH 2720, or MATH 2721.
Attributes: Mathematics Requirement, Science

MATH 2070 Graph Theory 1 3 cr
(Lab required) Introduction to graphs, digraphs, and multigraphs. Topics include trees, cycles and circuits, planarity, basic graph algorithms, and applications of graph theory to social and physical sciences. May not be held with MATH 2071 or the former MATH 2400 or COMP 4340.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: [MATH 1240 or MATH 1241] and [one of MATH 1220, MATH 1210 (B), MATH 1211 (B), MATH 1300 (C+), or MATH 1301 (C+)].
Equiv To: MATH 2071
Mutually Exclusive: COMP 4340, MATH 2400
Attributes: Mathematics Requirement, Science

MATH 2080 Introduction to Analysis 3 cr
(Lab required) The course is intended for students in mathematically rich disciplines. Fundamental properties of the real number system as a complete ordered field, Archimedean property, existence of square roots, density of rational numbers, uncountability of real numbers. Sequences, subsequences, limit theorems, monotonicity, Bolzano-Weierstrass theorem, Cauchy sequences. Rigorous treatment of limits and continuity of functions of one and several variables. Uniform continuity. Applications. May not be held with MATH 2081 or the former MATH 2202.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: [one of MATH 1232, MATH 1700 (B), MATH 1701 (B), or MATH 1710 (B)] and [one of MATH 1220, MATH 1210 (B), MATH 1211 (B) MATH 1300 (C+), MATH 1301 (C+)] and [MATH 1240 or MATH 1241].
Equiv To: MATH 2081
Mutually Exclusive: MATH 2202
Attributes: Mathematics Requirement, Science

MATH 2090 Linear Algebra 2 3 cr
(Lab required) The course is intended for students in mathematically rich disciplines. Abstract vector spaces, linear transformations, bases and coordinatization, matrix representations, orthogonalization, diagonalization, principal axis theorem. May not be held with MATH 2091, the former MATH 2300, the former MATH 2301, the former MATH 2350, or the former MATH 2352.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: one of MATH 1220, MATH 1210 (B), MATH 1211 (B), MATH 1300 (C+), or MATH 1301 (C+).
Equiv To: MATH 2091
Mutually Exclusive: MATH 2300, MATH 2301, MATH 2350, MATH 2352
Attributes: Mathematics Requirement, Science

MATH 2120 Introductory Numerical Methods for Engineers 4 cr
(Lab Required) Numerical methods applied to problems in engineering; roots of nonlinear equations and systems of linear equations, numerical differentiation and integration, initial-value problems. For Engineering and Geophysics students only. May not be held with MATH 2600 or MATH 2601.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: one of COMP 1010, COMP 1011, COMP 1012, COMP 1013; pre- or corequisite: MATH 2132 or the former MATH 2100.
Mutually Exclusive: MATH 2160, MATH 2161, MATH 2600, MATH 2601, MECH 2150
Attributes: Mathematics Requirement, Science

MATH 2130 Engineering Mathematical Analysis 1 3 cr
(Lab required) Multivariable differential and integral calculus up to and including multiple integrals in cylindrical and spherical coordinates. This course is intended for students in Engineering and Geophysics programs. May not be held for credit with MATH 2150, MATH 2151, MATH 2720, MATH 2721, the former MATH 2110, or the former MATH 2750.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: (MATH 1210 or MATH 1211) and (one of MATH 1232, MATH 1700, MATH 1701, or MATH 1710).
Mutually Exclusive: MATH 2110, MATH 2150, MATH 2151, MATH 2720, MATH 2721, MATH 2750
Attributes: Mathematics Requirement, Science

MATH 2132 Engineering Mathematical Analysis 2 3 cr
(Lab required) Infinite series, Taylor and Maclaurin Series; ordinary differential equations including Laplace transforms. This course is intended for students in Engineering and Geophysics programs. May not be held for credit with the former MATH 2100, the former MATH 2730, the former MATH 2731, the former MATH 2800, or the former MATH 2801.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: (MATH 1210 or MATH 1211) and (one of MATH 1232, MATH 1700, MATH 1701, or MATH 1710).
Mutually Exclusive: MATH 2100, MATH 2730, MATH 2731, MATH 2750, MATH 2800, MATH 2801
Attributes: Mathematics Requirement, Science

