# Math Methods Syllabus

## 2010 Fall Term: MWF 8:00–8:50, AND Fri 3:00-3:50, S 226

## Textbook: "Mathematical Methods in the Physical Sciences" (3e)    Mary L. Boas

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PHY/MAT 301 (4) Prerequisites:  MAT 201.
Students will study the mathematical methods used in Physics.  Topics include:  the algebra
and calculus of vectors, coordinate transformations, elements of matrix algebra, matrix
diagonalization, orthogonal curvilinear coordinates, tensor algebra, elements of tensor
calculus, Cartesian tensors, application of vectors and tensors to physical problems.

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# 1    Departmental Goals

Through the class discussion and lecture, you will be exposed to *problem solving techniques and skills* as they apply to the upper level physics courses at an *advanced* level. Solving the homework problems will help you to incorporate these principles into your general understanding of the world and the tests will verify whether or not you have gained this skill set.

Your grades on the homework and exams will reflect your knowledge of the principles and foundations and your ability to generalize and extend these. The point of turning in work is to <u>show me</u> how well you understand the material. The point of grading work is to <u>show you</u> how well you understand as well as how well you communicate your understanding. Please review returned homework to learn what you didn't understand.

# 2    Grading

30%    **Homework:** Homework will be assigned by chapter and is due on the "boxed days" (see the schedule). Many chapters will have straightforward problems assigned before we cover the material followed by harder problems after we cover the material. The point is encourage you to familiarize yourself with the material before class time. Solutions will be posted after the assignment is collected.

You should attempt every homework problem for the class before the homework is due so that we can discuss the problems that seem confusing.

15%
15%
15%
+25%

**Exams:** There will be three exams during the term and a longer, comprehensive final exam. Each exam will have an in-class, closed-book portion. They may also have an open-book and/or take-home portion.

100%    **Grades:** Final grades will be reported as a percentage of the total possible weighted average. If at any time during the semester you are curious about your grade, I have an Excel worksheet which can printout a summary of your individual grades.

**Expectations:** You are being compared to that subset of the national population who went to college and who majored in Physics. I consider average among this population to be a C so that you are not surprised after you graduate.

Grades are tied to numerical scores according to the criterion: "D" is *poor*, "C" is *good enough*, "B" is *well done*, "A" is *excellent*. You can expect a 90-80-70 grading scale, but I reserve the right to adjust it down if need be: The B/C boundary is usually near 78%. My best students usually score in the low 90's. My worst in the 40's. After each exam, I will tell you where the borders are.

The point of turning in work is to <u>show me</u> how well you understand the material. The point of grading work is to <u>show you</u> (1) how well you understand and (2) how well you communicate your understanding. Homework comments are intended to help you learn.

# 3   Policies

**Attendance:** Physical attendance is mandatory. Mental attendance is appreciated (not to mention helpful). If "something comes up," contact me (note, email,voice mail, courier, same-day word-of-mouth) **before** class. I can be contacted via the information on this page.

**Athletics:** It is your individual responsibility to inform me if you will miss class **before** you miss class. Even if an email is being sent on your behalf, see me before or after class so that I can inform you of variations from the syllabus. It is your responsibility to inform me of incoming report cards before you bring them so that I can have a grade prepared.

**Late Policy:** No credit will be given for problems worked in class regardless of attendance in the class. Late homework loses 5 points per day (not per class period).

**Missed Exams:** Make up exams **must** be scheduled before regular exam time. Documented, unforeseen events will be dealt with on a case-by-case basis.

**Office Hour Policy** My schedule (with office hours) is posted by my office door. I prefer that you visit during office hours, but I am in my office most days from about 8:00am to about 4:30pm. You are welcome to stop by whenever you have a question. If you call ahead, then we can find a time that suits us both.

**Disability Services:** For those with a documented physical or learning disability, please see Jim Ross, Coordinator for Academic Student Support Services, Administration Building Rm. 3336, 344-3521.

## 3.1   Campus Policies and Services

| Policy | Page of Catalog, by academic year | | | |
|---|---|---|---|---|
| | 10-11 | 09-10 | 08-09 | 07-08 |
| Disability Services (344-3521) | 23 | 20 | 25 | See Student Handbook |
| Tutoring Services (344-3363) | 23 | 20 | 25 | See Student Handbook |
| Attendance | 33 | 29 | 36 | 35 |
| Academic Honesty | 34 | 31 | 38 | 36 |

