

Course Syllabus

Linear Algebra and Vector Geometry

201-SN4-RE

Field of Study: Natural Sciences

Discipline: Mathematics

Weighting: 2-2-2

Course Duration: 60 h

Number of Units: 2

Semester: Autumn 2026 (August to December)

Teacher: Mohamed Noudha

Moodle: [A26] Linear Algebra and Vector Geometry - Noudha

Availabilities:

Will be listed on both Moodle and Omnivox

Course Description

1. Course content

This is the third course of mathematics in the program Natural Sciences (200.B1) following Differential Calculus (201-SN2-RE) and Integral Calculus (201-SN3-RE). It will be taken concurrently with Statistics and Probability (201-SN1-RE).

2. Competency Statement

Analyze problems using linear algebra and vector geometry concepts (0M04).

3. Elements of the Competency

1. Use the language of matrices
2. Manipulate two- and three-dimensional geometric and algebraic vectors
3. Represent lines and planes in the Euclidean space.
4. Use the methods of linear algebra and vector geometry in mathematical applications
5. Apply linear algebra and vector geometry concepts to solve problems related to science

5. Course Contribution to the Science Program

- Correct use of mathematical terminology and syntax
- Algebraic manipulation in accordance with established rules
- Appropriate use of necessary computer tools
- Demonstration of rigorous mathematical reasoning through the use of concepts, properties and theorems

Pedagogical Approaches

1. Theoretical Classes / Lectures

Lectures will emphasize active learning whenever possible; this places the students at the center of their learning by allowing them to actively engage the learning process and the construction of their own knowledge. Most lectures will therefore require students to be discussing, discovering, calculating, practicing, and questioning. Individual and small team work on open questions or practice exercises are to be expected, as well as round-table discussion of theory and concepts.

2. Practical Work

Students work is integrated into the vast majority of class sessions. In addition to class assignments and workshops, students will be required to complete formative exercises as personal work at home.

3. Participation Requirements

Students are expected to attend all lectures, as they inevitably are a central element of active learning. When in class, students will be expected to contribute ideas, results of calculations, team discussions or homework. Students are also expected to be very frequent visitors of the course website.

4. Bilingualism

The course is taught in English. Most course materials will be in English, unless, in the case of online material, better material is to be found in French. Homework and exams will be given in English, but students are allowed to answer in French and to ask for a (**verbal**) translation at any time.

5. Use of Information and Communication Technologies

ICTs are an integral part of this course. Many web 2.0 tools such as Wolfram Alpha, Desmos, Crowdmark and Webwork will be used. The course website is an essential tool in this class and the students are likely to be using it whenever they are working on this subject. As such the students' laptop is essential. Depending on the assignment students will either have to hand in a paper assignment or answer questions digitally online. Moreover, the professor reserves the right to restrict the use of the laptop in some lectures, should paper and pen be the best tools for the suggested activity.

Cheating and Plagiarism

Please note that all items of the Politique institutionnelle d'évaluation des apprentissages (PIEA) apply to this course. The PIEA can be found on Omnivox, in the section « Documents distribués ».

Course Evaluations

1. Formative evaluations

Formative assessments will be given throughout the term. This can include handouts, Webwork, Kahoots, Crowdmark, quizzes, polls etc... Any homework given should be seen as a way to practice for exams and to get used to the type of questions being asked on exams.

2. Sommative evaluations

Approximate Date	Evaluation type	Weight	Elements of competency
Week 3/4	Quiz 1	15	2,3
Week 8	<i>Cumulative midterm exam</i>	25	1,2,3,4

Week 13	Quiz 2	15	1,2,3,4
Week 16	In-class project	10	1,2,3,4,5
TBD	<i>Cumulative final exam</i>	35	1,2,3,4,5

- Students must keep a copy of all submitted and graded work until the end of the semester. All procedures regarding grading and grade reviews are specified in the PIEA, section 4.8.
- Students may lose up to 10% of the marks for incorrect notation

Typical exam instructions

- 1) **Write down any assumptions** you make before you start the problem
 - 2) Show **all** work whenever possible
 - 3) Points will be deducted for **UNPROVEN** work (even if it's "obvious")
 - 4) Place a **box** around your final answer
- ➔ By writing your name on this exam, you have acknowledged that you have read and understood the instructions above.

3. Educational Support

The student must take the necessary steps to meet with their teacher if the need arises, by making an appointment via MIO on Omnivox. The availability times are posted on the first page of this course outline, in printed form at the entrance of the faculty office on the 5th floor, as well as on the course's Moodle page.

Documents and Reference Material

Required Textbook:

The main reference for this course will be:

- Elementary linear algebra: Application version, 11th edition (available online)

The following are also excellent supplementary resources; however, none of them is required:

- Amyotte, L. Introduction à l'algèbre linéaire et à ses applications, 4e édition enrichie, ERPI, 2018.
- Charron, G., Parent, P., Algèbre linéaire et géométrie vectorielle 4e édition, Beauchemin Chenelière Éducation, 2011, 570 p.
- Ouellet, G. Algèbre linéaire. - Vecteurs et géométrie, 2ème édition. Griffon d'Argile, 2002.
- Papillon, V. Vecteurs, matrices et nombres complexes, 2ème édition, Modulo en ligne, 2012.