MATH 2136 Mathematics for Computer Engineering 3 cr
(Lab required) The course covers Fourier series, elementary set theory, number theory, enumeration, graph theory and group theory. May not be held with MATH 1240, MATH 1241, the former MATH 3120, or the former COMP 2130. The course is for Price Faculty of Engineering students only.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: MATH 2132.
Mutually Exclusive: COMP 2130, MATH 1240, MATH 1241, MATH 3120
Attributes: Mathematics Requirement, Science

MATH 2150 Multivariable Calculus 3 cr
(Lab required) The course is intended for students in mathematically rich disciplines. Parametric curves, arc length and curvature. Functions of several variables. Level curves. Partial derivatives, gradient, divergence and curl. Max/min problems. Double and triple integrals, line and surface integrals of functions and vector fields, and applications. Green's, Stokes, and divergence theorems. May not be held with MATH 2130, MATH 2151, MATH 2720, MATH 2721, or the former MATH 2750.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: MATH 2080 or MATH 2081 or the former MATH 2202.
Equiv To: MATH 2151
Mutually Exclusive: MATH 2130, MATH 2720, MATH 2721, MATH 2750
Attributes: Mathematics Requirement, Science

MATH 2160 Numerical Analysis 1 3 cr
(Lab required) Elementary techniques of numerical solution of mathematical problems: solution of equations, linear systems of equations, nonlinear equations; finite and divided differences, interpolation; numerical differentiation and integration. May not be held with MATH 2120, MATH 2161, the former MATH 2600, or the former MATH 2601.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: [one of MATH 1232, MATH 1700 (B), MATH 1701 (B), or MATH 1710 (B)] and [one of MATH 1220, MATH 1210 (B), MATH 1211 (B), MATH 1300 (C+), or MATH 1301 (C+)].
Equiv To: MATH 2161
Mutually Exclusive: MATH 2120, MATH 2600, MATH 2601, MECH 2150
Attributes: Mathematics Requirement, Science

MATH 2170 Number Theory 1 3 cr
(Lab required) Prime numbers, unique factorization, linear congruences, Chinese remainder theorem, multiplicative functions, primitive roots and quadratic reciprocity. May not be held with the former MATH 2500 or the former MATH 2501.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: (MATH 2090 or MATH 2091) or (MATH 1240 or MATH 1241) or (the former MATH 2350 or the former MATH 2352) or (a "B" or better in the former MATH 2300 or the former MATH 2301).
Mutually Exclusive: MATH 2500
Attributes: Mathematics Requirement, Science

MATH 2180 Real Analysis 1 3 cr
(Lab required) Introduction to metric spaces including connectedness, compactness and continuity; topics in infinite series of numbers, and sequences and series of functions. May not be held with the former MATH 3230.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: MATH 2080 or MATH 2081 or the former MATH 2202.
Equiv To: MATH 2181
Mutually Exclusive: MATH 3230
Attributes: Mathematics Requirement, Science

MATH 2720 Multivariable Calculus 3 cr
(Lab required) Calculus of several variables. This course is intended for students in one of the following programs: Actuarial Mathematics, Data Science, Statistics (Honours or Majors), Physics (Honours or Majors), Geophysics (Honours or Majors), and Physical Geography. May not be held with MATH 2130, MATH 2150, MATH 2151, MATH 2721, the former MATH 2110, or the former MATH 2750.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: (one of MATH 1220, MATH 1210 (B), MATH 1211 (B), MATH 1300, MATH 1301, or MATH 1310) and (one of MATH 1232, MATH 1700, MATH 1701, MATH 1710).
Equiv To: MATH 2721
Mutually Exclusive: MATH 2110, MATH 2130, MATH 2150, MATH 2151, MATH 2750
Attributes: Mathematics Requirement, Science

