**FALL 2019 CONTRACT INSTRUCTOR ADVERTISED COURSES**

**Fall 2019**

**BIT 1101 [0.5 credit]  
Mathematics II for IMD**  
Tailored for students in the interactive Multi-media Design program, this course covers systems of linear equations, vector space of n-tuples, subspaces and bases, matrix transformations, kernel, range, matrix algebra and determinants, inner products and orthogonality, eigenvalues, diagonalization and applications.

Precludes additional credit for [BIT 1001](https://calendar.carleton.ca/search/?P=BIT%201001), [BIT 1201](https://calendar.carleton.ca/search/?P=BIT%201201), [ECON 1401](https://calendar.carleton.ca/search/?P=ECON%201401), [ECON 1402](https://calendar.carleton.ca/search/?P=ECON%201402), [MATH 1104](https://calendar.carleton.ca/search/?P=MATH%201104), [MATH 1107](https://calendar.carleton.ca/search/?P=MATH%201107), [MATH 1119](https://calendar.carleton.ca/search/?P=MATH%201119), [MATH 1401](https://calendar.carleton.ca/search/?P=MATH%201401), [MATH 1402](https://calendar.carleton.ca/search/?P=MATH%201402).  
Prerequisite(s): restricted to students in the B.I.T. degree program.  
Lectures three hours a week, tutorial and laboratory one hour a week.

**MATH 1004 [0.5 credit]  
Calculus for Engineering or Physics**  
Limits. Differentiation of the elementary functions. Rules of differentiation. Inverse trigonometric functions. Applications of differentiation: max-min problems, curve sketching, approximations.Definite and indefinite integrals, techniques of integration. Applications to areas and volumes.

Precludes additional credit for [BIT 1000](https://calendar.carleton.ca/search/?P=BIT%201000), [BIT 1100](https://calendar.carleton.ca/search/?P=BIT%201100), [BIT 1200](https://calendar.carleton.ca/search/?P=BIT%201200), [MATH 1002](https://calendar.carleton.ca/search/?P=MATH%201002), [MATH 1007](https://calendar.carleton.ca/search/?P=MATH%201007), [MATH 1009](https://calendar.carleton.ca/search/?P=MATH%201009).  
Prerequisite(s): Ontario Grade 12 Mathematics: Advanced Functions, or [MATH 0005](https://calendar.carleton.ca/search/?P=MATH%200005) and [MATH 0006](https://calendar.carleton.ca/search/?P=MATH%200006), or equivalent. Restricted to students in the Faculty of Engineering, or in certain B.Sc. and B.A.S. programs where specified.  
Lectures three hours a week, tutorial one hour a week.

**MATH 1007 [0.5 credit]  
Elementary Calculus I**  
Limits. Differentiation of the elementary functions, including trigonometric functions. Rules of differentiation. Applications of differentiation: max-min problems, curve sketching, approximations. Introduction to integration: definite and indefinite integrals, areas under curves, fundamental theorem of calculus. Precludes additional credit for BIT 1000, BIT 1100, BIT 1200, [MATH 1002](http://calendar.carleton.ca/search/?P=MATH%201002), [MATH 1004](http://calendar.carleton.ca/search/?P=MATH%201004), [MATH 1009](http://calendar.carleton.ca/search/?P=MATH%201009), [MATH 1401](http://calendar.carleton.ca/search/?P=MATH%201401)/[ECON 1401](http://calendar.carleton.ca/search/?P=ECON%201401), [MATH 1402](http://calendar.carleton.ca/search/?P=MATH%201402)/[ECON 1402](http://calendar.carleton.ca/search/?P=ECON%201402).  
Prerequisite(s): Ontario Grade 12 Mathematics: Advanced Functions; or [MATH 0005](http://calendar.carleton.ca/search/?P=MATH%200005) and [MATH 0006](http://calendar.carleton.ca/search/?P=MATH%200006); or equivalent.  
Lectures three hours a week, tutorial one hour a week.

**MATH 1009 [0.5 credit]  
Calculus: with Applications to Business**  
Applications of mathematics to business. Limits. Differentiation of the elementary functions. Rules of differentiation. Max-min problems, curve sketching. Functions of several variables, partial differentiation, constrained max-min. Definite and indefinite integrals. Precludes additional credit for [BIT 1000](https://calendar.carleton.ca/search/?P=BIT%201000), [BIT 1100](https://calendar.carleton.ca/search/?P=BIT%201100), [BIT 1200](https://calendar.carleton.ca/search/?P=BIT%201200), BUSI 1705 (no longer offered), [MATH 1002](https://calendar.carleton.ca/search/?P=MATH%201002), [MATH 1004](https://calendar.carleton.ca/search/?P=MATH%201004), [MATH 1007](https://calendar.carleton.ca/search/?P=MATH%201007), [MATH 1401](https://calendar.carleton.ca/search/?P=MATH%201401)/[ECON 1401](https://calendar.carleton.ca/search/?P=ECON%201401), [MATH 1402](https://calendar.carleton.ca/search/?P=MATH%201402)/[ECON 1402](https://calendar.carleton.ca/search/?P=ECON%201402). This course is not acceptable for (substitute) credit in any of the following degree programs: B.Math., and also B.Sc., B.C.S., B.Eng., B.I.D.  
Prerequisite(s): Ontario Grade 12 Mathematics: Advanced Functions, or [MATH 0005](https://calendar.carleton.ca/search/?P=MATH%200005), or equivalent.

