MATH 53 SPRING 2018 FINAL EXAM LIST OF TOPICS

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The final exam will be cumulative, and cover everything we did in the course (all lectures, including PDE). You do not need to memorize Maxwell's equations, though you may be asked to work with them or similar PDE. You will be allowed to bring a **one page single-sided handwritten cheat sheet** to the final exam, which we will inspect when you turn in the exam. The goal of this is that making the sheet will force you to concisely organize the many concepts we have covered, and the relationships between them.

The main difference between the final and HW problems will be that there will be problems that require applying more than one concept, which may not even be from the same chapter.

Here is a list[1] of things you should know / know how to do in addition to the list for midterms 1 and 2; if you are comfortable with everything on this list, you should be fine.

The emphasis will be on computational problems, conceptual questions, and occasionally visualization, and not on formal proofs. However, you should know all of the definitions, derivations, and informal proofs that were covered in lecture.

- How to check whether a given function is a solution of a PDE.
- Curl of a gradient is zero; divergence of a curl is zero; divergence of gradient is the Laplacian.
- Definition of a parametrized surface.
- How to go between a description of a surface and a parametrization of it.
- How to find the tangent plane to a parametrized surface at a point on the surface (where the parametrization is smooth).
- How to calculate the area of a parametrized surface.
- Definition of integral of a function over a surface with respect to surface area.
- Definition of orientation of a surface. Difference between surfaces with boundary and without boundary.
- Definition of integral of a vector field over an oriented surface (flux).
- Statement of the divergence theorem.
- Use the divergence theorem to evaluate the flux of a vector field through a surface without boundary.
- Use the divergence theorem to simplify the calculation of the flux of a vector field through a surface with boundary, using a more convenient surface with the same boundary.
- Statement of Stokes theorem.
- A differentiable vector field on $\mathbb{R}^3$ is conservative if and only if its curl is zero.
- Use Stokes theorem to evaluate the line integral of a vector field around a closed curve by finding an oriented surface bounded by the curve and then integrating the curl over the surface.

[1] This list is a modified version of a similar list produced by Prof. Hutchings for a previous version of this course.