

## Math 445: Mathematics of Physics and Engineering II, Fall 2024

Everything can change with little or no notice at any moment...

**In particular, a class (lecture and/or discussion) can be moved to on-line mode on a very short notice, so please check your e-mail before every class.**

### Class number 39673R

Math 445 in Fall 2024 semester: Key dates

- August 26: first day of classes
- September 2: Labor Day, no class
- September 13: Last day to drop without a `W' AND with refund
- October 9: Midterm Exam 1
- October 10,11: Fall Break
- October 11: Last day to drop without a `W', BUT WITH NO refund
- October 25: Computer project 1 is due
- November 11: no class (Veterans Day)
- November 15: Last day to drop with a `W'
- November 20: Midterm Exam 2
- November 27-29: Thanksgiving Break
- December 6: Computer project 2 is due; Last day of classes
- December 18: Final exam (11am-1pm, in SLH 100)

### [Class Schedule](#)

### [Homework problems](#)

### [Some homework answers](#)

### [Computer Projects](#)

### [Crank-Nicolson scheme for the heat equation](#)

### [Implicit method for the wave equation](#)

### [Extended summary](#)

- **Instructor:** Dr. Sergey Lototsky  
**Office:** KAP 248D.  
**Phone:** 213-740-2389.  
**E-mail:** lototsky (at) USC (dot) edu  
**URL:** <https://dornsife.usc.edu/sergey-lototsky/>  
**Lectures:** MWF 1-1:50pm, SLH 100  
**Office hours:** MWF 11am-12pm [in-person/on zoom]

**Please do not hesitate to talk to me about your problems, questions, or concerns in this class. We can always arrange a special zoom meeting.**

- **Teaching Assistant:** Xilu Zhu  
**E-mail:** xiluzhu [at] usc (dot) edu  
**Discussions:** T Th 1-1:50pm, DMC 258.  
**Office hours:** 2-3pm Monday and 2-4pm Thursday in Math Center (KAP 263)

**Beside the discussion sections, the TA is responsible for administering and grading quizzes and collecting and grading homeworks.**

- **Textbook:** “Advanced Engineering Mathematics” by E. Kreyszig, Wiley. Any edition will work. The official version is the custom USC edition.
- **Supplement:** “Mathematics of Physics and Engineering” by Edward K. Blum and Sergey V. Lototsky, World Scientific, 2006 (ISBN-13: 9789812566218)
- **Course goal:** To realize that there is a lot of beautiful and useful mathematics out there beyond calculus and ordinary differential equations. In particular, we will cover all the material promised in the catalogue description of the course (Vector field theory; theorems of Gauss, Green, and Stokes; Fourier series and integrals; complex variables; linear partial differential equations; series solutions of ordinary differential equations), although not necessarily in this order. [Here](#) is an alternative look at it.
- Two very interesting books closely connected with the second half of the course:
  - Nicholas J. Giordano, Physics of the piano. Oxford University Press, Oxford, 2010. 184 pp.
  - Barry Mazur and William Stein, Prime numbers and the Riemann hypothesis. Cambridge University Press, Cambridge, 2016. xi+142 pp.

**Save the dates! There will be two in-class one-hour exams (October 9 and November 20, both Wednesday, during regular lecture time). The two-hour final exam is Wednesday, December 18, 11am-1pm, in the regular lecture room SLH 100.**

**Homework, Quizzes, etc.:** There will be 10 weekly quizzes (most Thursdays during the discussion sections), 11 homeworks (usually due on Tuesdays), and two computer projects (due Friday, October 25 and Friday, December 6). You should understand every solution to every homework problem and be ready to reproduce every solution without any help and in reasonable time. You are welcome to use any help whatsoever with the homework problems and the projects, but not with the quizzes.

**Note:** You might need a PDF Scanner, to submit your (mostly likely handwritten) work to Gradescope in PDF format (one PDF per assignment or exam). There are many free phone apps that you can use to scan your work to make a PDF, for instance Adobe Scan.

## Grading:

- Quizzes 15% total
- Homeworks, 15% total
- The projects, 10% total [5% each]
- Two Mid-Term Exams, 30% total [15% each]
- Final Two-Hour Exam, 30%

**Approximate Grading Scheme.** A: 90 and up; B: 80-89; C: 70-79. Pluses/minuses (As in A-, B+, etc.) will mostly be decided on a case-by-case basis.

