Math 152 (Linear Systems), Spring 2016

Common Course Page

- **Overview:**
    - The course concerns linear algebra concepts, stressing their application and their connection to geometry. A detailed week by week outline of the material can be found below.
    - Online notes for the class are found below. These notes will be used for the course instead of a commercial textbook.
    - Other resources to help you with the course material are available, listed below.
    - Webwork Assignments are posted online every week on Fridays and have a deadline for submission of Monday (after 10 days) at midnight.
    - Students are responsible for completing six one hour computer labs using the software, MATLAB.
    - Grade breakdown for the course:
        - homework (WebWork) 10%
        - computer labs 10%
        - 2 midterm tests worth 15% each
        - final exam 50%
    - There will be a common final exam. Midterm marks may be scaled to each section's average on the final exam (this scaling may be done in blocks of sections). More details on test and exams can be found below.
    - Test #1 is set for ~~Thursday February 4/Friday February 5~~. TBA
    - Test #2 is set for Wednesday March 16/Thursday March 17.
- **Resources:**
    - Drop-in tutoring provided by the Mathematics Department is available in the Math Learning Centre, details can be found here.
    - Course learning goals are available. This document may help you understand what we want you to understand from this course (and why).
- **Online Notes:**
    - Online notes are available here (3.8 MB pdf file, 258 pages) for all 6 chapters. We will be covering all six chapters, excluding the material listed as "additional topics".
    - Additions and Corrections:
        - An addition to the Chapter 3 notes describing the checksum technique for making hand calculations of Gaussian Elimination more reliable can be found here (written by Joel Feldman).
        - More additional notes written by Joel Feldman on the subject of complex numbers are available here.
        - Additional notes to Chapter 5 concerning the calculation of determinants and inverses and the solution of linear systems with complex coefficients can be found here.
- **Webwork Assignments:**
    - Webwork Assignments are posted online every week on Fridays and have a deadline for submission of Monday (after 10 days) at midnight.

- o There will be eleven assignments. Your lowest mark will be dropped from the average.
  - o WeBWorK assignments are posted on the UBC connect system.
  - o A WeBWorK tutorial, Assignment00_2016, will soon be posted. This will help you learn the syntax to enter answers for the WeBWorK assignments of the course. This tutorial has no due date and is not worth marks.
- **Computer Labs:**
  - o Computer labs using the mathematical software package MATLAB begin in the second week of classes. Each student does a lab every two weeks, starting in the second or third week. Look at your lab section registration information to see where your lab will be held and what week you start.
  - o MATLAB material will be tested on midterms and exams.
  - o The lab assignments are posted on the UBC connect system. Submissions are also done in this system in .doc format.
  - o Labs are due at midnight on the day of your scheduled lab.
  - o UBC has a site license for MATLAB but it (unfortunately) does not include versions for students' personal computers. Some information about MATLAB and how to download and use a freeware clone called Octave is availablehere.
  - o The lab rooms are available for your use outside of your lab hour. A schedule for the labs is posted here. Whenever there is nothing listed here, the room is free for your use.
- **Tests and Exam:**
  - o Students that miss term tests for a valid reason (official written verification is required) will have their final mark averaged proportionally over the other course material.
  - o No calculators or notes (closed book) for tests and exams.
  - o There will be common tests, different for the T/Th and the MWF sections. Test dates and details:
    - ▪ Test #1 Thursday February 4/Friday February 5. Some tests from previous years are given below. Note that some questions on these old tests are on material that is not on this year's first midterm.
      - ▪ Review problems for midterm #1 are archived here. Note that these review problems are not necessarily similar to questions you will have on your tests and exams this year. Rather, they are designed to help you understand the material. See the old posted tests below for some examples of the type of questions that will be on your tests this year.
      - ▪ Practise test #1 and solutions.
      - ▪ Solutions to the tests from 2008: TTh and MWF tests.
      - ▪ Solutions to the tests from 2009: TTh and MWF.
      - ▪ Solutions to the tests from 2010: TTh and MWF.
      - ▪ Solutions to one of the tests from 2011: here.
      - ▪ Solutions to the tests from 2012: TTh and MWF.
      - ▪ Solutions to the tests from 2014: TTh and MWF tests.

- Test #2 Wednesday March 16/Thursday March 17. Some tests from previous years are given below. Note that some questions on these old tests are on material that is not on this year's second midterm.
  - Review problems from test #2 are archived <u>here</u>.
  - <u>Practise test #2</u> and <u>solutions</u>.
  - Solutions to tests from 2008: <u>TTh</u> (the test itself is <u>here</u>) and <u>MWF</u> tests.
  - Solutions to 2009 tests: <u>TTh</u> and <u>MWF</u>.
  - Solutions to 2010 tests: <u>TTh</u> and <u>MWF</u> (Correction: in A1 the product BC is also defined).
  - Solutions to one of the tests from 2011: <u>here</u>.
  - Solutions to the tests from 2012: <u>TTh</u> and <u>MWF</u>.
  - Solutions to the tests from 2014: <u>TTh</u> and <u>MWF</u> tests.

- **Detailed Course Outline:** week by week with relevant note sections.
  1. January 4-8: vectors and coordinate representation; vector length, dot product, projection. *Notes sections 2.1, 2.2, 2.3*
  2. January 11-15: determinants; cross product; lines and planes in 2D and 3D and planes in 3D. *2.3, 2.4, 2.5*
  3. January 18-22: geometry of solutions of linear systems; linear dependence and independence; solving linear systems. *2.6, 3.1*
  4. January 25-29: solving linear systems (cont.); echelon form and rank; homogeneous equations and relationship to linear dependence; *3.2, 3.3, 3.4*
  5. February 1-5: resistor networks. ~~**Test #1**~~ *3.5*
  6. February 8-12: (Family Day); resistor networks (cont.); matrix multiplication; linear transformations. *3.5, 4.1, 4.2* **Test #1**

  Reading Week: February 15-19
  7. February 22-26 rotations, projections and reflections in 2D; matrix representation and composition of linear transformations; random walks; transpose. *4.2, 4.3, 4.4*
  8. Feb 29-March 4: matrix inverse; matrix representation of resistor network problems; determinants. *4.5, 4.6, 4.7*
  9. March 7-11: determinants (cont.); complex numbers; complex exponential and polar form; *4.7, 5.1, 5.2, 5.3*
  10. March 14-18: eigenvalues and eigenvectors; **Test #2** *6.1*
  11. March 21-24: eigenvalues and eigenvectors (cont.); powers of a matrix; application of eigen-analysis to random walks. (Good Friday) *6.1, 6.2*
  12. March 29-April 1: (Easter Monday) application of vector DEs to electrical networks; vector differential equations. *6.3, 6.4*
  13. April 4-8: review.