Lectures three hours a week, tutorial one hour a week.

**MATH 1401 [0.5 credit]  
Elementary Mathematics for Economics I**  
Functional relations: functional forms and error terms. Graphing economic magnitudes: scatter diagrams, time-series graphs, functional relationships. Applied calculus: mechanics of differentiation and integration, elasticity, consumer/producer surplus. Applied algebra: solving systems of linear equations and Keynesian national-income analysis. Problem solving approaches.

Also listed as [ECON 1401](https://calendar.carleton.ca/search/?P=ECON%201401).  
Precludes additional credit for [BIT 1000](https://calendar.carleton.ca/search/?P=BIT%201000), [BIT 1001](https://calendar.carleton.ca/search/?P=BIT%201001), [BIT 1100](https://calendar.carleton.ca/search/?P=BIT%201100), [BIT 1101](https://calendar.carleton.ca/search/?P=BIT%201101), [BIT 1200](https://calendar.carleton.ca/search/?P=BIT%201200), [BIT 1201](https://calendar.carleton.ca/search/?P=BIT%201201); [MATH 1007](https://calendar.carleton.ca/search/?P=MATH%201007), [MATH 1009](https://calendar.carleton.ca/search/?P=MATH%201009), [MATH 1104](https://calendar.carleton.ca/search/?P=MATH%201104), [MATH 1107](https://calendar.carleton.ca/search/?P=MATH%201107), [MATH 1119](https://calendar.carleton.ca/search/?P=MATH%201119).  
Prerequisite(s): Ontario Grade 12 U Advanced Functions, or [MATH 0005](https://calendar.carleton.ca/search/?P=MATH%200005), or equivalent; and [ECON 1000](https://calendar.carleton.ca/search/?P=ECON%201000) or [FYSM 1003](https://calendar.carleton.ca/search/?P=FYSM%201003), which may be taken concurrently with [MATH 1401](https://calendar.carleton.ca/search/?P=MATH%201401)/[ECON 1401](https://calendar.carleton.ca/search/?P=ECON%201401).  
Lectures three hours a week, tutorial one hour a week.

**MATH 1402 [0.5 credit]  
Elementary Mathematics for Economics II**  
Calculus: including partial differentiation, definite and indefinite integrals, techniques of integration, and unconstrained optimization. Vectors and matrices: scalar multiplication, inner product, linear dependence, matrix operations, rank, invertible matrix theorem, and determinants. Economic applications such as profit maximization, comparative statics, and the Leontief input-output model.

Also listed as [ECON 1402](https://calendar.carleton.ca/search/?P=ECON%201402).  
Precludes additional credit for [BIT 1000](https://calendar.carleton.ca/search/?P=BIT%201000), [BIT 1001](https://calendar.carleton.ca/search/?P=BIT%201001), [BIT 1100](https://calendar.carleton.ca/search/?P=BIT%201100), [BIT 1101](https://calendar.carleton.ca/search/?P=BIT%201101), [BIT 1200](https://calendar.carleton.ca/search/?P=BIT%201200), [BIT 1201](https://calendar.carleton.ca/search/?P=BIT%201201); [MATH 1007](https://calendar.carleton.ca/search/?P=MATH%201007), [MATH 1009](https://calendar.carleton.ca/search/?P=MATH%201009), [MATH 1104](https://calendar.carleton.ca/search/?P=MATH%201104), [MATH 1107](https://calendar.carleton.ca/search/?P=MATH%201107), [MATH 1119](https://calendar.carleton.ca/search/?P=MATH%201119).  
Prerequisite(s): [ECON 1000](https://calendar.carleton.ca/search/?P=ECON%201000) or [FYSM 1003](https://calendar.carleton.ca/search/?P=FYSM%201003) with a grade of C- or higher, and [ECON 1401](https://calendar.carleton.ca/search/?P=ECON%201401)/[MATH 1401](https://calendar.carleton.ca/search/?P=MATH%201401) with a grade of C- or higher.  
Lectures three hours a week, tutorial one hour a week.

**MATH 2004 [0.5 credit]  
Multivariable Calculus for Engineering or Physics**  
Curves and surfaces. Polar, cylindrical and spherical coordinates. Partial derivatives, gradients, extrema and Lagrange multipliers. Exact differentials. Multiple integrals over rectangular and general regions. Integrals over surfaces. Line integrals. Vector differential operators. Green’s Theorem, Stokes’ theorem, Divergence Theorem. Applications.