MATH 2740 Mathematics of Data Science 3 cr
(Lab required) This course introduces some of the mathematical tools used in Data Science. Topics include linear algebra: least squares, singular value decomposition, principal components analysis, and graph theory: centrality, social network theory, clustering. This course can only be used as an elective in an Honours, Major, or Joint Honours program in Mathematics.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: [(MATH 1210 (B) or MATH 1211 (B)) or (one of MATH 1220, MATH 1300, or MATH 1301)] and (one of MATH 1232, MATH 1700, MATH 1701, or MATH 1710).
Attributes: Mathematics Requirement, Science

MATH 2920 Special Topics in Mathematics 3 cr
Topics of current interest in Mathematics that will vary with the needs and interests of students and faculty. This course can be completed as a topics course multiple times under different titles.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: Consent of Department.
Attributes: Mathematics Requirement, Science

MATH 3132 Engineering Mathematical Analysis 3 3 cr
(Lab required) Vector integral calculus; series of Ordinary differential equations; Fourier series and Partial differential equations. This course is intended for students in Engineering and Geophysics programs. May not be held with former MATH 3100, the former MATH 3740, or the former MATH 3800.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: MATH 2130 and MATH 2132.
Mutually Exclusive: MATH 3100, MATH 3740, MATH 3800
Attributes: Mathematics Requirement, Science

MATH 3142 Engineering Mathematical Analysis 4 3 cr
Introduction to discrete mathematics; systems of linear differential equations; complex function theory and applications. For Engineering and Geophysics students only. May not be held with MATH 3110, MATH 3700, MATH 3710, or MATH 3800.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: MATH 2130; and MATH 2132 or the former MATH 2110.
NOTE: MATH 3132 is highly recommended.
Mutually Exclusive: MATH 3110, MATH 3700, MATH 3710, MATH 3800
Attributes: Mathematics Requirement, Science

MATH 3320 Algebra 2 3 cr
Basic structure theory of groups, integral domains and field extensions. Not to be held with the former MATH 3350.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: MATH 2020 or MATH 2021 or (the former MATH 3300 and consent of instructor).
Mutually Exclusive: MATH 3350
Attributes: Mathematics Requirement, Science

MATH 3322 Algebra 3 3 cr
A continuation of topics in Algebra 1 and Algebra 2. More structure theory of groups, general ring theory, fields and field extensions, Galois theory.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: MATH 3320 or (the former MATH 3350 and consent of instructor).
Attributes: Mathematics Requirement, Science

MATH 3330 Computational Algebra 3 cr
An introduction to the use of computers for symbolic mathematical computation, involving solving nonlinear systems and differential equations. A suitable software package will be used to explore applications.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: MATH 2090 or MATH 2091 or the former MATH 2300 or the former MATH 2301 or the former MATH 2350 or the former MATH 2352 or consent of instructor.
Attributes: Mathematics Requirement, Science

MATH 3340 Complex Analysis 1 3 cr
Analytic functions, Cauchy's theorem and integral formula, series representation of analytic functions, calculus of residues, Rouche's theorem and the principle of the argument. May not be held with the former MATH 3710.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: (MATH 2180 or the former MATH 3230) and [MATH 2150 or MATH 2151 or MATH 2720 (B) or MATH 2721 (B) or the former MATH 2750].
Mutually Exclusive: MATH 3710
Attributes: Mathematics Requirement, Science

MATH 3360 Combinatorics 2 3 cr
Advanced topics in combinatorics, including generating functions, elementary design theory, recurrences, chains and antichains, Polya counting. The course is challenging and is intended for students in mathematically rich disciplines. May not be held with the former MATH 4400.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: MATH 2030 or MATH 2031 or the former MATH 3400.
Mutually Exclusive: MATH 4400
Attributes: Mathematics Requirement, Science

