# Maths 21A2018

This standard multivariable calculus course extends single variable calculus to higher dimensions. It provides a vocabulary for understanding 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

Harvard Hall, 104

Tue/Thu    8:30-11:30



| 1.Exam | 2.Exam | Final |
|---|---|---|
| July 12 | July 26 | Aug 9 |
| 8:30 AM | 8:30 AM | 8:30 AM |
| Harvard 104 | Harvard 104 | Harvard 104 |

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

# Seminar

We/Thu 2-3, Sci Scenter 310

# Accessibility

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

# Textbook

You do not need a book. If you want to see an other angle, take any of the textbooks available. The Stewart Calculus text is a popular option.

# Organisation

Oliver Knill, office:Mon 3-5, Fr 11-12

knill@math.harvard.edu

SC 432, Tel: (617) 495 5549

# Course Assistants

Jayant Gopalan and Sergio Martinez

# Academic Integrity

We strictly follow the Harvard Summer school policies. Students are responsible to know the rules and guidelines.

# CALENDAR

| Su | Mo | Tu | We | Th | Fr | Sa |
|----|----|----|----|----|----|----|
| 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 | 7 | 8 | 9 | 10 | 11 |

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

# SYLLABUS

### 1. Week:  Geometry / Space

Lect 1-2   6/26  Space, Vectors, Dot Product

Lect 3-4   6/28  Cross product, Lines/Planes

### 2. Week:  Surfaces / Curves

Lect 5-6   7/3 Implicit /Parametric Surface

Lect 7-8   7/5 Curves, Chain Rule, Arc Length

### 3. Week:  Linearization / Gradient

Lect 9-10   7/10 Partial Derivatives, Review

Lect 11-12 7/12 Midterm. Gradient

### 4. Week:  Extrema / Double Integrals

Lect 13-14  7/17  Tangents, Extrema

Lect 15-16  7/19 Lagrange . Double integrals

### 5. Week:  Triple Integrals /Line Integrals

Lect 17-18  7/24 Double and triple integrals

Lect 19-20  7/26  Midterm Line integrals

### 6. Week:  Vector fields /Integral Theorem
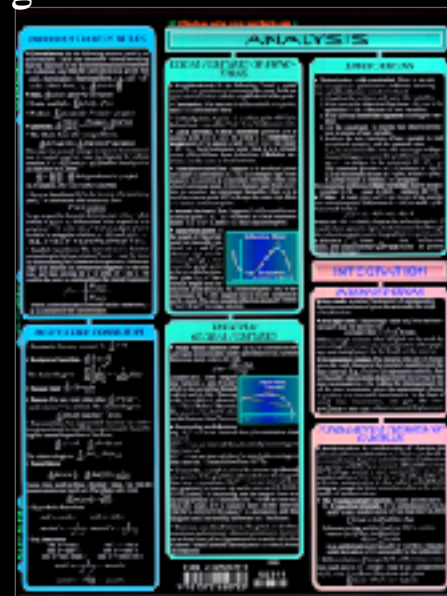
Lect 21-22  7/31 Curl, Greens theorem, Flux

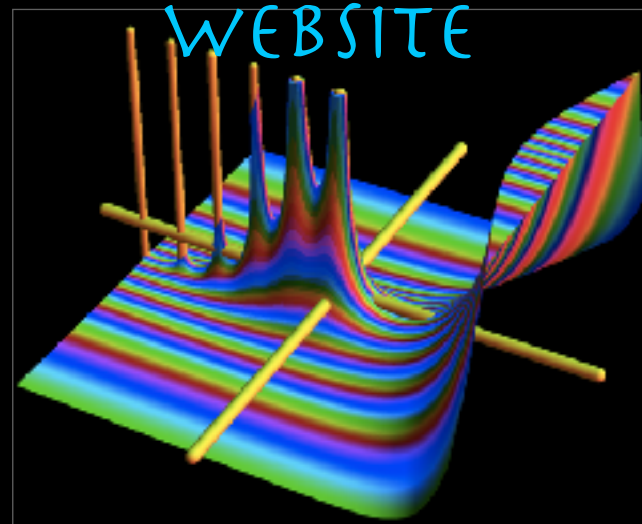Lect 23-24  7/02 Stokes /Divergence theorem

# PREREQUISITES

**Arithmetic, Algebra, Geometry**

**Trigonometry, Exp and Log,**

**Single Variable Calculus**

# WEBSITE

math.harvard.edu/~knill/teaching/summer2018