

# **MATH 2107A [0.5 Credit] Linear Algebra II**

## **Basic Information:**

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|---------------------------------|---|
| <u>Class Schedule:</u>          | Pre-recorded videos posted in Brightspace   |
| <u>My Office Hour Schedule:</u> | Mondays – Wednesdays 9:00 – 12:00 (in Online MTC found in BrightSpace)  |
| <u>TA Office Hour Schedule:</u> | Mondays: 17:30-18:30 and Wednesdays 18:30-20:00 starting May 17, 2021.  |
| <u>Course Instructor:</u>       | Kyle Harvey   |
| <u>Email:</u>                   | <a href="mailto:kyle.harvey@carleton.ca">kyle.harvey@carleton.ca</a>  |
| <u>Course Webpage:</u>          | All course material will be made available through Brightspace. Please check Brightspace regularly for updates on the course. |

## **Course Information:**

|                                |   |
|--------------------------------|---|
| <u>Prerequisites:</u>          | MATH 1104 or MATH 1107 and a grade of C- or higher in MATH 1007 or equivalent, or permission of the School.   |
| <u>Textbook:</u>               | Linear Algebra and Its Applications, by D. Lay, S. Lay and J. Mc-Donald, sixth edition.   |
| <u>Course Overview:</u>        | Finite-dimensional vector spaces (over $\mathbb{R}$ and $\mathbb{C}$ ), subspaces, linear independence and bases. Linear transformations and matrices. Inner product spaces (over $\mathbb{R}$ and $\mathbb{C}$ ); Orthonormal bases. Eigenvalues and diagonalization. Bilinear and quadratic forms; principal axis theorem. Precludes additional credit for MATH 1102 (no longer offered), <a href="#">MATH 2152</a> |
| <u>Classes</u>                 | All lectures will have pre-recorded videos with corresponding Powerpoint Presentations posted on Brightspace. It is highly recommended that you print the slides or have them available through other means to use in conjunction with the watching the videos.   |
| <u>Calculators:</u>            | It is recommended that you utilize an online RREF calculator online. Other calculators are permitted as well. Here is a link to a good RREF calculator:<br><a href="https://www.symbolab.com/">https://www.symbolab.com/</a>  |
| <u>Additional Practice:</u>    | There will be additional homework documents with final answers posted in Brightspace. It would be wise to tackle these questions in addition to the online assignments to ensure that you practice the material well enough to prepare you in this course and future courses in linear algebra. This homework will not be graded formally, but it will help solidify concepts.  |
| <u>Tutorials/Office Hours:</u> | Tutorial times and one of the class time slots will be utilized as office hours to give you a chance to ask questions about the assignment due that week with your TA (Assignments will be due on Thursdays). Details will be posted in Brightspace as soon as they become available. I will also be hosting office hours in the Virtual Math Tutorial Centre.  |

## **Assessment:**

**Assignments (50%):** There will be 12 online assignments due on Thursdays at 11:59 pm. The specific due dates of the assignments can be found below. The best 10 out of 12 assignments will be used to calculate your final grade (assignments are weighted equally at 5% each). Note that the last assignment is due during the exam period, but it is an optional assignment as only 10 out of 12 assignments will be counted. All assignments are available now so that you can get ahead if you so wish.

| Due Date | Assignment | Lessons of Focus for the Assignment |
|----------|------------|-------------------------------------|
| May 20   | 1          | 1, 2, 3                             |
| May 27   | 2          | 4, 5, 6                             |
| Jun 3    | 3          | 7, 8                                |
| Jun 10   | 4          | 9, 10                               |
| Jun 17   | 5          | 11, 12                              |
| Jul 8    | 6          | 13, 14                              |
| Jul 15   | 7          | 15, 16                              |
| Jul 22   | 8          | 17, 18                              |
| Jul 29   | 9          | 19, 20                              |
| Aug 5    | 10         | 21, 22                              |
| Aug 12   | 11         | 23, 24                              |
| Aug 19   | 12         | 25, 26                              |

Assignments will be run through WebWork. More details will be posted in Brightspace as to how to access the assignments.

**Final Exam (50%):** The final exam will be a three-hour open book exam scheduled by the university. You will not be permitted to post questions or solutions on forums, Chegg, or other such sites. These places will be checked and offenders who are caught will be directed to the Deans office which could have dire consequences up to and including expulsion from the university. You are also not permitted to discuss the exam with anyone else (you are required to do the exam individually).

## **Policies:**

### **Academic Integrity:**

Be sure that you know that academic integrity standards at Carleton which can be found [here](#).

### **Academic Accommodation:**

You may need special arrangements to meet your academic obligations during the term. For an accommodation request the processes are as follows:

**Pregnancy obligation:** write to me with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details see the [Student Guide](#)

**Religious obligation:** write to me with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details see the [Student Guide](#)

**Academic Accommodations for Students with Disabilities:** The Paul Menton Centre for Students with Disabilities (PMC) provides services to students with Learning Disabilities (LD), psychiatric/mental health disabilities, Attention Deficit Hyperactivity Disorder (ADHD), Autism Spectrum Disorders (ASD), chronic medical conditions, and impairments in mobility, hearing, and vision. If you have a disability requiring academic accommodations in this course, please contact PMC at 613-520-6608 or [pmc@carleton.ca](mailto:pmc@carleton.ca) for a formal evaluation. If you are already registered with the PMC, contact your PMC coordinator to send me your Letter of Accommodation at the beginning of the term, and no later than two weeks before the first in-class scheduled test or exam requiring accommodation (if applicable). After requesting accommodation from PMC, meet with me to ensure accommodation arrangements are made. Please consult the [PMC website](#) for the deadline to request accommodations for the formally-scheduled exam (if applicable).

### **Course Progression:**

The following topics will be covered in this course:

| <b>Topic</b>  | <b>Chapter</b> |
|---|----------------|
| Spaces and Vector Spaces ( $R^n, C^n, M_{mn}, P_n, \dots$ )         | 4.1            |
| Subspaces   | 4.1            |
| Linear Combinations and Span  | 4.2 + 4.3      |
| Linear Independence   | 4.3            |
| Basis and Dimension   | 4.3 + 4.5      |
| Col Space, Row Space, Nul Space, Rank, and Nullity                  | 4.2 + 4.6      |
| Coordinate Vectors  | 4.4            |
| Change of Basis Matrix  | 4.7            |
| Eigenvalues and Eigenvectors  | 5.1            |
| Characteristic Equation and Algebraic Multiplicity                  | 5.2            |
| Eigenspaces and Geometric Multiplicity                              | 5.2            |
| Diagonalization and Fast Matrix Multiplication                      | 5.3 + 5.5      |
| Linear Transformations  | 4.2 + 5.4      |
| Kernel and Range of Transformations                                 | 4.2 + 5.4      |
| Transformation Matrix Representation                                | 5.4            |
| Injective, Surjective, and Inverse Linear Transformations           | 5.4            |
| Dot Products, Norm, Distance, and Angles Between Vectors            | 6.1            |
| Orthogonal Vectors, Sets, and Complements, and Orthonormal Matrices | 6.2            |
| Orthogonal Projections and Decompositions                           | 6.3            |
| Gram Schmidt Process and QR Factorization                           | 6.4            |
| Least Squares Problem and Linear Models                             | 6.5 + 6.6      |
| Inner Product Spaces  | 6.7            |
| Diagonalization of Symmetric Matrices and The Spectral Theorem      | 7.1            |
| Quadratic Forms   | 7.2            |
| Principle Axis Theorem  | 7.3            |