Precludes additional credit for [BIT 2005](https://calendar.carleton.ca/search/?P=BIT%202005), [MATH 2000](https://calendar.carleton.ca/search/?P=MATH%202000), and [MATH 2008](https://calendar.carleton.ca/search/?P=MATH%202008).  
Prerequisite(s): i) [MATH 1005](https://calendar.carleton.ca/search/?P=MATH%201005) or [MATH 2007](https://calendar.carleton.ca/search/?P=MATH%202007); and ii) [MATH 1104](https://calendar.carleton.ca/search/?P=MATH%201104) or [MATH 1107](https://calendar.carleton.ca/search/?P=MATH%201107); or permission of the School. Restricted to students in the Faculty of Engineering, or in certain B.Sc. programs where specified.  
Lectures three hours a week, tutorial one hour a week.

**MATH 2007 [0.5 credit]  
Elementary Calculus II**  
Techniques of integration, improper integrals. Polar coordinates, parametric equations. Indeterminate forms, sequences and series, Taylor's formula and series. Precludes additional credit for [BIT 2007](https://calendar.carleton.ca/search/?P=BIT%202007), [MATH 1002](https://calendar.carleton.ca/search/?P=MATH%201002), [MATH 1005](https://calendar.carleton.ca/search/?P=MATH%201005).  
Prerequisite(s): i) [MATH 1004](https://calendar.carleton.ca/search/?P=MATH%201004), or a grade of C- or higher in [MATH 1007](https://calendar.carleton.ca/search/?P=MATH%201007); or permission of the School.  
Lectures three hours a week, tutorial one hour a week.

**MATH 2008 [0.5 credit]  
Intermediate Calculus**  
Partial differentiation, chain rule, gradient, line and multiple integrals with applications, transformations of multiple integrals.

Precludes additional credit for [BIT 2005](https://calendar.carleton.ca/search/?P=BIT%202005), [MATH 2000](https://calendar.carleton.ca/search/?P=MATH%202000), and [MATH 2004](https://calendar.carleton.ca/search/?P=MATH%202004).  
Prerequisite(s): one of [MATH 1002](https://calendar.carleton.ca/search/?P=MATH%201002), [MATH 1005](https://calendar.carleton.ca/search/?P=MATH%201005) or [MATH 2007](https://calendar.carleton.ca/search/?P=MATH%202007), and one of [MATH 1102](https://calendar.carleton.ca/search/?P=MATH%201102), [MATH 1104](https://calendar.carleton.ca/search/?P=MATH%201104) or [MATH 1107](https://calendar.carleton.ca/search/?P=MATH%201107).  
Lectures three hours a week and one hour tutorial.

**MATH 3800 [0.5 credit]  
Ordinary Differential Equations (Honours)**  
Analytic ordinary differential equations: series solutions of ordinary differential equations about ordinary and regular singular points. Asymptotic solutions. Sturm-Liouville theory. Bessel and Legendre functions. Fourier series.

Precludes additional credit for [MATH 3404](https://calendar.carleton.ca/search/?P=MATH%203404) and [PHYS 3808](https://calendar.carleton.ca/search/?P=PHYS%203808).  
Prerequisite(s): i) [MATH 2000](https://calendar.carleton.ca/search/?P=MATH%202000) with a grade of C- or higher, or ([MATH 3009](https://calendar.carleton.ca/search/?P=MATH%203009) with a grade of B or higher, and permission of the instructor); and ii) [MATH 2454](https://calendar.carleton.ca/search/?P=MATH%202454) with a grade of C- or higher, or ([MATH 2404](https://calendar.carleton.ca/search/?P=MATH%202404) with a grade of B or higher, and permission of the instructor).  
Lectures three hours a week and one hour tutorial.

**STAT 2507 [0.5 credit] Introduction to Statistical Modeling I** A data-driven introduction to statistics. Basic descriptive statistics, introduction to probability theory, random variables, various discrete and continuous distributions, contingency tables and goodness-of-fit, sampling distributions, distribution of sample mean, Central Limit Theorem, application to interval estimation and hypothesis testing. A statistical software package will be used. [STAT 2507](http://calendar.carleton.ca/search/?P=STAT%202507) may not be counted for credit in any program, if taken after successful completion of [STAT 2559](http://calendar.carleton.ca/search/?P=STAT%202559). Precludes additional credit for BIT 2000, BIT 2100, ECON 2200, [ECON 2201](http://calendar.carleton.ca/search/?P=ECON%202201), [GEOG 2006](http://calendar.carleton.ca/search/?P=GEOG%202006), [STAT 2606](http://calendar.carleton.ca/search/?P=STAT%202606), [STAT 3502](http://calendar.carleton.ca/search/?P=STAT%203502)

Prerequisite(s): an Ontario Grade 12 university-preparation Mathematics or equivalent, or permission of the School of Mathematics and Statistics. Lectures three hours a week, laboratory one hour a week.

**STAT 2509 [0.5 credit] Introduction to Statistical Modeling II** A data-driven approach to statistical modeling. Basics of experimental design, analysis of variance, simple linear regression and correlation, nonparametric procedures. A statistical software package will be used. Precludes additional credit for STAT 2607, ECON 2202.

