



**CEGEP CHAMPLAIN - ST. LAWRENCE**  
**201-NYC-05 : Vectors and Matrices**  
**Fall 2007**

**Instructor:** Martin Huard  
**Office:** 318  
**Web Site :** <http://slc.qc.ca/mh/>

**e-mail :** [mhuard@slc.qc.ca](mailto:mhuard@slc.qc.ca)  
**Telephone:** 656-6921, ext. 261

**Ponderation:** 3-2-3

**Credits:** 2 2/3

**Prerequisite** Compulsory : Secondary V Mathematics  
Recommended: Differential Calculus (Math 201-NYA-05)  
Integral Calculus (Math 201-NYB-05)

### **Program Objectives**

In this course you will use/apply the methods of Linear Algebra and Vector Geometry to problem solving (satisfying objective 00UQ 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;
- 8) appropriate attitudes.

### **Course Objectives**

The Vectors and Matrices course introduces that branch of mathematics called Linear Algebra. In this course you will learn to apply the methods of Linear Algebra and Matrix methods to problem solving. To meet this objective, you will learn:

- 1) to express concrete problems as linear equations;
- 2) to solve Systems of Linear Equations using Matrices;
- 3) to establish connections between Geometry and Algebra;
- 4) to determine the equations of Hyperplanes and their intersections;
- 5) to calculate Angles, Length, Areas, and Volumes,
- 6) to demonstrate propositions;
- 7) to make two- and three- dimensional drawings of Hyperplanes.

### **Teaching Method**

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

### **Textbook** (Optional)

*Elementary Linear Algebra: Abridged version (9th Edition)* by H. Anton and C. Rorres, John Wiley & Sons (2005).

The only calculator permitted during exams is the SHARP EL-531, which is available at the bookstore.

### **Additional References**

*Elementary Linear Algebra: (5th Edition)* R. Larson, B. Edwards and D. Falvo, Houghton Mifflin (2004).

*Elementary Linear Algebra: (4th Edition)* by S. Venit and W. Bishop, Brooks/Cole (1995).

## Course Content

1. Systems of Linear Equations - definition of a system of linear equations, Gaussian elimination, Gauss-Jordan elimination, homogeneous systems of linear equations, applications.
2. Matrices - definition of a matrix, operations on matrices, row reduction, elementary matrices, inverse of a matrix.
3. Determinants - the determinant function, evaluating determinants, properties of determinants, cofactor expansion, Cramer's Rule, eigenvalues and eigenvectors \*.
4. Geometric Vectors - definition in  $\mathbb{R}^2$  and  $\mathbb{R}^3$ , arithmetic of geometric vectors, position vectors, interesting theorems proven with geometric vectors.
5. Algebraic Vectors - definition in  $\mathbb{R}^n$  (emphasis on  $\mathbb{R}^2$  and  $\mathbb{R}^3$ ), the arithmetic of vectors, the dot product, the cross product, the scalar triple product.
6. Equations of Lines and Hyperplanes - hyperplanes in  $\mathbb{R}^2$  and  $\mathbb{R}^3$ , lines in  $\mathbb{R}^3$ , vector, parametric and symmetric equations, distances and intersections.
7. Vector Spaces - definition of a vector space, subspaces, linear span of a set of vectors, linear dependence, bases and dimension, coordinate vectors \*, row/column space of a matrix \*, rank and nullity \*, inner product spaces \*, linear transformations \*.

\* These topics will only be covered if time allows.

## Evaluation

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

- 1) to use appropriate concepts;
- 2) to represent situations in terms of vectors and matrices;
- 3) to choose and apply algorithms correctly;
- 4) to solve systems of linear equations exactly;
- 5) to adequately represent objects in  $\mathbb{R}^2$  and  $\mathbb{R}^3$ ;
- 6) to be able to justify your reasoning in the steps you take;
- 7) to manipulate algebraic expressions correctly;
- 8) to arrive at exact answers;
- 9) to arrive at correct interpretation of results;
- 10) to use the appropriate terminology (notation).

There will be 4 term tests (12 % each), four assignments (3% each) and a final examination (40%). A student missing a test will be given zero (0). Late assignments will be severely penalised, 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.

## Absences

Attendance is mandatory and a maximum of 7 absences will be tolerated (explained and/or unexplained). More than the 7 absences may mean failure in the course.

## Rules & Regulations

St. Lawrence Campus has definite regulations concerning cheating, plagiarism and the quality of written English. 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 the St. Lawrence web site (<http://www.slc.qc.ca/>) in *Academics - Academic Regulations* where these rules are clearly indicated.