

MA/PHY 506 Methods of Theoretical Physics (Fall 2026)

Lectures

Monday, Wednesday, Friday 12:00-12:50pm, F. Paul Anderson Tower Rm. 267

No classes on Monday, September 7 (Labor Day), October 26 (Midterm break),
and November 25 & 27 (Thanksgiving)

Midterm exam: October 9th, Final Exam (tentative): December 14th, 1:00pm.

Instructor: Anatoly Dymarsky

TA:

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Office:

Office Hours: Tuesday, 2:00-3:00pm (by prior appointment)

Course Webpage: <https://uk.instructure.com/courses/2200604>

Course Description

The course and its sequel (MA/PHY 507) are designed to develop, for first-year graduate students, familiarity with the mathematical tools useful in physics. Additional focus of the course would be to address typical gaps in understanding pertaining to standard computational skills necessary for graduate physics curriculum. Topics covered by the course will include elements of calculus, including calculus with vector fields, curvilinear coordinates, linear algebra and tensors, infinite series, integrating and solving differential equations, and methods of complex variables. Work with Green's functions, eigenvalues, matrices and the calculus of variations are included as a part of MA/PHY 506 and 507.

This course is restructured to focus on mathematical skills most relevant for the age of AI.

Prerequisites

Students should have completed MA 213 and MA 214 (or equivalents). Familiarity with the following topics is assumed: differential and integral calculus, complex numbers and elementary complex functions, ordinary differential equations, and basic linear algebra.

Course Rules and Policies

The course activities, besides lectures, will include homeworks and or in-class quizzes (roughly one for each topic, approximately one homework every 1-2 weeks, between 8 and 10 assignments in total), as well as Midterm and Final exams. Homework assignments will be posted to Canvas, homework solutions should be turned in to the instructor at the beginning of class (on the posted due date). Late homeworks are not accepted (unless the delay is caused by illness or other pressing circumstance which were discussed and approved by the instructor beforehand).

Exams are open book (including use of ebooks or other electronic resources), but use of any math-

ematical, communication or AI software is prohibited.

Grade Distribution

H.work & Quizzes	30 %	Grading scale for undergraduates: 85-100% or above=A, 70-84%=B,
Midterm exam	30 %	55-69%=C, 41-54%=D, 40% or below=E
Final exam	40 %	For graduates: 85-100%=A, 70-84%=B, 55-69%=C, below 55%=E

Recommended literature and resources

- G. B. Arfken, H. J. Weber, Mathematical Methods for Physicists
- J. Mathews, R. L. Walker, Mathematical Methods of Physics
- E. Butkov, Mathematical Physics
- ChatGPT, Claude, DeepSeek

Course Topics

Corresponding chapters for reading will be posted to Canvas.

1. Elements of calculus (Taylor series, limits)
2. Fundamentals of Linear Algebra
3. Curvilinear coordinates and calculus with vector fields
4. Variational calculus
5. Elements of complex analysis
6. Infinite Series and Integrals
7. Ordinary differential equations

Excused Absences Policy

Students need to notify the professor of absences prior to class when possible. Senate Rules 5.2.4.2 defines the following as acceptable reasons for excused absences: (a) serious illness, (b) illness or death of family member, (c) University-related trips, (d) major religious holidays, and (e) other circumstances found to fit “reasonable cause for nonattendance” by the professor.

Students anticipating an absence for a major religious holiday are responsible for notifying the instructor in writing of anticipated absences due to their observance of such holidays no later than the last day in the semester to add a class. Two weeks prior to the absence is reasonable, but should not be given any later. Information regarding major religious holidays may be obtained through the Ombud (859-257-3737), <http://www.uky.edu/Ombud/ForStudents/ExcusedAbsences.php>.

Students are expected to withdraw from the class if more than 30

Per Senate Rule 5.2.4.2, students missing any graded work due to an excused absence are responsible: for informing the Instructor of Record about their excused absence within one week following

the period of the excused absence (except where prior notification is required); and for making up the missed work. The professor must give the student an opportunity to make up the work and/or the exams missed due to an excused absence, and shall do so, if feasible, during the semester in which the absence occurred.

Verification of Absences Policy

Students may be asked to verify their absences in order for them to be considered excused. Senate Rule 5.2.4.2 states that faculty have the right to request “appropriate verification” when students claim an excused absence because of illness, or death in the family. Appropriate notification of absences due to University-related trips is required prior to the absence when feasible and in no case more than one week after the absence.