



CEGEP CHAMPLAIN - ST. LAWRENCE
201-BNJ-05: Topics in Mathematics
Winter 2009

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Ponderation: 3-2-3

Credits: 2 2/3

Prerequisite : Differential Calculus (Math 201-NYA-05)

Co-requisite : Vectors and Matrices (Math 201-NYC-05)

Program Objectives

We will introduce some of the fundamental mathematical notions not normally met in a college algebra or calculus. Topics will be unified by common approaches, techniques of proof (especially a beautiful new one!) and the study of discrete dynamical systems. The latter subject pulls together apparently unrelated topics, not only using them individually, but also making them depend on one another. Thus the course partially satisfies objective 00UV of the Science Programme.

More generally, you will learn

- 1) to solve problems systematically;
- 2) to reason logically;
- 3) to communicate in a clear and precise fashion;
- 4) to use previously acquired knowledge when dealing with new situations;
- 5) to use the appropriate information technologies;
- 6) to work autonomously;
- 7) the historical context of the concepts taught and
- 8) appropriate attitudes.

Course Objectives

You will learn:

- 1) to work with sequences and series of real and complex numbers and sequences of points in the plane;
- 2) to prove theorems using the axiom of mathematical induction;
- 3) to work with complex numbers;
- 4) to solve polynomial equations over the complex numbers;
- 5) to solve elementary combinatorics problems;
- 6) to solve basic probability problems and
- 7) to use a computer algebra system (Maple) as a mathematical tool.

Teaching Method

The course is given in an interactive lecture form, with frequent interludes for you to try out the ideas being considered.

Textbook

Robertson, Wallace, *Exploring the Labyrinth, Second Edition: With a Taste of Maple.*

Course Content

- 1) Sequences, recursive definitions, mathematical induction, arithmetic and geometric sequences, convergence. Discrete dynamical systems, fixed points and convergence, cobweb diagrams, solving affine systems, introduction to chaos and fractals, fractal dimension.
- 2) Series, evaluating some series by solving dynamical systems.
- 3) Planar transformations. Dynamical systems in the plane.
- 4) Complex numbers, basic operations, de Moivre's theorem, complex exponents. Affine functions, complex-valued dynamical systems.
- 5) Polynomials: synthetic division, the remainder theorem, zeros, the factor theorem. Finding solutions for certain polynomial equations. Using discrete dynamical systems to find approximate real solutions for equations: Newton's method.
- 6) Combinatorial analysis: permutations and combinations. The binomial theorem.
- 7) Basic probability theory, conditional probability, Markov chains, a probabilistic method for building fractals.

Evaluation

The evaluation in this course will verify that you have learned:

- 1) to use the appropriate concepts;
- 2) to represent situations in terms of dynamical systems;
- 3) to manipulate and apply complex numbers in a variety of situations;
- 4) to be able to justify your reasoning in the steps you take;
- 5) to manipulate algebraic expressions correctly;
- 6) to arrive at exact answers;
- 7) to arrive at correct interpretations of results;
- 8) to justify the steps you have taken in problem solving and
- 9) to use the appropriate terminology and notation.

There will be four term tests, four assignments and a final evaluation consisting of a final exam examination. The midterm and final grade will be calculated as follows:

	<u>Midtem grade</u>	<u>Final Grade</u>
Tests	2 at 40% each	4 at 12% each
Assignments	2 at 10% each	4 at 3% each
Final Exam	-	40%

If a student is absent for a test due to a College-authorized reason (see the *Institutional Policy on the Evaluation of Student Achievement (IPESA)*, section 2.7 on the SLC web site <http://www.slc.qc.ca/>), then a make up evaluation will be given, otherwise a student will be given zero (0). Late assignments will be severely penalised (10% taken off per day), and will not be accepted once I have given back the graded assignments.

Tests and assignments (including the final examination) will be graded on the proper use of English and Mathematics. That means that written passages must be grammatically correct and that proper mathematical style and notation will be required. Improper use may result in a loss of up to 15% of the grade.

Absences

Attendance is mandatory and a maximum of 5 absences will be tolerated (explained and/or unexplained). More than the 5 absences may mean failure in the course (see section 5.2 of the IPESA).

Rules & Regulations

St. Lawrence has definite regulations concerning cheating and plagiarism. Any student caught cheating or plagiarizing on an assignment or a test will automatically receive a zero for that assignment or test. If a student is caught a second time, automatic failure in the course will result and disciplinary action may be taken. For more information, the student can consult section 5.5 of the IPESA where these rules are clearly indicated.