Prerequisite(s): i) STAT 2507 and ii) Grade 12 Mathematics (Geometry and Discrete Mathematics), or MATH 0107; or equivalents; or permission of the School. Lectures three hours a week, laboratory one hour a week.

**STAT 2605 [0.5 credit]  
Probability Models**  
Basic probability; discrete random variables with focus on binomial and Poisson random variables; continuous random variables, transformation theorem, simulating continuous random variables; exponential random variable, normal random variable, sums of random variables, central limit theorem. Elements of Markov chains, and introduction to Poisson processes. Restricted to students in Bachelor of Computer Science, Bachelor of Mathematics in Computer Mathematics, and Bachelor of Engineering in Communications Engineering.

Precludes additional credit for [STAT 2655](https://calendar.carleton.ca/search/?P=STAT%202655) and [STAT 3502](https://calendar.carleton.ca/search/?P=STAT%203502).  
Prerequisite(s): [MATH 1007](https://calendar.carleton.ca/search/?P=MATH%201007) or [MATH 1004](https://calendar.carleton.ca/search/?P=MATH%201004) or [MATH 1002](https://calendar.carleton.ca/search/?P=MATH%201002), and [MATH 1104](https://calendar.carleton.ca/search/?P=MATH%201104) or [MATH 1107](https://calendar.carleton.ca/search/?P=MATH%201107) (or [MATH 1102](https://calendar.carleton.ca/search/?P=MATH%201102)).  
Lectures three hours a week, tutorial one hour a week.

**STAT 2606 [0.5 credit]  
Business Statistics I**  
Introduction to statistical computing; probability concepts; descriptive statistics; estimation and testing of hypotheses. Emphasis on the development of an ability to interpret results of statistical analyses with applications from business. Restricted to students in the School of Business.

Precludes additional credit for [BIT 2000](https://calendar.carleton.ca/search/?P=BIT%202000), BIT 2100 (no longer offered), BIT 2300 (no longer offered), ECON 2201 (no longer offered), [ECON 2210](https://calendar.carleton.ca/search/?P=ECON%202210), [ENST 2006](https://calendar.carleton.ca/search/?P=ENST%202006), [GEOG 2006](https://calendar.carleton.ca/search/?P=GEOG%202006), [STAT 2507](https://calendar.carleton.ca/search/?P=STAT%202507), and [STAT 3502](https://calendar.carleton.ca/search/?P=STAT%203502).  
Prerequisite(s): [MATH 1009](https://calendar.carleton.ca/search/?P=MATH%201009) with a grade of C- or better, or permission of the School.  
Lectures three hours a week and laboratory one hour a week.

**STAT 2607 [0.5 credit]  
Business Statistics II**  
Topics include: experimental design, multiple regression and correlation analysis, covariance analysis, and introductory time series. Use of computer packages. Restricted to students in the School of Business.

Precludes additional credit for [STAT 2509](https://calendar.carleton.ca/search/?P=STAT%202509), ECON 2202, [ECON 2220](https://calendar.carleton.ca/search/?P=ECON%202220).  
Prerequisite(s): [STAT 2606](https://calendar.carleton.ca/search/?P=STAT%202606).  
Lectures three hours a week and one hour laboratory.

**Stat 3661** **[0.5 credit]**

**Life Contingent Risk Modelling I**

Mixed distributions; conditional expectations; introduction to life insurance; traditional and modern insurance contracts; underwriting; premiums; pension plans and retirement benefits; survival models; reserves; present value random variable; force of mortality; life tables; insurance benefits; annuities; premium calculation.

Prerequisites: STAT 2660 and STAT 3506 with grades of C+ or higher; or permission of the School.

Lectures three hours a week, tutorial one hour a week.

**WINTER 2020 CONTRACT INSTRUCTOR ADVERTISED COURSES**

**Winter 2019**

**BIT 1001 [0.5 credit]  
Mathematics II for NET**  
Tailored for students in the Network Technology program, this course covers systems of linear equations, vector space of n-tuples, subspaces and bases, matrix transformations, kernel, range, matrix algebra and determinants, inner products and orthogonality, eigenvalues, diagonalization and applications.

Precludes additional credit for [BIT 1101](https://calendar.carleton.ca/search/?P=BIT%201101), [BIT 1201](https://calendar.carleton.ca/search/?P=BIT%201201), [ECON 1401](https://calendar.carleton.ca/search/?P=ECON%201401), [ECON 1402](https://calendar.carleton.ca/search/?P=ECON%201402), [MATH 1104](https://calendar.carleton.ca/search/?P=MATH%201104), [MATH 1107](https://calendar.carleton.ca/search/?P=MATH%201107), [MATH 1119](https://calendar.carleton.ca/search/?P=MATH%201119), [MATH 1401](https://calendar.carleton.ca/search/?P=MATH%201401), [MATH 1402](https://calendar.carleton.ca/search/?P=MATH%201402).  
Prerequisite(s): restricted to students in the B.I.T. degree program.  
Lectures three hours a week, tutorial and laboratory one hour a week.

