

Study Guide for Test # 4 for the 4th edition of the textbook  
MA 242.601 and MA 242.651

The test will cover the following sections of Chapter 13: 1, 2, 3, 5, and 6. In addition it will contain material from Chapter 10, section 5 on parametric surfaces, material on pages 777-778, and Section 6 of Chapter 12.

1. Chapter 13, section 1: Vector fields

- (a) You should know the general definition of a vector field, and know the definition of a **conservative vector field** and **potential function** for a conservative vector field.

2. Chapter 13, section 2: Line Integrals

- (a) Be able to compute line integrals of the following type, in which the parametrized curves will be specified in the problem so that you will **NOT** have to find the parametrizations of the curves to work the problems.
- i.  $\int_C f(x, y, z) ds$  The line integral of a function with respect to arc length
  - ii.  $\int_C \vec{F} \cdot d\vec{r}$  The line integral of a vector field along a curve; The Work Integral

3. Chapter 13, section 3: Fundamental Theorem for Line Integrals

- (a) You should know and be able to use the Fundamental Theorem for Line Integrals given on page 925 in your textbook.
- (b) You should know how to **test** a given vector field to determine if it is conservative or not. The information you need here is given in several places. (1) For two dimensions, see Theorem 5, page 928. (2) For three dimensions see problem 29, page 933. (3) Finally note that after we studied the curl of a vector field (section 13.5) we repackaged the preceding ideas in Theorem 4, page 943.
- (c) You should be able to find all potential functions for a **given** conservative vector field. For a review see the file "Finding Potential Functions" at the URL

<http://www4.ncsu.edu/~lkn/MA242/MA242.601/finding-potential-functions.pdf>

4. