Math-S 21A 2022

This multivariable calculus course extends single variable calculus to higher dimensions. It provides a vocabulary for understanding data appearing in fundamental processes of nature like weather, planetary motion, waves, diffusion, finance, or quantum mechanics. It helps to visualize processes and data. It teaches important background needed for statistics, discrete mathematics, computer graphics, bio medical sciences, bio-informatics or economics. It provides tools for describing curves, surfaces, solids and other geometrical objects in space. It develops methods for solving optimization problems with and without constraints. You learn a powerful computer algebra system. The course will enhance problem solving and visualization skills and prepares you for further study in other fields of mathematics and its applications.

Lectures

TTH8:30-11:30 AM, SciCtr E

1.Exam	2.Exam	Final
JULY 7	JULY 21	AUG 4
8:30 AM	8:30 AM	8:30 AM
HALL E	HALL E	HALL E

Part	Grade
1. Hourly	20
2. Hourly	20
Homework	25
Lab	5
Final	30

Seminar

Choice of Wednesday or Thursday

Organisation

Oliver Knill, office:Mon 3-5, knill@math.harvard.edu

SC 432, Tel: (617) 495 5549

Course Assistants

Sara Manning (smanning@college) and Wittman Goh (wgoh@college)

Expectations

For expectations and especially about rules for publishing of material

https://studenthandbook.summer.harvard.edu

Accessibility

We are committed to an accessible academic community. For details see the Accessibility Office.

http://www.summer.harvard.edu/resources-policies/accessibility-services

Academic Integrity

We strictly follow the Harvard Summer school policies. Students are responsible to know the rules and guidelines.
http://www.summer.harvard.edu/policies/student-responsibilities

CALENDAR

SU	MO	TU	WE	TH	FR	SA
19	20	21	22	23	24	25
26	27	28	29	30	1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31	1	2	3	4	5	6

- ▢ First class
- ▢ Reviews
- ▢ Midterm exams
- ▢ Independence day
- ▢ Mathematica due
- ▢ Final exam

SYLLABUS

1. Week: Geometry / Space
Lect 1-2   6/21 Space, Vectors, Dot Product

Lect 3-4   6/23 Cross product, Lines/Planes

2. Week: Surfaces / Curves
Lect 5-6   6/28 Implicit /Parametric Surface

Lect 7-8   6/30 Curves, Arc Length

3. Week: Linearization / Gradient
Lect 9-10   7/5 Partial Derivatives, Review

Lect 11-12 7/7 Midterm. Gradient

4. Week: Extrema / Double Integrals
Lect 13-14 7/12 Tangents, Extrema

Lect 15-16 7/14 Lagrange . Double integrals

5. Week: Triple Integrals /Line Integrals
Lect 17-18 7/19 Double and triple integrals

Lect 19-20 7/21 Midterm Line integrals

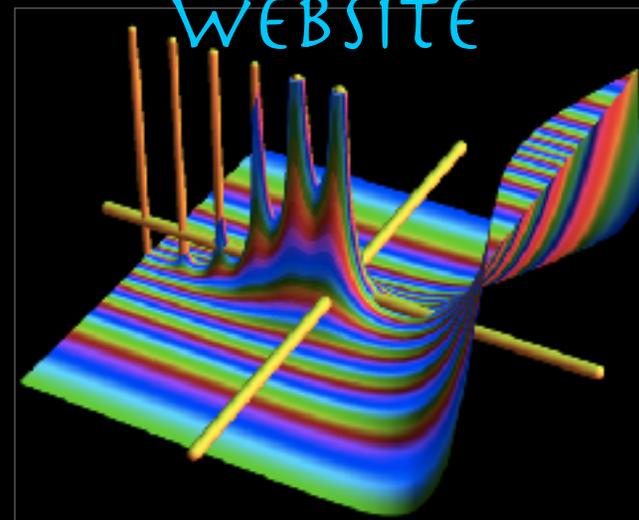### 6. Week: Vector fields /Integral Theorem
Lect 21-22 7/26 Curl, Greens theorem, Flux

Lect 23-24 7/28 Stokes /Divergence theorem

PREREQUISITES

Arithmetic, Algebra, Geometry Trigonometry, Exp and Log, Single Variable Calculus

WEBSITE

math.harvard.edu/~knill/teaching/summer2022