

Linear Algebra and Differential Equations

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Lecture 1

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Text: Linear Algebra and Differential Equations by Alexander Givental

The GSI is Janak Ramakrishnan janakdaniel@gmail.com, will hold discussion sections M W F

Each class, I will give reading and homework assignments, due by the next class, of about 3 problems each. Also, each week, on Monday, you must hand in at least one question about the reading or problems (which, we'll discuss in class). There will be one midterm and a quiz or two. Students will be encouraged to discuss homework in class.

Grading: Questions & Homework 30%, Midterms and quizzes 30%, Final 40%

1. Linear Equations

The simplest example: $ax = b$. More generally,

$$a_1x_1 + a_2x_2 + \dots + a_nx_n = b$$

Example.

$$3x + 5y = 7.$$

One can think this geometrically as, When does the plane $z = 3x + 5y$ intersect the plane $z = 7$? *Systems of linear equations*

$$a_{11}x_1 + a_{12}x_2 + \dots + a_{1n}x_n = b_1$$

$$a_{21}x_1 + a_{22}x_2 + \dots + a_{2n}x_n = b_2$$

...

$$a_{m1}x_1 + a_{m2}x_2 + \dots + a_{mn}x_n = b_m$$

Examples.

$$3x + 5y = 0 \quad \text{and} \quad 4x - y = 0. \quad (a)$$

$$3x + 5y = 7 \quad \text{and} \quad -6x - 10y = -14. \quad (b)$$

A different sort of example. *Volterra's Equation:* Given a continuous function g on the interval $[0, 1]$, find f such that

$$f(x) + \int_0^x f(y)(x-y)dy = g(x).$$

This equivalent to $f''(x) + f(x) = g''(x)$.

For the holidays: How long can you stir a pot of boiling soup with a silver spoon?

Read Section 1.1.1 and do Exercise 1.1.1 (c) for Wednesday.