MATH 3370 Graph Theory 2 3 cr
Advanced topics in graph theory, including matchings and coverings, optimization, factors, flows, extremal graph theory, basic Ramsey theory, connectivity, and spectral graph theory. Selected applications in science and operations research are studied. The course is challenging and is intended for students in mathematically rich disciplines. May not be held with COMP 4340.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: MATH 2070 or MATH 2071 or the former MATH 2400 (B) or permission of instructor.
Mutually Exclusive: COMP 4340
Attributes: Mathematics Requirement, Science

MATH 3380 Introduction to Projective Planes 3 cr
Affine planes and projective planes, cross ratio, complex projective plane (the great unifier), Desargues' theorem, projective planes over division rings, Pappus' theorem and commutativity, the fundamental theorem for projectivities on a line, introduction of coordinates in a projective plane. May not be held with the former MATH 2552 or the former MATH 3430.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: MATH 2020 or MATH 2021 or the former MATH 3300 or the former MATH 3350 or consent of instructor.
Mutually Exclusive: MATH 2550, MATH 2551, MATH 2552, MATH 3430
Attributes: Mathematics Requirement, Science

MATH 3390 Introduction to Topology 3 cr
Topological spaces, continuity, connectedness, compactness, separation properties. May not be held with the former MATH 3240.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: MATH 2180 or the former MATH 3230 or consent of instructor.
Mutually Exclusive: MATH 3240
Attributes: Mathematics Requirement, Science

MATH 3410 Introduction to Mathematical Logic 3 cr
Propositional and first-order logic. Recursion theory. May not be held with the former MATH 4250.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: MATH 2020 or MATH 2021 or the former MATH 2202 or the former MATH 2352 or consent of instructor.
Mutually Exclusive: MATH 4250
Attributes: Mathematics Requirement, Science

MATH 3420 Numerical Analysis 2 3 cr
Numerical methods for eigenvalue problems, nonlinear systems, initial-value problems, boundary-value problems; finite difference methods for ordinary and partial differential equations; error analysis. Not to be held with the former MATH 3600 or the former MATH 3601.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: [MATH 2090 or MATH 2091 or the former MATH 2300 (B) or the former MATH 2301 (B) or the former MATH 2352] and [MATH 2150 or MATH 2151 or MATH 2720 (B) or MATH 2721 (B) or the former MATH 2750] and (MATH 2160 or MATH 2161 or the former MATH 2600 or the former MATH 2601). Pre- or corequisite: MATH 3440 or the former MATH 2800 or the former MATH 2801.
Mutually Exclusive: MATH 3600
Attributes: Mathematics Requirement, Science

MATH 3440 Ordinary Differential Equations 3 cr
Theory and applications of ordinary differential equations; existence and uniqueness of solutions, linear systems, simple nonlinear systems. This course is theory-based and is intended for students in mathematically rich disciplines. Not to be held with the former MATH 3800.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: MATH 2180 or [(MATH 1300 (B) or MATH 1301 (B)) and (the former MATH 2730 (B) or the former MATH 2731 (B) or the former MATH 2750)].
Mutually Exclusive: MATH 3800
Attributes: Mathematics Requirement, Science

MATH 3460 Partial Differential Equations 3 cr
Method of characteristics for first order PDEs, wave, beam, heat and Laplace equations, derivation of PDEs, existence and uniqueness, energy estimates, well-posedness, maximum principles, separation of variables. Not to be held with the former MATH 3810.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: [(MATH 2150 or MATH 2151 or the former MATH 2750) or ((MATH 2720 (B) or MATH 2721 (B)) and (the former MATH 2730 (B) or the former MATH 2731 (B)))] and [MATH 3440 or the former MATH 3800].
Mutually Exclusive: MATH 3810
Attributes: Mathematics Requirement, Science

MATH 3472 Real Analysis 3 3 cr
Fourier series and Fourier transforms; orthogonal systems and L2 theory, convergence and approximation. Multivariable calculus of maps from Rn to Rm, general chain rule and general notion of derivative, implicit function and inverse function theorems. Not to be held with the former MATH 3740 or the former MATH 3760.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: MATH 3470.
Mutually Exclusive: MATH 3476, MATH 3740, MATH 3760
Attributes: Mathematics Requirement, Science

