

Math 2210-5 Review for Final Exam

Below is a list of problem types. These, together with the problem types from the other two review sheets, are the types of problems you might see on the exam. Certainly, not all of these problems will appear on the exam (there isn't enough time for that); and it is entirely possible that a problem will appear on the exam which does not fit into any of these types. I will allow two page of notes for the Final Exam. These pages must be hand-written (NO XEROX!!!). This exam will cover material from the entire course.

1. Given the parametric equations for a curve, sketch the curve.
2. Given a curve, find the parametric equations.
3. Compute the velocity and acceleration vectors for a given parametric curve in 2D or 3D.
4. Compute the unit tangent vector to a curve.
5. Compute the unit normal to a curve.
6. Compute the curvature of a curve.
7. Compute the unit binormal to a curve.
8. Compute the torsion of a curve (any problem involving torsion will be very easy).
9. Use the properties of dot product and cross product to prove various things about $\hat{\mathbf{T}}$, $\hat{\mathbf{N}}$, and $\hat{\mathbf{B}}$.
10. Compute the tangent line to a curve.
11. Compute the tangential and normal components to the acceleration vector.
12. Parameterize simple surfaces such as: plane, sphere, ellipsoid, graph of f , etc.
13. Sketch a given vector field.
14. Given the graph of a vector field, sketch its flow.
15. Given the contour diagram for a function f , sketch the vector field ∇f .
16. Show that a given parameterized curve is the flow for a given vector field (i.e., it satisfies the system of DEs).
17. Compute a line integral geometrically.
18. Compute a line integral by parameterizing the curve.
19. Decide whether a given vector field is
 - (a) gradient?
 - (b) conservative?
20. Use the Fundamental Theorem of Calculus for Line Integrals to compute a line integral.
21. Compute the Work done by a force on a particle as it moves along a given curve.
22. Find the potential of a vector field. That is, given a field \vec{F} , find a function f so that $\nabla f = \vec{F}$.
23. Use Green's Theorem to compute a line integral.
24. Understand what the flux of \vec{F} through a surface S , written, $\text{Flux}_S(\vec{F})$, means.
25. Compute a flux integral by parameterizing the surface.
26. Compute a flux integral geometrically.

27. Compute the divergence of a given vector field.
28. Use Gauss's Divergence Theorem to compute flux integrals over closed surfaces.
29. Know what a harmonic function is (divergence of its gradient is zero).
30. Show that a given function is harmonic.
31. Lots of different possible flux integrals and line integrals for harmonic functions.
32. Compute the curl of a given vector field.
33. Prove things about curl and divergence.
34. Know Stokes' Theorem.
35. Compute line integrals using Stokes' Theorem (easy ones, geometric).
36. Compute flux integrals using Stokes Theorem (easy ones, geometric).
37. Given a vector field \vec{F} ,
 - (a) determine if a vector potential exists, that is a vector field \vec{G} such that $\text{curl } \vec{G} = \vec{F}$.
 - (b) if such a \vec{G} exists, find it.
38. Don't forget to look at your other two review sheets, from Exams 1 and 2!!!