Study Guide for Math 275 Final

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The exam will be open book, open notes, and any calculator you like. Computers (including laptops and palmtops such as Palm Pilots) are not permitted.

Please be aware that the fact that it is an open book exam does not mean that you do not have to study!

Any use of your calculator should be described, and you should pay careful attention to the instructions for each problem as to what kind of work needs to be shown.

There may be some built-in makeup opportunities on this exam: you might be able to improve scores on particular problems in the previous exams if you get good scores on particular problems on the final. I have not decided whether to do this; in any case, any such problems will be an essential part of the final (there will be no additional work purely for makeup).

Disclaimer (this is standard): nothing I say here about what I am not covering in any way restricts the content of the hardest question on the exam.

12.2: Know how to do the vector computations described here. Be able to carry out vector computations with pictured vectors as well. Remember how to get a vector from an arrow between points.

12.3, 12.4: Be able to compute dot products and cross products of vectors. Be sure that you know how to compute the dot product of two vectors given their lengths and the angle between them. There might be questions about scalar and vector projections (pictorial as well as computational). Be familiar with the relationship between the magnitude of the cross product of two vectors and the lengths of the vectors and angle between them. Also, be aware of the convention determining the direction in which the cross product of two vectors points (right hand rule).

12.5: Know how to develop equations of lines and planes! Both parametric and symmetric equations of lines should be familiar. Know how to use the cross product of two vectors lying in a plane to get a normal vector to the plane. Know the relation between normal vectors to a plane and equations of the plane.

12.6: I doubt that I will ask a question directly about this section (though surfaces of these types definitely may show up in problems).

12.7: Be ready for applications of cylindrical and spherical coordinates. I don't know that I am likely to directly test this section, but I might. It is more likely that your knowledge of these coordinate systems will be tested in the context of multiple integration.

13.1: Be ready to develop parameterizations of curves. Remember the three simple cases: line segments, circles, graphs of functions.

13.2: I doubt that I will test the easy content of this section directly, but of course you have to use it to do stuff from later sections.

13.3: I may ask you to compute arc length and/or curvature for a parameterized curve. If I do, you may expect that things will come out neatly from a computational standpoint. This is a good section to bookmark for formulas!

13.4: I might ask some question about dynamics of a particle. Computing velocity and acceleration is easy of course, and you have the formulas in the section for tangential and normal components of acceleration. If I ask about tangential and normal components of acceleration, that will count as the curvature question; I don't think it terribly likely that I will. I might give the accelaration for a particle at all times along with position and velocity vectors at a particular time and ask you to find the position vector at all times.

14.1: Be ready to draw level curves for a function (remember to label them with values), or to answer a question about a function when a contour map of the function is given (questions about the signs of partial derivatives using contour maps are definitely fair game).

14.2: I don't think I am going to ask about this section. If I do, it will be a question about a discontinuity loaded with hints (I will indicate what paths to the discontinuity to try).

14.3: Be able to compute partial derivatives. Know about Clairaut's Theorem.

14.4: Be able to find tangent planes and compute linear approximations. I'm probably more likely to ask about tangent planes to level surfaces of functions or parameterized surfaces, though. The linear approximation ideas are important.

14.5: I might ask about chain rules.

14.6: Be able to compute directional derivatives and gradient vectors. You might want to be able to say something intelligent about directional derivatives of a function whose contour map is given. Be aware of the fact that the gradient indicates the direction in which a function increases fastest and that its magnitude indicates that largest rate of increase.

14.7, 14.8: Be familiar with these techniques for finding maxima and minima, or maxima and minima subject to constraints. You will not have to do a 14.7 question and a 14.8 question: you might have a choice between them. This is a question which might provide makeup points for a question on the earlier exam.

15.1: I might ask a question about numerical approximation of a double integral over a rectangle or an average value.

15.2: Be able to compute double integrals. Be aware of Fubini's theorem (ability to change order of integration on rectangular regions.) You may find the formula on the top of p. 980 useful.

15.3: Be able to set up and compute double integrals over general regions. You may be asked to look at an iterated integral and draw the region of integration, or set up (or set up and evaluate) an integral over a region given as a picture. Be sure to take advantage of elementary geometrical formulas when possible.

15.4: Be able to convert integrals to polar coordinates when it is convenient to do so. It is quite likely that there will be no direct question about this, but you might have to do a conversion to evaluate some integral from a problem derived from a later section. But I might ask about the section directly as well: I might for example draw a region and ask you to set up an integral over that region using a conversion to polar coordinates.

15.5: I will not ask about this section.

15.6: I will not ask directly about this section, though you might be able to solve the 16.6 problem (if there is one) with methods from this section.

15.7: There will definitely be an unavoidable triple integral setup problem (like 2a, test 4, though probably easier). Otherwise, be able to evaluate triple iterated integrals. I will not ask you to both set up and evaluate a triple integral.

15.8: Be able to do the conversions described in this section when needed. My remarks on this section are similar to my remarks on section 15.4.

15.9: I will definitely ask a question about this section, similar to the one on Test 4.

16.1: There isn't much to say about this section.

16.2: I am not likely to ask for line integrals with respect to arc length. I may ask you to compute a line integral with respect to a vector field directly.

16.3: Know how to tell when a vector field has "independence of path", how to recover a function from its gradient, and how to apply the fundamental theorem of line integrals.

16.4: I don't know that I'm likely to ask about this section directly. If I do, it will be much as in Test 4.

16.5: Be able to compute curls and divergences.

16.6: Expect questions strongly resembling the homework. You should be able to find a tangent plane to a parameterized surface at a given point.

You should be able to compute the area of a parameterizd surface (if the integration is manageable). The second kind of question might be superseded by a more general surface integral question (section 16.7).

16.7: Expect questions strongly resembling the homework problems: compute surface integrals of functions or with respect to vector fields. In either 16.6 or 16.7, I might (but I do not promise to) restrict problems to setup.

16.8-9: I will tell you precisely what kinds of question to expect (if any) when we have talked about these sections.