

# Calculus I and II

Math S-1ab  
Harvard Summer School  
Summer 2004

## Staff

- Matthew Leingang (June 29–July 23)  
Science Center 323  
leingang@math.harvard.edu
- Robin Gottlieb (July 26–August 17)  
Science Center 429  
gottlieb@math.harvard.edu
- Dawei Chen (Course Assistant)  
dchen@math.harvard.edu



**HARVARD**  
SUMMER SCHOOL  
June 28–August 20

## What is calculus good for?



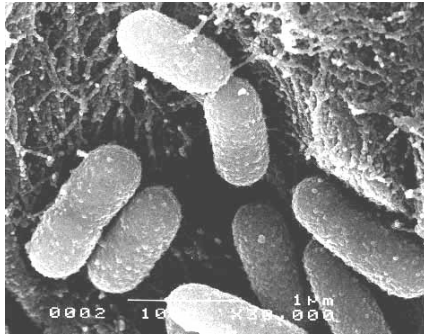
## Hatsumon – Ballistics



- A ball is dropped off the roof of the Science Center. How fast is it going when it hits the ground?



## Hatsumon – Microbiology



- A population of bacteria reproduces asexually, doubling every hour. If the population starts with 100 cells, how many cells are present after 90 minutes?



## Hatsumon – Microeconomics



- A consumer has \$100 with which to purchase food. He prefers cheese to other foods in the sense that if the price of cheese goes up 10%, he only reduces his consumption of cheese by 5%. If the price of cheese is \$3/lb., how much cheese should he buy?

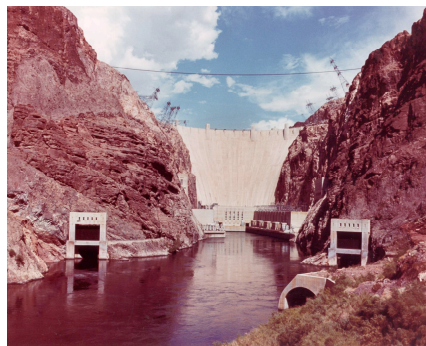


## Hatsumon – Volume

- What is the volume of a Krispy Kreme Donut?



## Hatsumon – Hydrostatics



- How thick does a dam need to be so as not to collapse from the weight of all the water it's holding back?



## Hatsumon – Organismal Bio



- How many field mice are needed in a given environment to sustain a population of owls?



**All of these problems (and many more) can be solved with Calculus!**

*“Over three centuries of constant use have not completely dulled this incomparable instrument.”—Nicholas Bourbaki*



## Topics

- (Functions)
- Differential Calculus
  - Limits
  - Derivatives
  - Rates of Change (with Applications)
  - Optimization (with Applications)
- Integral Calculus
  - Areas
  - Volumes
  - Work
  - Pressure
  - Much, much more!

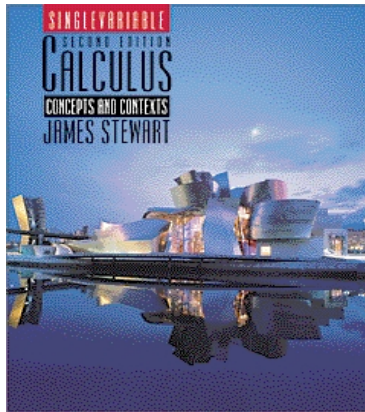


## Topics

- Differential Equations
  - describe the way quantities change with respect to other quantities (e.g.,  $F = ma$ )
- Sequences and Series
  - give a way to solve differential equations and to approximate functions by polynomials



## Textbook



- *Single Variable Calculus: Concepts and Contexts*, 2nd edition, by James Stewart

- Available at Harvard Coop and elsewhere

- Additional notes for

second half of the course  
to be published on web  
site



## Workload

- Class: 10AM–Noon, Monday–Friday
- Discussion Section: 2–3PM, Monday–Friday
- Homework (~16 problems/day)
- Reading Assignments (2 sections/day)
- Estimated Total: 8 hours/day!



## Technology

- Calculators and computers are good aids in computational problems and in checking derivations, **but...**
- ...are not allowed on exams
- Do not buy a calculator. Learn to use Mathematica instead.



## Exams

- Midterm I: Monday July 12
  - Midterm II: Friday July 23
  - Midterm III: Monday August 6
- All midterms occur in discussion section  
Exams are synthetic (not exactly like homework)
- Final: Tuesday August 17, 9:00 AM  
Location TBA



## Grades

- Midterms: 3 @ 15%
- Final: 30%
- Homework 25%



## Gratuitous Baby Shot #1