**Missed work.** The general rule: no make-up exams or quizzes, and no late submissions of homeworks or the project (but early submissions, especially in electronic format, are welcome).

**Emergencies will be handled on a case-by-case basis.** If you miss the final exam, with a valid excuse, you get an incomplete in the class; an incomplete is a major inconvenience for a number of people, including yourself, so, please, do not miss the final.

**To encourage and reward consistent performance throughout the semester, I will not automatically drop any scores (such as the two lowest quizzes, etc.)**

## Students Requiring Special Accommodation

Any student requesting academic accommodations based on special needs is required to register with Office Of Student Accessibility Services (OSAS) each semester. A letter of verification for approved accommodations can be obtained from OSAS. Please be sure the letter is delivered to me (or to TA) as early in the semester as possible. OSAS is located in GFS 120. To contact OSAS: (213) 740-0776 [tel.], OSASFrontDesk@usc.edu [e-mail], [on the web](#).

## Academic Integrity

USC seeks to maintain an optimal learning environment. General principles of academic honesty include the concept of respect for the intellectual property of others, the expectation that individual work will be submitted unless otherwise allowed by an instructor, and the obligations both to protect one's own academic work from misuse by others as well as to avoid using another's work as one's own. All students are expected to understand and abide by these principles. Scampus (the Student Guidebook) contains the Student Conduct Code in Section 11.00, while the recommended sanctions are in Appendix A.

**Academic Support** [The Kortschak Center for Learning and Creativity](#)

## Supplementary materials

### Sample exams

[Earlier MT1s](#)   [MT1-S2022-problems](#) [MT1-S2022-sol](#) [MT1-Fall2024-Sol](#)

[Earlier MT2s](#)   [MT2-S2022](#) [MT2-F2022](#) [Now...was the actual exam]

[Earlier Finals](#)   [Final-S2022](#) [Final-F2022](#)

## Other materials

### My notes

- [Introduction](#)
- [Vectors](#)
- [Some names and faces behind some formulas](#)
- [Motion in the central field](#)
- [Grad, Div, Laplacian, and Curl in non-cartesian coordinates](#)
- [PDEs describing fluids](#)
- [Fourier and Laplace Transforms](#)
- [Applications of Fourier analysis](#)
- [PDEs \(Transport, Heat, Wave, Laplace\) in the whole space](#)
- [PDEs in a bounded domain](#)
- [Telegraph equation](#)
- [Inhomogeneous equations and inhomogeneous boundary conditions](#)
- [Solving PDEs: Separation of variables and the method of characteristics](#)
- On Music
  - [Basic](#)
  - [PDEs: a summary](#)
  - [PDEs: details](#)
- [The Weierstrass Approximation Theorem](#)
- [Elementary Quantum Mechanics](#)
- [Gamma and Beta functions](#)
- [The ladder theorem and beyond](#)

### Other Notes and Illustrations

- [An article about the mathematics of the tumbling box \(and also a tennis racquet\)](#)
- [Rotation in space: a .gif video](#)
- [A double integral four different ways. Why?](#)
- The “complex origins” of the HP corporation
  - The first product: [front](#) and [inside](#)
  - The [patent](#)

- [Pentode](#)
- [Simplified analysis](#), following Section 5.6 of the book “An Imaginary Tale” by Paul Nahin (Princeton University Press, 1998)
- [Oscillations of a heavy chain: the equation](#)
- [Advanced music theory](#)
- [How to write Greek letters](#) (by Olga Korosteleva, CSULB)
- [Basic exercises on ruler-compass construction](#) (by Olga Korosteleva, CSULB)
- [An article about the sampling theorem](#)
- The book **Fourier Analysis** by T. Korner (Cambridge University Press, 1988) is a great reference for many topics in this class. Here are some examples from the book:
  - [A nowhere differentiable function](#)
  - [Analysis of the Gibbs phenomenon](#)
  - [Non-uniqueness for the heat equation](#)
  - [Heat equation on the half-line](#)

#### More

- [On handwriting](#)
- [What makes an expert?](#)
- [No optional material](#)
- Real-life math: [addition](#), [construction](#), [cartoonSB](#), [work](#), [treasure hunt](#), [cartoonS](#), [algebra](#), [electricity](#)
- [About Schrodinger and his cat](#)
- (Non-quantum) Uncertainty Principle in real life: [Plates](#) [Directions](#)
- [When a closed-form explicit formula does not help that much!](#)