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, bioinformatics 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**

SC Hall E, Tue/Thu 8:30-11:30

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<td>1. Hourly</td>
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<td>2. Hourly</td>
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<tr>
<td>Homework</td>
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<td>Lab</td>
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<td>Final</td>
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**Exam**

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| 1    | July 9
| 2    | July 23
| Final| Aug 6

**Seminar**

Problem session: Thu 1-2PM
Room SC 110 (close to Mark 1)

**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: Monday 3:30-5
knill@math.harvard.edu
SC 432, Tel: (617) 495 5549

**Course Assistants**

Harrel Blatt
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Derek Booth
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**SYLLABUS**

1. **Week: Geometry / Space**
   - Lect 1-2 6/23 Space, Vectors, Dot Product
   - Lect 3-4 6/25 Cross product, Lines/Planes

2. **Week: Surfaces / Curves**
   - Lect 5-6 6/31 Implicit /Parametric Surface
   - Lect 7-8 7/2 Curves, Chain Rule, Arc Length

3. **Week: Linearization / Gradient**
   - Lect 9-10 7/7 Partial Derivatives, Review
   - Lect 11-12 7/9 Midterm. Gradient

4. **Week: Extrema / Double Integrals**
   - Lect 13-14 7/14 Tangents, Extrema
   - Lect 15-16 7/16 Lagrange . Double integrals

5. **Week: Triple Integrals /Line Integrals**
   - Lect 17-18 7/21 Double and triple integrals
   - Lect 19-20 7/23 Midterm Line integrals

6. **Week: Vector fields /Integral Theorem**
   - Lect 21-22 7/28 Curl, Greens theorem, Flux
   - Lect 23-24 7/30 Stokes /Divergence theorem

**PREREQUISITES**

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

**WEBSITE**

math.harvard.edu/~knill/courses/summer2015