MATH 3474 Real Analysis 2 3 cr
Multivariable calculus of maps from Rn to Rm, general chain rule and general notion of derivative, implicit function and inverse function theorems. Functions of bounded variation and Riemann-Stieltjes integration. May not to be held with the former MATH 3470, the former MATH 3740, or the former MATH 3760.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: [One of MATH 2150, MATH 2151, MATH 2720 (B), MATH 2721 (B), or the former MATH 2750] and [MATH 2180 or the former MATH 3230].
Mutually Exclusive: MATH 3470, MATH 3740, MATH 3760
Attributes: Mathematics Requirement, Science

MATH 3476 Real Analysis 3 3 cr
This course provides an introduction to Lebesgue integration theory and Fourier theory. It includes a thorough development of the theory of Fourier series and approximations and an introduction to Fourier integral transforms. May not be held with MATH 3472, the former MATH 3470, the former MATH 3740, or the former MATH 3760.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: MATH 3474.
Mutually Exclusive: MATH 3470, MATH 3472, MATH 3740, MATH 3760
Attributes: Mathematics Requirement, Science

MATH 3480 Set Theory 3 cr
Axiomatic set theory. Cardinality, well-ordered sets, ordinal numbers, cardinal numbers. Axiom of Choice. Ordinal and cardinal arithmetic. Transfinite induction and recursion. May not be held with the former MATH 3220.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: MATH 2020 or MATH 2021 or the former MATH 2202 or consent of instructor.
Mutually Exclusive: MATH 3220
Attributes: Mathematics Requirement, Science

MATH 3610 Introduction to Mathematical Modelling 3 cr
An introduction to the principles and techniques involved in the design, development, solution, testing and revision of mathematical models of real world phenomena illustrated through the discussion of case studies. May not be held with the former MATH 3820 or the former MATH 3821.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: MATH 2150 or MATH 2151 or MATH 2720 (B) or MATH 2721 (B) or MATH 2130 (B) or consent of Instructor.
Mutually Exclusive: MATH 3820, MATH 3821
Attributes: Mathematics Requirement, Science

MATH 3920 Intermediate Topics in Mathematics 3 cr
Topics of current interest in Mathematics that will vary with the needs and interests of students and faculty. This course can be completed as a topics course multiple times under different titles.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: Consent of Department.
Attributes: Mathematics Requirement, Science

MATH 4240 Advanced Group Theory 3 cr
Representation theory of finite groups, presentations of finite and infinite groups, or other topics.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: MATH 3322 or the former MATH 3350 or consent of instructor.
Attributes: Mathematics Requirement, Science

MATH 4260 Abstract Measure Theory 3 cr
Lebesgue and abstract measures, measurable functions, convergence theorems, absolutely continuous functions, measure spaces, the Radon-Nikodym theorem, Fubini's and Tonnelli's theorems. Not to be held with the former MATH 4750.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: [One of MATH 3476, MATH 3472, the former MATH 3740 (B +), or the former MATH 3760.]
Mutually Exclusive: MATH 4750
Attributes: Mathematics Requirement, Science

MATH 4270 Algebraic Topology 3 cr
This course will serve as an introduction to elements of homotopy or homology theory. Not to be held with the former MATH 4230.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: (MATH 3320 or the former MATH 3300) and (MATH 3390 or the former MATH 3240), or consent of instructor.
Mutually Exclusive: MATH 4230
Attributes: Mathematics Requirement, Science

MATH 4280 Basic Functional Analysis 3 cr
Banach spaces, Hahn-Banach, open mapping and closed graph theorems, principle of uniform boundedness, linear operators and functionals, dual space, Lp and Lq spaces, weak and weak* topologies, Hilbert spaces and compact operators on a Hilbert space. Not to be held with the former MATH 4750.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: [One of MATH 3476, MATH 3472, the former MATH 3740 (B+), or the former MATH 3760] and [MATH 3390 or the former MATH 3240], or consent of instructor.
Mutually Exclusive: MATH 4750
Attributes: Mathematics Requirement, Science

