Math 2934 — Summer 2015
Review for final exam

The final exam will cover the following sections of the text:

- 12.1, 12.2, 12.3, 12.4, 12.5, 12.6;
- 13.1, 13.2;
- 14.1, 14.3, 14.4, 14.5, 14.6, 14.7;
- 15.1, 15.2, 15.3, 15.4, 15.7, 15.8, 15.9;
- 16.1, 16.2, 16.3, 16.4, 16.5.

For all of these sections up through 16.2, you can refer to the review sheets for the first three exams. I've added a couple of comments below for sections 16.3, 16.4, and 16.5.

16.3. The fundamental theorem for line integrals. We covered the entire section, except, if you want, you can skip the last subsection titled "Conservation of Energy".

Note: in class, we often referred to the function f whose gradient is the vector field $\mathbf{F}$ as the "potential function for $\mathbf{F}$"

16.4. Green's theorem. You should remember Green's Theorem (in the red box on page 12). Notice that it's important, for the theorem to hold, that the curve C be positively oriented, meaning that C is parameterized so that, as t increases, you move around C with the interior of C on your left (and the exterior of C on your right).

You don't need to know about the proof of Green's Theorem (on page 1109). You can also skip Example 5 on pages 1112–113, as we won't be discussing Green's Theorem on domains with holes in them. You should study Examples 1, 2, 3, and 4. (Notice, by the way, that the double integral in Example 4 turns out to be the same one you computed on problem 2 of the third exam.)

The final paragraph of the section is interesting and helps tie together some of the disparate things we've been studying, making them easier to remember. It points out that you can use Green's theorem to show that if $\mathbf{F} = P\ \mathbf{i} + Q\ \mathbf{j}$ satisfies $\frac{\partial P}{\partial y} = \frac{\partial Q}{\partial x}$ at all points in a domain D with no holes in it; then the line integral of $\mathbf{F}$ around any closed curve in D must be zero. This is a fact we had already learned in section 16.3, but now we see a reason why it is true.

16.5. Curl and divergence. All you need to know from this section is how to find the curl and the divergence of a vector field.

The curl of a vector field $\mathbf{F} = P\ \mathbf{i} + Q\ \mathbf{j} + R\ \mathbf{k}$ is another vector field, and is given by the formula in the red box numbered [1] on page 1115. It is easy to remember as the determinant of a matrix,

$$\text{curl } \mathbf{F} = \begin{vmatrix} \mathbf{i} & \mathbf{j} & \mathbf{k} \\ \frac{\partial}{\partial x} & \frac{\partial}{\partial y} & \frac{\partial}{\partial z} \\ P & Q & R \end{vmatrix}.$$

The divergence a vector field $\mathbf{F} = P\ \mathbf{i} + Q\ \mathbf{j} + R\ \mathbf{k}$ is a scalar function, given by the formula in the red box numbered [9] on page 1118.

You should look at Examples 1, 2, 3, and 4. You can skip the remainder of this section.

Sections 16.6 through 16.9 will not be covered on this exam. However, I might ask you to compute a triple integral of the type which appears in the divergence theorem. So you should look at where this is done in Examples 1 and 2 on page 1155.