Professor Alan Sokal
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Lectures: Tuesdays 1–2, Thursdays 10–11 and 3–4, all in Malet Place, Room 1.02
Problem classes: Wednesdays 12–1 (with Dr. Timoshin), in Malet Place, Room 1.02
Office hours: To be negotiated with you later this week

Recommended Texts: There is no single book that is perfect for all the topics in this course. You will therefore have to get into the (good) habit of reading the relevant sections in *several* textbooks (each one with its own idiosyncrasies, gems and flaws) and then synthesizing what you have learned. With each topic I will give you a detailed reading list, but here is a preliminary list of useful reference books:

Chester, *Mechanics*
Chow, *Classical Mechanics*
Feynman, *The Feynman Lectures on Physics*, vol. 1
Kleppner and Kolenkow, *An Introduction to Mechanics*
Lunn, *A First Course in Mechanics*
Smith and Smith, *Mechanics*, 2nd ed.

(Of these, my favorite is Kleppner and Kolenkow; also, Feynman is idiosyncratic but often brilliant.) I will also hand out my own notes when I feel (modestly) that I can explain a topic better than any of the existing texts.

Approximate Outline:

Vector algebra and kinematics (review).

Newton's first and second laws (review). Galileo's principle of relativity. Newton's third law. How to set up mechanics problems. Conservation of momentum. Conservation of angular momentum.

Solvable cases of one-dimensional motion (review). Energy in one-dimensional motion. Simple harmonic oscillator, damped harmonic oscillator, forced harmonic oscillator (review). Anharmonic oscillator and perturbation theory.

Work done by a force. Work-energy theorem. Conservative and nonconservative forces; potential energy and conservation of energy in two- and three-dimensional motion.

Velocity and acceleration in polar coordinates. Central-force motion. Kepler's laws of planetary motion.

Open systems ("systems with changing mass"): accretion of matter, rocket motion.

Oscillations: systems of masses on springs. Normal modes.

Waves: Frequency, period, wavelength, harmonics. Wave equation for vibrating strings. Progressive and standing waves, superposition, beats. Dispersive waves.

Problem Sets: One cannot learn mathematics solely by watching *someone else* do mathematics (even if that "someone" is a UCL professor). To learn mathematics, you must solve mathematics problems — lots of them — by *yourself*. Therefore, I will assign problem sets every week; they are to be handed in at the following week's problem class. *These problem sets are the most important part of the course.*

It is essential that you do the problem sets faithfully each week; if you put them off, even a little bit, you will have an *extremely* hard time catching up. Give yourself lots of time — mathematics is not a speed race — and do *not* expect to do a whole problem set in one sitting. If you get completely stuck on a problem, go on to another problem, and come back to the first one on a later day — your unconscious mind will be working on it in the meantime! I suggest therefore that you start on the problem set early in the week.

I do not expect you to get everything right on the problem sets the first time around. (Indeed, if you do get everything right, then you should complain to me that the problem sets are not challenging enough!) Rather, the purpose of the problem sets is to give you an opportunity to struggle with the ideas discussed in class by applying them to concrete physical and mathematical problems, and in this way to solidify your understanding of those ideas. Only by such an intellectual struggle can you learn mathematics (or anything else of value, for that matter).

In writing up the problem sets, therefore, you must attempt to explain, as clearly and precisely as you can, the logic behind what you are trying to do: what is the physical or mathematical situation, what are the givens, what are the unknowns, what are the principles to be applied, how you intend to apply those principles, etc. (Please use full English sentences, and large clearly-labelled drawings.) This explanation is especially important if you are *not* able to complete the problem: you should try to pinpoint, as clearly as possible, at what point you got stuck and why — this will serve as the basis for the class discussion. The coursework grade will be based on the logic and clarity of your explanation.

Grading formula:

Coursework	10%
Final exam	90%