MATH 4290 Complex Analysis 2 3 cr
Conformal mappings, normal families, harmonic and subharmonic functions, Perron's family, Dirichlet problem and Green's function. Not to be held with the former MATH 4710.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: [MATH 3340 or the former MATH 3700 (B+) or the former MATH 3710] and (MATH 3390 or the former MATH 3240).
Mutually Exclusive: MATH 4710
Attributes: Mathematics Requirement, Science

MATH 4300 Combinatorial Geometry 3 cr
Topics in combinatorial geometry, including arrangements of convex bodies, introduction to polytopes, problems in discrete geometry, repeated distances, and geometric graphs.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: MATH 3360 or the former MATH 3400 or consent of instructor.
Attributes: Mathematics Requirement, Science

MATH 4320 Dynamical Systems 3 cr
Techniques for the qualitative analysis of nonlinear systems of ordinary differential equations and discrete-time systems. Not to be held with the former MATH 4800.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: MATH 3440 or the former MATH 3800.
Mutually Exclusive: MATH 4800
Attributes: Mathematics Requirement, Science

MATH 4330 Fundamentals of Approximation Theory 3 cr
Theoretical aspects of approximation theory: density, existence, uniqueness; direct and inverse theorems for polynomial approximation.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: (MATH 2080 or MATH 2081 or the former MATH 2202) and (MATH 2160 or MATH 2161 or the former MATH 2600 or the former MATH 2601), or consent of instructor.
Attributes: Mathematics Requirement, Science

MATH 4340 Introduction to Algebraic Geometry 3 cr
This course will introduce students to the basics of affine and projective varieties through a combination of basic theoretical tools and elementary examples.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: MATH 3322 or the former MATH 3350 or consent of instructor.
Attributes: Mathematics Requirement, Science

MATH 4360 Introduction to Differential Geometry 3 cr
Manifolds and submanifolds; vector and tensor fields, Lie brackets and derivatives. Also at least one of the following: exterior differential calculus and Stokes' theorem, introduction to Riemannian geometry, symplectic geometry and hamiltonian mechanics. Not to be held with the former MATH 4730.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: [One of MATH 3476, MATH 3472, the former MATH 3740 (B), or the former MATH 3760] and [MATH 3390 or the former MATH 3240].
Mutually Exclusive: MATH 4730
Attributes: Mathematics Requirement, Science

MATH 4370 Linear Algebra and Matrix Analysis 3 cr
Vector and matrix norms, matrix factorizations, eigenvalues and eigenvectors, theory of non-negative matrices. Applications to differential equations, math biology, numerical analysis, digital image processing, data mining, GPS, Markov chains, graph theory, etc. will be given in this course. Not to be held with the former MATH 4310.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: MATH 2090 or MATH 2091 or the former MATH 2300 (B) or the former MATH 2301 (B) or the former MATH 2350 or the former MATH 2352.
Mutually Exclusive: MATH 4310
Attributes: Mathematics Requirement, Science

MATH 4380 Mathematical Biology 3 cr
Formulation, analysis and simulation of suitable models in mathematical biology. Applications will be chosen from fields such as population dynamics, epidemiology, ecology, immunology and cellular dynamics. Not to be held with the former MATH 3530.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: MATH 4320 or the former MATH 3800 or consent of instructor.
Mutually Exclusive: MATH 3530
Attributes: Mathematics Requirement, Science

MATH 4390 Numerical Approximation Theory 3 cr
Computational aspects of approximation by interpolatory polynomials, convolutions, artificial neural networks, splines and wavelets.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: [MATH 2150 or MATH 2151 or MATH 2720 (B) or MATH 2721 (B) or the former MATH 2750] and (MATH 2160 or MATH 2161 or the former MATH 2600 or the former MATH 2601), or consent of instructor.
Attributes: Mathematics Requirement, Science

