

## Physics 230 Winter 2012 Course Syllabus

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Office hours: Tuesdays Noon to 1:00 p.m. or other times by appointment.

### Objectives

The objective of this one credit-hour class is that you develop fluency in formulating and solving physics problems using a symbolic-mathematics language like Mathematica. Mathematica is a powerful analytical tool that can be applied to a wide variety of problems in both academic and industrial settings. You will find it useful in most of your upper-division physics and astronomy courses and in a number of our research groups on campus. Many of our students say that Physics 230 was one of their favorite classes at BYU.

### Course Materials

We will be using the Mathematica (v 8.0) software package for this course. This university-site-licensed software is available in our classroom and in our department computer labs. It is also supposed to be available within each of the Open-Access computer labs on campus. The course materials will consist entirely of laboratory exercises (available on the course website) and online software documentation. There are no textbooks or course packets to purchase.

### Lab Exercises

During each 3-hour lab period, you are to complete each of the assigned lab exercises, in addition to reading/executing the documentation provided with or linked to those exercises. You complete an exercise by showing the output on your computer screen to your TAs and having them initial that exercise on your sign-off sheet. The sign-off sheet will be collected at the end of the semester. There is no assigned work outside of the scheduled lab periods, though you may use the classroom computers outside of class whenever the room is not in use by sections or courses. You may be tempted to work through the exercises on your own and come to class only to have your assignments passed off and recorded. We discourage this approach. Because the labs are designed to include a lot of interaction with your TAs, those who work only outside of class generally spend twice as much time on each lab as those who attend class. Furthermore, those who do not come to class when the instructor and/or TAs are available tend to expect extra help after hours.

**Late work:** If you get behind on your lab exercises, you still be permitted to pass them off to your TA at the beginning of your next scheduled lab period without penalty. Any work accepted later than that will be dated and penalized at a rate of 25% per week. For a lab containing 10 exercises, suppose that you complete 5 exercises during the regularly-scheduled lab period, 1 exercise at the beginning of the next lab period, 2 exercise in the middle of the next lab period, and the last 2 exercises three lab periods after the due date. Your score will then be  $5+1+2(0.75)+2(0.25) = 8$  points. No lab exercises will be accepted after the last day of classes. The labs do tend to get increasingly difficult as the semester progresses; so please make every effort to keep up. You may work on your lab exercises outside of your normally scheduled lab period as long as the room is not being used by another section or course. Exceptions are possible in extenuating circumstances, but only if requested in advance or reasonably soon after the due date.

## Final Exam

The final exam will be a one-hour in-class test during the regularly scheduled final exam time (see the BYU class schedule). While your grade is largely based on your lab exercises, the final exam is an opportunity to demonstrate that you can solve basic problems without help from the TAs. You will complete the exam within an initially empty Mathematica notebook and will not be permitted to refer to your textbook, your lab exercises, or any other preexisting notes or files for help. You may, however, rely on the built-in software documentation.

## Final grades

The final exam will carry twice the weight of a single lab. Most students should be able to receive an A or an A- in this class by diligently completing each assignment and performing well on the final exam, though grades will fall off sharply due to missed or incomplete lab reports. The final grade scale is as follows:

Score	95%	92%	89%	86%	83%	80%	77%	74%	70%	65%	60%
Grade	A	A-	B+	B	B-	C+	C	C-	D+	D	D-

## Class Schedule

Lab	Sec 1 Monday 2-5 PM	Sec 2 Friday Noon - 3 PM	Topics
1	Jan 9	Jan 13	Introduction to Mathematica (notebook basics, menus, documentation, syntax, applications and simple examples)
2	Jan 23	Jan 20	Functions and Lists (functions, arguments, list generation and processing, random numbers, statistics)
3	Jan 30	Jan 27	Plotting Functions and Lists (plot types and options)
4	Feb 6	Feb 3	Advanced Graphics (graphics primitives and interactive graphics)
5	Feb 13	Feb 10	Differentiation (limits, extrema, partial and higher-order derivatives, implicit differentiation, series expansions)
6	Feb 21	Feb 17	Integration (definite and indefinite integrals, multiple integrals, regional integrals, algorithms and options for numerical integration)
7	Feb 27	Feb 24	Linear Algebra (vector and matrix operations, linear systems of equations, eigenvectors and eigenvalues)
8	Mar 5	Mar 2	Complex Analysis (operations, unit circle, functions, calculus)
10	Mar 12	Mar 9	Programming I (logic, conditional statements, piecewise functions, procedural vs functional programs, loop structures, recursive structures)
11	Mar 19	Mar 16	Programming II (scoping constructs, iterative equation solving, procedural flow control, debugging)
12	Mar 26	Mar 23	Optimization (1D curve fitting, data variables vs parameters, cost functions, algorithms, uncertainties)
13	Apr 2	Mar 30	Data Processing (data import/export, text parsing and formatting, multimedia, integrated data sources)
14	Apr 9	Apr 6	Sample final exam problems
Final Exam	Tue 4/17 3-4 PM	Wed 4/18 11AM - 12 PM	In the lab, at the computer, one hour, comprehensive

**Honor Code Standards:** In keeping with the principles of the BYU Honor Code, students are expected to be honest in all of their academic work. Academic honesty means, most fundamentally, that any work you present as your own must in fact be your own work and not that of another. Violations of this principle may result in a failing grade in the course and additional disciplinary action by the university. Students are also expected to adhere to the Dress and Grooming Standards. Adherence demonstrates respect for yourself and others and ensures an effective learning and working environment. It is the university's expectation, and my own expectation in class, that each student will abide by all Honor Code standards. Please call the Honor Code Office at 422-2847 if you have questions about those standards.

**Harassment:** Harassment of any kind is inappropriate at BYU. Specifically, BYU's policy against sexual harassment extends not only to employees of the university but to students as well. If you encounter sexual harassment, gender-based discrimination, or other inappropriate behavior, please talk to your professor, contact the Equal Employment Office at 422-5895 or 367-5689, or contact the Honor Code Office at 422-2847.

**Disabilities:** BYU is committed to providing reasonable accommodation to qualified persons with disabilities. If you have any disability that may adversely affect your success in this course, please contact the University Accessibility Center at 422-2767. Services deemed appropriate will be coordinated with the student and instructor by that office.

**Children in the Classroom:** The serious study of the physical and mathematical sciences requires uninterrupted concentration and focus in the classroom. Having small children in class is often a distraction that degrades the educational experience for the entire class. Please make other arrangements for child care rather than bringing children to class with you. If there are extenuating circumstances, please talk with your instructor in advance.