

Math 211, Fall 2011: Final Exam Study Guide

The final exam will take place on Tuesday 20 December at 2:00pm in our usual classroom, the Paino Lecture Hall. It will be 3 hours long. You will not be allowed to use notes, books or calculators of any kind. The exam will cover all the material from this semester.

Format of the exam

The exam will have roughly 12-15 problems, each of a similar length and difficulty to the midterm questions. You should do as many of the questions as fully as possible. You will get partial credit if you have the right idea for a question, even if you do not get it completely correct. You should also explain your answers fully, to an amount of detail appropriate to the question. The rule of thumb is that you should explain the key steps needed to solve the problem, but do not have to explain minor steps that you use along the way.

Techniques of integration

The only techniques of integration that you need to know for this exam are the following:

- integrals of power functions
- integrals of sine and cosine
- integrals of exponential functions
- integrals of sums, differences and constant multiples
- changes of variables (integration by substitution) in relatively simple cases

You will NOT need to know integration by parts, partial fractions, trig substitutions, integrals of powers of sine and cosine (except for relatively simple substitutions such as integrating $\sin x \cos^n x$).

Syllabus

The syllabus for the final includes all the material from the three midterms. You should go over the study guides for those as part of your preparation. In addition, you need to know about the following topics. You should:

- vector fields (16.1)
 - be able to sketch a diagram of a vector field (in two dimensions) from its formula

- integrals along curves (16.2)
 - be able to use a parametrization to calculate the integral of a function along a curve in either \mathbb{R}^2 or \mathbb{R}^3
 - be able to use a parametrization to calculate the integral of a vector field along a curve in either \mathbb{R}^2 or \mathbb{R}^3
 - understand what the integral of a vector field along a curve represents and be able to estimate the value of such an integral from a diagram of the vector field and the curve
- conservative vector fields (16.3)
 - know what it means to say a vector field is conservative
 - know and be able to apply the Fundamental Theorem of Calculus for integral along curves in the case of a conservative vector field
 - know that the integral of a conservative vector field around a closed curve is zero
 - be able to use ‘partial integration’ (that is, integrating with respect to one variable and then the other) to find a function f whose gradient is a given conservative vector field
 - know what is meant by a simply-connected region in \mathbb{R}^2 and be able to say if a given region is simply-connected or not
 - be able to show that a vector field $\mathbf{F} = \langle P, Q \rangle$ is or is not conservative by calculating $\frac{\partial Q}{\partial x}$ and $\frac{\partial P}{\partial y}$
- Green’s Theorem (16.4)
 - know the statement of Green’s Theorem
 - be able to apply Green’s Theorem to calculate the integral of a vector field along a closed curve
 - be able to apply Green’s Theorem to calculate the area of a region of the plane
 - understand that the two parts of Green’s Theorem represent in some sense the total amount of ‘rotation’ possessed by a vector field, and that a conservative vector field has zero rotation

The exam will not have any questions on parametrized surfaces, surface integrals, curl, divergence, Stokes’ Theorem or the Divergence Theorem.

This is not a complete list of what you might have to do on the test but it covers most of the ideas involved. In particular, you may have to combine several of these ideas or techniques, and you may have to think to decide what to use to solve a problem.

Preparing for the test

The best way to prepare for the test is to do practice questions. You can find final exams from previous years on the Math Department web site and I'll provide a link from the course web site. You should try to do practice questions under exam conditions, that is, without a textbook or notes, writing out your answers fully as though it were the real thing, and with only the appropriate amount of time. If you can't take 3 hours, then do, say one third of the questions on a previous final and give yourself 1 hour.

You should also go back over past homework problems, especially those for which the grader has written a comment or deducted points and make sure you understand the comment or why you lost points. If you can't work this out or have any other questions about the grading, please come and ask me about it. I'll have office hours all day on Thursday and Friday this week to help you prepare.

You should also just work through more practice problems. If you didn't do the practice problems assigned for the homeworks, now would be a good time to do those. If you did, you can make up some more problems on your own (which is also a good exercise to see if you understand the material) and try to solve them. You can always ask me if you are unsure of something.

Beyond that, please let me know how else I can help you prepare, and good luck!