† - 10/11: Midterm Reports.    and    ∗ - 10/19: Last day to withdraw-passing

| Date | Day | Topic | Pre-class Readings | |
|------|-----|-------|--------------------|---|
| 8/16 | M | (No Class) | | |
| | W | 1. **Review** of Patterns, Sequences, Series, Convergence | 1: 1-9 | 20 |
| | | (Tests of, Conditional, Interval of) | | |
| | F | 2. Generating a Power Series | 1: 10-14 | 16 |
| 8/23 | $M_{1a}$ | 3. Using Series | 1: 14-15 | 11 |
| | W | 4. Problems (Have tried the homework! Bring questions.) | 1: 16 | |
| | $F_{1b}$ | 5. Complex Numbers & Complex Algebra | 2: 1-5,8 | 12 |
| 8/30 | $M_{2a}$ | 6. Euler, Powers and Roots, Trig and Hypertrig      (§2.6-7 ?) | 2: 9-12 | 11(+4) |
| | W | 7. Applications & Problems (Have tried the homework! Bring questions.) | 2: 13-17 | 10 |
| | $F_{2b}$ | 8. Vectors, Scalar and Vector Products | 3: 1,4,5 | 19 |
| 9/6 | M | ========== **Labor Day** ========== | | |
| | W | 9. Matrices, Systems of Linear Equations, Determinants | 3: 1-3 | 14 |
| | F | 10. ⇒ **Test 1** ⇐ | Chap. 1–2 | |
| 9/13 | M | 11. Post-test | | |
| | $W_{3a}$ | 12. Matrix Operations and Properties | 3: 6,9 | 16 |
| | F | 13. Solving Systems of Linear Equations (Computers) | | |
| 9/20 | M | 14. Linear Systems | 3: 7-8 | 18 |
| | W | 15. Vector Spaces: Eigen- values, vectors, functions | 3: 10-11,14 | 25 |
| | F | 16. Problems (Have tried the homework! Bring questions.) | 3: 15 | |
| 9/27 | $M_{3b}$ | 17. Quick Review of Partial Derivatives | 4: 1-8,10 | 26 |
| | W | 18. Constraints: Lagrange Multipliers | 4: 9 | 9 |
| | F | 19. Miscellaneous Use of Partials | 4: 10-13 | 18 |
| 10/4 | $M_4$ | 20. Review of Multiple Integrals, Jacobians | 5: 1-5 | 32 |
| | W | 21. Problems (Have tried the homework! Bring questions.) | 5: 6 | |
| | F | ========== **Fall Break** ========== | | |
| † 10/11 | $M_5$ | 22. Review of Vector Analysis, differentiation | 6: 1-7,10,11 | 45 |
| | W | 23. Review of Vector Integration | 6: 8-11 | 37 |
| | F | 24. ⇒ **Test 2** ⇐ | Chap. 3–5 | |
| 10/18 | M | 25. Exam Postview | | |
| ∗ | W | 26. Problems (Have tried the homework! Bring questions.) | 6: 12 | |
| | $F_6$ | 27. Periodicity $(\nu, \omega, f, \lambda, k)$, Periodic Functions | 7: 1-2 | 5 |
| 10/25 | $M_{7a}$ | 28. Fourier Series, Fourier Coefficients, Reciprocal Space | 7: 3-5 | 10 |
| | W | 29. Details of Fourier Series | 7: 6-8 | 9 |
| | F | 30. Even & Odd Functions | 7: 9-11 | 12 |
| 11/1 | M | 31. Fourier Transforms | 7: 12 | 9 |
| | W | 32. Problems (Have tried the homework! Bring questions.) | 7: 13 | |
| | $F_{7b}$ | 33. Review of ODE: 1st, 2nd order linear with constant coefficients | 8: 1-7 | 42 |
| 11/8 | M | 34. Laplace Transforms, Delta Function, Green Functions | 8: 8-12 | 29 |
| | W | 35. Problems (Have tried the homework! Bring questions.) | 8: 8 | |
| | $F_8$ | 36. Calculus of Variations: Euler Equation | 9: 1-3 | 10 |
| 11/15 | M | 37. Multiple Variables: Lagrange's Equations | 9: 5 | 6 |
| | W | 38. ⇒ **Test 3** ⇐ | Chap. 6–8 | |
| | F | 39. Post-test | | |
| 11/22 | $M_{9a}$ | 40. Applications | 9: 4,6-8 | 7 |
| | W | ========== **Thanksgiving Break** ========== | | |
| | F | ========== **Thanksgiving Break** ========== | | |
| 11/29 | M | 41. Problems (Have tried the homework! Bring questions.) | 9: 8 | |
| | $W_{9b}$ | 42. Review: **BRING QUESTIONS** | Chap. 1–9 | |
| | F | ========== **Study Day** ========== | | |
| 12/6 | M | 43. **Final Exam**: 8:30–10:30 | Comprehensive | |