**MATH 1004 [0.5 credit]  
Calculus for Engineering or Physics**  
Limits. Differentiation of the elementary functions. Rules of differentiation. Inverse trigonometric functions. Applications of differentiation: max-min problems, curve sketching, approximations.Definite and indefinite integrals, techniques of integration. Applications to areas and volumes.

Precludes additional credit for [BIT 1000](https://calendar.carleton.ca/search/?P=BIT%201000), [BIT 1100](https://calendar.carleton.ca/search/?P=BIT%201100), [BIT 1200](https://calendar.carleton.ca/search/?P=BIT%201200), [MATH 1002](https://calendar.carleton.ca/search/?P=MATH%201002), [MATH 1007](https://calendar.carleton.ca/search/?P=MATH%201007), [MATH 1009](https://calendar.carleton.ca/search/?P=MATH%201009).  
Prerequisite(s): Ontario Grade 12 Mathematics: Advanced Functions, or [MATH 0005](https://calendar.carleton.ca/search/?P=MATH%200005) and [MATH 0006](https://calendar.carleton.ca/search/?P=MATH%200006), or equivalent. Restricted to students in the Faculty of Engineering, or in certain B.Sc. and B.A.S. programs where specified.  
Lectures three hours a week, tutorial one hour a week.

**MATH 1005 [0.5 credit]  
Differential Equations and Infinite Series for Engineering or Physics**  
First-order differential equations. Second-order linear equations with constant coefficients, undetermined coefficients, variation of parameters. Sequences and series, convergence tests, estimation of sums. Power series, Taylor series, remainders. Fourier series.

Precludes additional credit for [BIT 2004](https://calendar.carleton.ca/search/?P=BIT%202004), [BIT 2007](https://calendar.carleton.ca/search/?P=BIT%202007), [MATH 1002](https://calendar.carleton.ca/search/?P=MATH%201002), [MATH 2007](https://calendar.carleton.ca/search/?P=MATH%202007), and [MATH 2404](https://calendar.carleton.ca/search/?P=MATH%202404).  
Prerequisite(s): i) [MATH 1004](https://calendar.carleton.ca/search/?P=MATH%201004); and ii) [MATH 1104](https://calendar.carleton.ca/search/?P=MATH%201104) (or [MATH 1107](https://calendar.carleton.ca/search/?P=MATH%201107)), either previously or concurrently; or equivalents; or permission of the School.Restricted to students in the Faculty of Engineering, or in certain B.Sc. programs where specified.  
Lectures three hours a week, tutorial one hour a week.

**MATH 1007 [0.5 credit]  
Elementary Calculus I**  
Limits. Differentiation of the elementary functions, including trigonometric functions. Rules of differentiation. Applications of differentiation: max-min problems, curve sketching, approximations. Introduction to integration: definite and indefinite integrals, areas under curves, fundamental theorem of calculus. Precludes additional credit for BIT 1000, BIT 1100, BIT 1200, [MATH 1002](http://calendar.carleton.ca/search/?P=MATH%201002), [MATH 1004](http://calendar.carleton.ca/search/?P=MATH%201004), [MATH 1009](http://calendar.carleton.ca/search/?P=MATH%201009), [MATH 1401](http://calendar.carleton.ca/search/?P=MATH%201401)/[ECON 1401](http://calendar.carleton.ca/search/?P=ECON%201401), [MATH 1402](http://calendar.carleton.ca/search/?P=MATH%201402)/[ECON 1402](http://calendar.carleton.ca/search/?P=ECON%201402).  
Prerequisite(s): Ontario Grade 12 Mathematics: Advanced Functions; or [MATH 0005](http://calendar.carleton.ca/search/?P=MATH%200005) and [MATH 0006](http://calendar.carleton.ca/search/?P=MATH%200006); or equivalent.  
Lectures three hours a week, tutorial one hour a week.

**MATH 1009 [0.5 credit]  
Calculus: with Applications to Business**  
Applications of mathematics to business. Limits. Differentiation of the elementary functions. Rules of differentiation. Max-min problems, curve sketching. Functions of several variables, partial differentiation, constrained max-min. Definite and indefinite integrals. Precludes additional credit for [BIT 1000](https://calendar.carleton.ca/search/?P=BIT%201000), [BIT 1100](https://calendar.carleton.ca/search/?P=BIT%201100), [BIT 1200](https://calendar.carleton.ca/search/?P=BIT%201200), BUSI 1705 (no longer offered), [MATH 1002](https://calendar.carleton.ca/search/?P=MATH%201002), [MATH 1004](https://calendar.carleton.ca/search/?P=MATH%201004), [MATH 1007](https://calendar.carleton.ca/search/?P=MATH%201007), [MATH 1401](https://calendar.carleton.ca/search/?P=MATH%201401)/[ECON 1401](https://calendar.carleton.ca/search/?P=ECON%201401), [MATH 1402](https://calendar.carleton.ca/search/?P=MATH%201402)/[ECON 1402](https://calendar.carleton.ca/search/?P=ECON%201402). This course is not acceptable for (substitute) credit in any of the following degree programs: B.Math., and also B.Sc., B.C.S., B.Eng., B.I.D.  
Prerequisite(s): Ontario Grade 12 Mathematics: Advanced Functions, or [MATH 0005](https://calendar.carleton.ca/search/?P=MATH%200005), or equivalent.

