Math 223: Linear Algebra

Lecture 1

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http://www.math.ubc.ca/~lior/teaching/2122/223_W22/

Practical Linearity

- Signal processing
- Electromagnetism
- Quantum mechanics.

Linearity in Mathematics I

Theorem

Let f, g be real-valued functions on $[a,b]$ and let $\alpha, \beta \in \mathbb{R}$ be real numbers. Let $x_0 \in [a,b]$.

- *If f, g are continuous at x_0 then so is $\alpha f + \beta g$.*
- *If f, g are differentiable at x_0 then so is $\alpha f + \beta g$.*
- *If f, g are integrable on $[a,b]$ then so is $\alpha f + \beta g$.*

Linearity in Mathematics II

Theorem

f, g, α, β, x_0 as above.

- *If f, g are differentiable at x_0 then*

$$(\alpha f + \beta g)'(x_0) = \alpha\left(f'(x_0)\right) + \beta\left(f'(x_0)\right)$$

- *If f, g are differentiable on $[a, b]$ then*

$$(\alpha f + \beta g)' = \alpha f' + \beta g'$$

- *If f, g are integrable on $[a, b]$ then*

$$\int_a^b (\alpha f + \beta g)(x)\,\mathrm{d}x = \alpha \int_a^b f(x)\,\mathrm{d}x + \beta \int_a^b g(x)\,\mathrm{d}x$$

Goals, a.k.a. what's hard in this course?

- Calculation
- Language of linear algebra.
- Abstract mathematics
  - Working with new definitions
  - Working with unspecific elements of abstract sets
  - Formal proofs
- "Honours" mathematics
  - For most problems you will need to find the *idea* that solves them.

Components of the course

- Classes (MWF 10:00-10:50)
- Office hours: after class + TBA
- Problem sets: weekly, mainly conceptual problems.
  - Practice, Extra-credit, Supplementary problems.
  - Computation on the side
- Two in-class midterms.
- Final exam
- Piazza

Resources

- Instructor
- Math Learning Center
- Fellow students
- Textbook
- Definitions: Wikipedia

On the web

- Course website: `https://www.math.ubc.ca/~lior/teaching/2122/223_W22/`
  - Syllabus; notes
  - Problem sets
  - Schedule, whiteboard scans
- Canvas
  - Homework submission
  - Solutions
  - Grades
- Piazza

How to work

- Read before class
- Mindful learning in and out of class
- Solve problem rather than review notes
- Come to office hours & use discussion board
- ASK QUESTIONS

Abducted by an alien circus company, Professor Doyle is forced to write calculus equations in the centre ring.

(Gary Larson, "The Far Side", 15/9/1992)

About me

- Lior Silberman (Li'$\overline{\text{or}}$ $\overline{\text{Zil}}$berman)
- Email: `lior@math.ubc.ca`, Office: MATX 1112
- Work: Number Theory, Geometry, Topology, Random structure, ...