Recommended online resources:

- Khan academy – [Linear algebra](#)
- 3Blue1Brown – [Essence of linear algebra](#)

Electronic Devices:

For each class, students are required to have a laptop computer and headphones.

Course outline

The schedule of activities is presented in the table below. Depending on how the session progresses, some changes may be made along the way. Please review frequently.

Weeks	Topics / content	Details / activities / evaluations
1-6	Algebraic vectors: n-tuples, equality, add/subtract/scalar multiplication + properties, magnitude/direction, graphical & geometric methods. Dot product: calculation, properties, angle, projection, orthogonality, geometric problems. Cross product: calculation, properties, i/j/k, orthonormal bases, orthogonal-vector/angle/parallel tests, parallelogram/triangle area. Scalar triple product: calculation, properties, volume of parallelepiped, coplanarity. Lines: parametric/symmetric/general forms, point tests, direction vectors (2 points or point+direction), intersection, skew lines, distances, closest point. Planes: linear/vector forms, normals, equation from normal+point / 2 vectors+point / 3 points, plane-plane & line-plane relations (parallel/orthogonal/angle/intersection), distances, closest point. Sketching lines & planes in 3D. <i>Note that Week 6 is Interdisciplinary Week.</i>	Quiz 1 (15%) Week 3/4
7-11	Matrix basics: definition/size/a_{ij}/equality, add/subtract/scalar mult/transpose/trace/multiplication, types (row, column, square, zero, identity, triangular, diagonal, symmetric, skew-symmetric) + main diagonal, proving theorems from properties. Linear systems: augmented matrix $[A B]$, row ops, REF/RREF, Gaussian & Gauss-Jordan elimination, homogeneous/non-homogeneous, consistency, solution types, $AX=B$. Inverses: 2×2 formula, Gauss-Jordan for larger matrices, solving systems via inverse, real-world problems $\rightarrow$ linear systems. <i>Note that Week 9 is Reading Week.</i>	Cumulative Midterm (25%) Week 8
12-13	Determinants evaluation: row/column expansion, properties, minors & cofactors. Applications: inverse via cofactors, Cramer's Rule, further applications, theorems.	Quiz 2 (15%) Week 13
14-17	Linear independence: linear combinations, span, independence vs. dependence, concept of a basis (linked to vectors & row-reduction/rank).	In-class Project

	Review and practice: All techniques, integrated problem solving.	(10%) Week 16
	<i>Exam week</i>	Final Exam (35%)

Late Submission of Assignments:

A late assignment will incur a penalty of 10% of the grade per late day.

Absence from an evaluation:

In the event of absence from an evaluation, it is imperative to complete the absence form provided for this purpose. This form must be completed and submitted within 24 hours following the time of the missed evaluation. If the form is not completed and submitted within this time limit, the teacher reserves the right to give a grade of zero for the evaluation. All procedures regarding absences from evaluations are specified in the PIEA, section 4.7. As a general rule, there are no retakes in the event of a failed test or exam. Exceptionally, the Academic Dean may authorize a retake of a final exam after consulting the teacher. In such cases, the grade cannot exceed the passing mark.

Recording of Classes:

Recording of classes is **not** allowed unless advance permission is given by the instructor.

Language and PIEA:

La "Politique institutionnelle d'évaluation des apprentissages" (PIEA) applies to this course. The quality of language is important in all courses. A maximum penalty of 10% may be applied for errors, in either French or English. Please refer to the PIEA document available in "Documents & messages" on Omnivox.

Cheating and Plagiarism:

Cheating is the deception or unauthorized use or attempted use of material, information, notes, study aids, devices or communication during an academic exercise. Cheating is a serious academic offence and can result in dire consequences. The following are some examples of cheating:

- Copying from another student during an examination or allowing another to copy your work.
- Unauthorized collaboration on a take home assignment or examination.
- Using notes during a closed book examination.
- Taking an examination for another student, or asking or allowing another student to take an examination for you.
- Changing a graded exam and returning it for more credit.
- Submitting substantial portions of the same paper to more than one course without consulting with each instructor.
- Allowing others to research and write assigned papers or do assigned projects, including use of commercial term paper services.
- Submitting someone else's work as your own.
- Unauthorized use during an examination of any electronic devices such as cell phones, computers or other technologies to retrieve or send information.
- All procedures regarding academic integrity are specified in the PIEA, section 4.9

Usage of artificial intelligence:

Unless otherwise indicated by the instructor, the use of artificial intelligence during an evaluation is prohibited. All guidelines regarding the use of AI by students and instructors are detailed in the document "Politique institutionnelle sur l'utilisation éthique et responsable de l'intelligence artificielle".

Final Exam Requirement:

Students must achieve a minimum grade of 40% on the final exam in order to pass the course.