Lectures three hours a week, tutorial one hour a week.

**MATH 1104 [0.5 credit]  
Linear Algebra for Engineering or Science**  
Systems of linear equations. Matrix algebra. Determinants. Invertible matrix theorem. Cramer’s rule. Vector space R^n; subspaces, bases. Eigenvalues, diagonalization. Linear transformations, kernel, range. Complex numbers (including De Moivre’s theorem). Inner product spaces and orthogonality. Applications.

Precludes additional credit for [BIT 1001](https://calendar.carleton.ca/search/?P=BIT%201001), [BIT 1101](https://calendar.carleton.ca/search/?P=BIT%201101), [BIT 1201](https://calendar.carleton.ca/search/?P=BIT%201201), [MATH 1102](https://calendar.carleton.ca/search/?P=MATH%201102), [MATH 1107](https://calendar.carleton.ca/search/?P=MATH%201107), [MATH 1119](https://calendar.carleton.ca/search/?P=MATH%201119), [MATH 1401](https://calendar.carleton.ca/search/?P=MATH%201401)/[ECON 1401](https://calendar.carleton.ca/search/?P=ECON%201401), [MATH 1402](https://calendar.carleton.ca/search/?P=MATH%201402)/[ECON 1402](https://calendar.carleton.ca/search/?P=ECON%201402). Note: [MATH 1119](https://calendar.carleton.ca/search/?P=MATH%201119) is not an acceptable substitute for [MATH 1104](https://calendar.carleton.ca/search/?P=MATH%201104).  
Prerequisite(s): Ontario Grade 12 Mathematics: Advanced Functions, or [MATH 0005](https://calendar.carleton.ca/search/?P=MATH%200005), or equivalent, or permission of the School. Restricted to students in the Faculty of Engineering, the School of Computer Science, or in certain B.Sc. and B.A.S. programs where specified.  
Lectures three hours a week and tutorial one hour a week.

**MATH 1107 [0.5 credit]  
Linear Algebra I**  
Systems of linear equations; vector space of n-tuples, subspaces and bases; matrix transformations, kernel, range; matrix algebra and determinants. Dot product. Complex numbers (including de Moivre's Theorem, and n-th roots). Eigenvalues, diagonalization and applications. Note: [MATH 1119](https://calendar.carleton.ca/search/?P=MATH%201119) is not an acceptable substitute for [MATH 1107](https://calendar.carleton.ca/search/?P=MATH%201107).

Precludes additional credit for [BIT 1001](https://calendar.carleton.ca/search/?P=BIT%201001), [BIT 1101](https://calendar.carleton.ca/search/?P=BIT%201101), [BIT 1201](https://calendar.carleton.ca/search/?P=BIT%201201), [MATH 1102](https://calendar.carleton.ca/search/?P=MATH%201102), [MATH 1104](https://calendar.carleton.ca/search/?P=MATH%201104), [MATH 1119](https://calendar.carleton.ca/search/?P=MATH%201119), [MATH 1401](https://calendar.carleton.ca/search/?P=MATH%201401)/[ECON 1401](https://calendar.carleton.ca/search/?P=ECON%201401), [MATH 1402](https://calendar.carleton.ca/search/?P=MATH%201402)/[ECON 1402](https://calendar.carleton.ca/search/?P=ECON%201402).  
Prerequisite(s): Ontario Grade 12 Mathematics: Advanced Functions, or [MATH 0005](https://calendar.carleton.ca/search/?P=MATH%200005), or equivalent, or permission of the School.  
Lectures three hours a week and tutorial one hour a week.

**MATH 1401 [0.5 credit]  
Elementary Mathematics for Economics I**  
Functional relations: functional forms and error terms. Graphing economic magnitudes: scatter diagrams, time-series graphs, functional relationships. Applied calculus: mechanics of differentiation and integration, elasticity, consumer/producer surplus. Applied algebra: solving systems of linear equations and Keynesian national-income analysis. Problem solving approaches.

