

OVERVIEW OF EXAM 3 IN MATH 550

Sections of the Textbook Covered:

- 5.1, 5.2, 5.3, 5.4 Double and Triple Integrals
- 5.5 Change of Variables Theorem (know statement and all applications)
- 6.1 Scalar and Vector Line Integrals
- 6.2 Green's Theorem
- 7.1 Parameterized Surfaces

Other Topics Covered at the End:

- *Orientations of k -dimensional manifolds.* See definition 2.7, page 502. If one has a never vanishing k -form ω on a k -dimensional manifold one can define an orientation κ by the rule

$$\kappa_p(\mathbf{e}_1, \dots, \mathbf{e}_k) = \frac{\omega_p(\mathbf{e}_1, \dots, \mathbf{e}_k)}{|\omega_p(\mathbf{e}_1, \dots, \mathbf{e}_k)|}.$$

The book prefers to define orientations as never vanishing k -forms, but this is equivalent to my definition. You should be able to state my definition, and know examples in the cases $k = 0, 1, 2, 3$.

- *Outward unit normal vectors and Induced Boundary orientations.* See page 393 (in the context of Green's theorem), pages 403 and 518 (initial and terminal points of an oriented curve), Definition 3.1 on page 450 (for surfaces in 3D and their bounding curves), page 453 (in the context of Gauss's Divergence Theorem), and Definition 2.9 on page 505 for the general case. Be able to give my definitions and to solve study question 6.
- *k -forms, exterior derivatives.* See the discussion in section 8.1, and Definition 3.1 on page 512. Be able to define a basic k -form and to solve study question 1. Know also the chart in Figure 8.12, page 518.
- *Integration of Differential Forms.* See Definition 2.1, page 495 for 1-forms, Definition 2.3, page 496 for 2-forms, and Definition 2.6, page 500 for the general case. Be able to give my definition (in the general case) and do study questions 2, 3, 4.
- *Generalized Fundamental Theorem of Calculus.* See Theorem 3.3, page 403 for the 1-dimensional case, Theorem 2.1, page 391 (Green's Theorem, 2-dimensional case), Theorem 3.2, page 450 (Stokes's theorem, 2-dimensional case), Theorem 3.3, page 453 (Gauss's theorem, 3-dimensional case), and Theorem 3.2, page 512 for the general case. Be able to state the general case and do the examples in study question 2, 3, 4.