

# Math 152, Linear Systems

## Spring 2019

**Description:** Math 152, Linear Systems, is a first course in linear algebra. It emphasizes geometry in two and three dimensions, applications to engineering and science problems, and practical computations using Matlab.

**Web site:** [www.math.ubc.ca/~karu/m152](http://www.math.ubc.ca/~karu/m152). The website includes useful links to the textbook, Canvas page, old exams, etc.

**Textbook:** We will use online lecture notes specifically written for this course. The course web page has a link to the notes.

**Webwork.** There will be weekly homework problems using the online Webwork system. Assignments are posted on the Canvas page and they are due on Mondays 10PM. Late assignments will not be accepted, but the lowest score of the 11 assignments will be dropped from the final grade.

**Matlab Assignments.** There will be 6 Matlab assignments. The assignments are done using the online Matlab system. All 6 labs count towards your final grade. Material from the labs is included in the exams.

**Exams.** There will be two midterm exams during class hours, on February 5/6 and March 13/14. The  $2\frac{1}{2}$  hour final exam will be scheduled by the university. Electronic aids (calculators, cell phones, etc.), notes and books are not allowed in the exams.

**Evaluation.** Your final grade will be based on your performance on Webwork (10%), Matlab assignments (10%), midterm exams (15% each) and final exam (50%).

### List of topics covered.

- week #1 January 1-4: vectors and coordinate representation; vector length. Notes sections 2.1, 2.2, 2.3
- week #2 January 7-11: dot product, projection; determinants; cross product; lines in 2D, lines and planes in 3D. 2.3, 2.4, 2.5

- week #3 January 14-18: lines and planes (continued); geometry of solutions of linear systems; linear dependence and independence; 2.5, 2.6
- week #4 January 21-25: solving linear systems; echelon form, reduced row echelon form, rank; homogeneous equations. 3.1, 3.2, 3.3
- week #5 January 28 - February 1: homogeneous systems (continued); geometric applications; resistor networks. 3.3, 3.4, 3.5
- week #6 February 4-8: Midterm #1; matrix multiplication; linear transformations. 4.1, 4.2
- week #7 February 11-15: rotations, projections and reflections in 2D; matrix representation and composition of linear transformations; random walks. 4.2, 4.3, 4.4
- Spring Break: February 18-22
- week #8 February 25-March 1: random walks (continued); transpose; matrix inverse; determinants. 4.3, 4.4, 4.5, 4.6
- week #9 March 4-8: determinants (cont.); complex numbers; complex exponential and polar form; 4.6, 5.1, 5.2, 5.3, 5.4
- week #10 March 11-15: Midterm #2; eigenvalues and eigenvectors 6.1
- week #11 March 18-22: eigenvalues and eigenvectors (cont.); powers of a matrix; application of eigen-analysis to random walks. 6.1, 6.2
- week #12 March 25-29: vector differential equations; application of vector DEs to electrical networks. 6.3, 6.4
- week #13 April 1-4: complete course material; review.