Also listed as [ECON 1401](https://calendar.carleton.ca/search/?P=ECON%201401).  
Precludes additional credit for [BIT 1000](https://calendar.carleton.ca/search/?P=BIT%201000), [BIT 1001](https://calendar.carleton.ca/search/?P=BIT%201001), [BIT 1100](https://calendar.carleton.ca/search/?P=BIT%201100), [BIT 1101](https://calendar.carleton.ca/search/?P=BIT%201101), [BIT 1200](https://calendar.carleton.ca/search/?P=BIT%201200), [BIT 1201](https://calendar.carleton.ca/search/?P=BIT%201201); [MATH 1007](https://calendar.carleton.ca/search/?P=MATH%201007), [MATH 1009](https://calendar.carleton.ca/search/?P=MATH%201009), [MATH 1104](https://calendar.carleton.ca/search/?P=MATH%201104), [MATH 1107](https://calendar.carleton.ca/search/?P=MATH%201107), [MATH 1119](https://calendar.carleton.ca/search/?P=MATH%201119).  
Prerequisite(s): Ontario Grade 12 U Advanced Functions, or [MATH 0005](https://calendar.carleton.ca/search/?P=MATH%200005), or equivalent; and [ECON 1000](https://calendar.carleton.ca/search/?P=ECON%201000) or [FYSM 1003](https://calendar.carleton.ca/search/?P=FYSM%201003), which may be taken concurrently with [MATH 1401](https://calendar.carleton.ca/search/?P=MATH%201401)/[ECON 1401](https://calendar.carleton.ca/search/?P=ECON%201401).  
Lectures three hours a week, tutorial one hour a week.

**MATH 1402 [0.5 credit]  
Elementary Mathematics for Economics II**  
Calculus: including partial differentiation, definite and indefinite integrals, techniques of integration, and unconstrained optimization. Vectors and matrices: scalar multiplication, inner product, linear dependence, matrix operations, rank, invertible matrix theorem, and determinants. Economic applications such as profit maximization, comparative statics, and the Leontief input-output model.

Also listed as [ECON 1402](https://calendar.carleton.ca/search/?P=ECON%201402).  
Precludes additional credit for [BIT 1000](https://calendar.carleton.ca/search/?P=BIT%201000), [BIT 1001](https://calendar.carleton.ca/search/?P=BIT%201001), [BIT 1100](https://calendar.carleton.ca/search/?P=BIT%201100), [BIT 1101](https://calendar.carleton.ca/search/?P=BIT%201101), [BIT 1200](https://calendar.carleton.ca/search/?P=BIT%201200), [BIT 1201](https://calendar.carleton.ca/search/?P=BIT%201201); [MATH 1007](https://calendar.carleton.ca/search/?P=MATH%201007), [MATH 1009](https://calendar.carleton.ca/search/?P=MATH%201009), [MATH 1104](https://calendar.carleton.ca/search/?P=MATH%201104), [MATH 1107](https://calendar.carleton.ca/search/?P=MATH%201107), [MATH 1119](https://calendar.carleton.ca/search/?P=MATH%201119).  
Prerequisite(s): [ECON 1000](https://calendar.carleton.ca/search/?P=ECON%201000) or [FYSM 1003](https://calendar.carleton.ca/search/?P=FYSM%201003) with a grade of C- or higher, and [ECON 1401](https://calendar.carleton.ca/search/?P=ECON%201401)/[MATH 1401](https://calendar.carleton.ca/search/?P=MATH%201401) with a grade of C- or higher.  
Lectures three hours a week, tutorial one hour a week.

**MATH 2008 [0.5 credit]  
Intermediate Calculus**  
Partial differentiation, chain rule, gradient, line and multiple integrals with applications, transformations of multiple integrals.

Precludes additional credit for [BIT 2005](https://calendar.carleton.ca/search/?P=BIT%202005), [MATH 2000](https://calendar.carleton.ca/search/?P=MATH%202000), and [MATH 2004](https://calendar.carleton.ca/search/?P=MATH%202004).  
Prerequisite(s): one of [MATH 1002](https://calendar.carleton.ca/search/?P=MATH%201002), [MATH 1005](https://calendar.carleton.ca/search/?P=MATH%201005) or [MATH 2007](https://calendar.carleton.ca/search/?P=MATH%202007), and one of [MATH 1102](https://calendar.carleton.ca/search/?P=MATH%201102), [MATH 1104](https://calendar.carleton.ca/search/?P=MATH%201104) or [MATH 1107](https://calendar.carleton.ca/search/?P=MATH%201107).  
Lectures three hours a week and one hour tutorial.

**MATH 2107 [0.5 credit]  
Linear Algebra II**  
Finite-dimensional vector spaces (over R and C), subspaces, linear independence and bases. Linear transformations and matrices. Inner product spaces (over R and C); Orthonormal bases. Eigenvalues and diagonalization. Bilinear and quadratic forms; principal axis theorem.

Precludes additional credit for [MATH 1102](https://calendar.carleton.ca/search/?P=MATH%201102).  
Prerequisite(s): i) [MATH 1104](https://calendar.carleton.ca/search/?P=MATH%201104), or a grade of C- or higher in [MATH 1107](https://calendar.carleton.ca/search/?P=MATH%201107) or MATH 1109; and ii) a grade of C- or higher in [MATH 1007](https://calendar.carleton.ca/search/?P=MATH%201007) or equivalent; or permission of the School. Note: in item i), [MATH 1119](https://calendar.carleton.ca/search/?P=MATH%201119) is NOT acceptable as a substitute for MATH 1109.  
Lectures three hours a week and one hour tutorial.