MATH 4440 Numerical Analysis of Partial Differential Equations 3 cr
Finite difference method, mathematical theory of Elliptic PDEs, finite element method, iterative solution of linear systems. Emphasis will be on the error analysis (stability, consistency and convergence) of the various methods.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: [One of MATH 3420, former MATH 3600, or the former MATH 3601] and [MATH 3460 or the former MATH 3810] and [One of MATH 3474, the former MATH 3470, the former MATH 3740 (B), or the former MATH 3760], or consent of instructor. It is recommended that MATH 4370 be taken prior to or at the same time.
Attributes: Mathematics Requirement, Science

MATH 4450 Number Theory 2 3 cr
Algebraic number theory, arithmetic geometry and analytic number theory, Diophantine equations, examples such as arithmetic of elliptic curves and Dirichlet L-functions. Not to be held with the former MATH 3450.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: [(MATH 2020 or MATH 2021) and MATH 2170] or [(the former MATH 2500 or the former MATH 2501) and the former MATH 2202 and the former MATH 2750], or consent of instructor.
Mutually Exclusive: MATH 3450
Attributes: Mathematics Requirement, Science

MATH 4460 Partial Differential Equations 2 3 cr
Green's function, Poisson, heat, Schrodinger and wave equations in two and three spatial dimensions, variational characterization of eigenvalues, Fourier and Laplace transforms, introduction to functional analytic techniques in PDEs. Not to be held with the former MATH 4810.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: [MATH 3460 or the former MATH 3810] and [one of MATH 3474, the former MATH 3470, the former MATH 3740 (B), or the former MATH 3760], or consent of instructor.
Mutually Exclusive: MATH 4810
Attributes: Mathematics Requirement, Science

MATH 4470 Rings and Modules 3 cr
The general theory of (non-commutative) rings, modules and algebras.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: MATH 3322 or the former MATH 3350 or consent of instructor.
Attributes: Mathematics Requirement, Science

MATH 4490 Optimization 3 cr
This course introduces the theory and practice of optimization. Both unconstrained and constrained problems are considered, as well as continuous and discrete optimization. Topics include linear programming, unconstrained optimization, constrained nonlinear optimization and integer programming. Applications to Statistics and Data Science will be explored. May not be held with the former MATH 3490.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisites: [one of MATH 2090, MATH 2091, MATH 2740, the former MATH 2300, the former MATH 2301, the former MATH 2350, or the former MATH 2352] and [one of MATH 2150, MATH 2151, MATH 2720, MATH 2721, or the former MATH 2750]; or consent of instructor.
Mutually Exclusive: MATH 3490
Attributes: Mathematics Requirement, Science

MATH 4910 Project Course in Mathematics 3 cr
A research project by the student in consultation with the department head and an appropriate supervising Faculty member. A written report will be required to be submitted by the end of the term. An oral examination may be required. This course is restricted to students in the fourth year of the Honours or Major program in Mathematics and is not available to Graduate Students. This course may not be held for credit with MATH 4900.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: Consent of Department.
Mutually Exclusive: MATH 4900
Attributes: Mathematics Requirement, Science

MATH 4920 Advanced Topics in Mathematics 3 cr
Advanced topics of current interest in Mathematics that will vary with the needs and interests of students and faculty. This course can be completed as a topics course multiple times under different titles.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: Consent of Department.
Attributes: Mathematics Requirement, Science

MATH 4921 Sujets choisis en mathématiques 3 cr
Sujets d'intèrêt courant en mathèmatiques ou en mathèmatiques appliqués, selon les besoins et interet des ètudiants et professeurs, incluant notamment des sujets specializes non disponibles dans les autres cours offerts par le secteur. L'ètudiant(e) ne peut se fair crèditer à la fois le MATH 4921 et le MATH 4920. Prèalable: autorisation par le chef du secteur des sciences mathèmatiques.
Equiv To: MATH 4920
Attributes: Université de Saint-Boniface