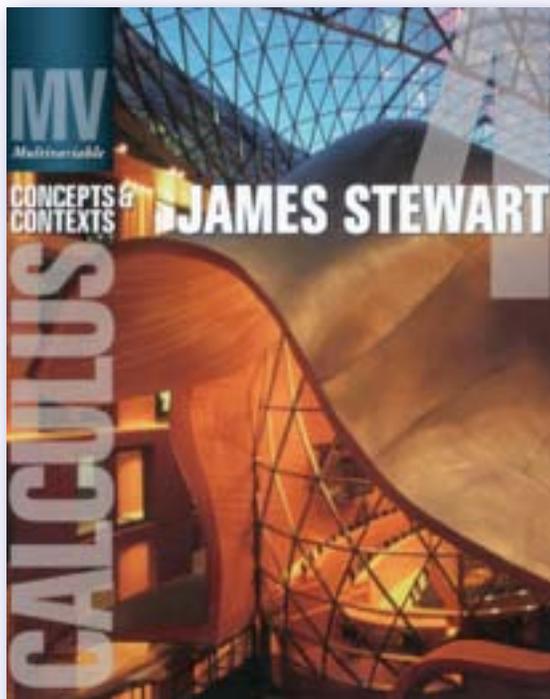


## TEXTBOOK



We do not require a textbook. **James Stewart**, *Multivariable Calculus* is a popular side reading. Any edition.

## ORGANISATION

Course head: Oliver Knill

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SC 432, Tel: (617) 495 5549

## MATHEMATICA

We have a computer algebra project in this course. Harvard has a cite license for Mathematica a professional and powerful software.

## SECTIONS

The course lectures (except reviews and intro meeting) are taught in sections. This assures you can discuss the material in class. Additional problem sessions help too. Sections meet at:

MWF 9, MWF 10, MWF 11, MWF 12, TTh 10-11:30, TTh 11:30-13:00. Please section for one.

## MQC

Sun to Thu in 309, 8:30-10:30PM

## DATES

1. EXAM	2. EXAM	FINAL
TBA	TBA	TBA
7 PM	7 PM	TBA
HALL B	HALL B	TBA

## GRADES

PART	PERCENTAGE
1. HOURLY	15
2. HOURLY	15
HOMEWORK	25
LAB	5
FINAL	40

Harvard University Fall 2016

# MATH 21A

## SYLLABUS 2016

This standard multivariable calculus course extends single variable calculus to higher dimensions. It provides a vocabulary for understanding fundamental processes like weather, planetary motion, waves, heat and analysis in finance, life and social sciences. It teaches important background needed for statistics, computer graphics, bioinformatics, etc. It provides tools for visualization as we study curves, surfaces, solids and other geometrical objects in 2 and 3 dimensions. It develops methods for solving optimization problems with and without constraints. You learn a powerful computer algebra system. The course will enhance problem solving skills and prepares you for further study in any other fields of mathematics and its applications.

# CALENDAR

S	M	T	W	T	F	S
28	29	30	31	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	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	12
13	14	15	16	17	18	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

# SYLLABUS

## 1. Vector geometry

September 7: labour day, September 9 first classes

- 1 coordinates and distance 9.1
- 2 vectors and dot product 9.2-3

## 2. Functions

- 1 cross product lines/planes 9.4
- 2 level surfaces quadrics 9.6
- 3 curves, velocity acceleration 10.1-2

## 3. Curves

- 1 arc length curvature 10.3-4
- 2 other coordinates 9.7
- 3 parametric surfaces 10.5

## 4. Partial derivatives

- 1 review for first hourly
- first midterm (week 1-3) TBA
- 2 continuity 11.1-11.2
- 3 partial derivatives, gradient 11.3

## 5. Linear approximation

- 1 partial differential equations 11.3
- 2 linear approximation 11.4
- 3 chain rule implicit differentiation 11.5

## 6. Gradient

- 1 Columbus day (no class)
- 2 tangent spaces 11.6
- 3 directional derivative 11.6

## 7. Extrema

- 1 maxima, minima, saddle points 11.7
- 2 Lagrange multipliers 11.8
- 3 more problems, global extrema 11.8

## 8. Double integrals

- 1 double integrals 12.1-3
- 2 polar integration 12.4
- 3 surface area 12.6

## 9. Triple integrals

- 1 review for second midterm
- second midterm (week 5-8) TBA
- 2 triple integrals 12.7
- 3 spherical integrals 12.8

## 10. Line integrals

- 1 vector fields 13.1
- 2 line integrals 13.2
- 3 line integral theorem 13.3

## 11. Stokes theorem

- 1 Greens theorem 13.4
- 2 Curl, Div, flux 13.5-6
- 3 Stokes theorem 13.7

## 12. Divergence theorem

- 1 divergence theorem 13.8
- 2 Thanksgiving (no class)
- 3 Thanksgiving (no class)

## 13. Overview

- 2 Green-Stokes=Gauss 13.7-8
- 2 Overview 13.5-8

Reading period (3-9) and Exam period (10-21)