**MATH 3705 [0.5 credit]  
Mathematical Methods I**  
Laplace transforms, series solutions of ordinary differential equations, the Frobenius method. Fourier series and Fourier transforms, solutions of partial differential equations of mathematical physics, boundary value problems, applications. This course may be taken for credit as a 3000-level Honours Mathematics course, by students in any Honours program in the School of Mathematics and Statistics.

Precludes additional credit for [PHYS 3808](https://calendar.carleton.ca/search/?P=PHYS%203808).  
Prerequisite(s): i) [MATH 1005](https://calendar.carleton.ca/search/?P=MATH%201005) or [MATH 2404](https://calendar.carleton.ca/search/?P=MATH%202404), and ii) [MATH 2004](https://calendar.carleton.ca/search/?P=MATH%202004) or [MATH 2008](https://calendar.carleton.ca/search/?P=MATH%202008) or MATH 2009; or permission of the School.  
Lectures three hours a week and one hour tutorial.

**MATH 3800 [0.5 credit]  
Mathematical Modeling and Computational Methods**  
Design and analysis of mathematical models for problems in science. Computational methods, including function evaluation, interpolation, solution of linear equations, root finding, integration, solution of differential equations, Fourier series and Monte Carlo methods.

Also listed as CMPS 3800.  
Precludes additional credit for [MATH 3806](https://calendar.carleton.ca/search/?P=MATH%203806)/COMP 3806.  
Prerequisite(s): i) [MATH 1107](https://calendar.carleton.ca/search/?P=MATH%201107) or [MATH 1104](https://calendar.carleton.ca/search/?P=MATH%201104); ii) [MATH 1005](https://calendar.carleton.ca/search/?P=MATH%201005) or [MATH 2007](https://calendar.carleton.ca/search/?P=MATH%202007); and iii) knowledge of a computer language.  
Lectures three hours a week, laboratory one hour a week.

**STAT 2507 [0.5 credit] Introduction to Statistical Modeling I** A data-driven introduction to statistics. Basic descriptive statistics, introduction to probability theory, random variables, various discrete and continuous distributions, contingency tables and goodness-of-fit, sampling distributions, distribution of sample mean, Central Limit Theorem, application to interval estimation and hypothesis testing. A statistical software package will be used. [STAT 2507](http://calendar.carleton.ca/search/?P=STAT%202507) may not be counted for credit in any program, if taken after successful completion of [STAT 2559](http://calendar.carleton.ca/search/?P=STAT%202559). Precludes additional credit for BIT 2000, BIT 2100, ECON 2200, [ECON 2201](http://calendar.carleton.ca/search/?P=ECON%202201), [GEOG 2006](http://calendar.carleton.ca/search/?P=GEOG%202006), [STAT 2606](http://calendar.carleton.ca/search/?P=STAT%202606), [STAT 3502](http://calendar.carleton.ca/search/?P=STAT%203502)

Prerequisite(s): an Ontario Grade 12 university-preparation Mathematics or equivalent, or permission of the School of Mathematics and Statistics. Lectures three hours a week, laboratory one hour a week.

**STAT 2509 [0.5 credit] Introduction to Statistical Modeling II** A data-driven approach to statistical modeling. Basics of experimental design, analysis of variance, simple linear regression and correlation, nonparametric procedures. A statistical software package will be used. Precludes additional credit for STAT 2607, ECON 2202.

Prerequisite(s): i) STAT 2507 and ii) Grade 12 Mathematics (Geometry and Discrete Mathematics), or MATH 0107; or equivalents; or permission of the School. Lectures three hours a week, laboratory one hour a week.

**STAT 3507 [0.5 credit]  
Sampling Methodology**  
The sample survey as a vehicle for information collection in government, business, scientific and social agencies. Topics include: planning a survey, questionnaire design, simple random, stratified, systematic and cluster sampling designs, estimation methods, problem of non-response, related topics.

Prerequisite(s): one of: [STAT 2507](https://calendar.carleton.ca/search/?P=STAT%202507), [STAT 2509](https://calendar.carleton.ca/search/?P=STAT%202509), [STAT 2606](https://calendar.carleton.ca/search/?P=STAT%202606), [STAT 2607](https://calendar.carleton.ca/search/?P=STAT%202607), ECON 2201, ECON 2202, [ECON 2210](https://calendar.carleton.ca/search/?P=ECON%202210), [ECON 2220](https://calendar.carleton.ca/search/?P=ECON%202220), or equivalent; or permission of the School.  
Lectures three hours a week and one hour laboratory.

**Stat 3662 [0.5 credit]**

**Life Contingent Risk Modelling II**

Policy values; multiple state models; formulae for probability; Markov multiple state models; pension mathematics; yield curves; interest rate risk; emerging costs for life insurance; equity linked insurance; deterministic and stochastic pricing; reserving, participating, and universal life insurance.

Prerequisite: STAT 3661 with a grade of C+ or higher; or permission of the School.

Lectures three hours a week, tutorial one hour a week.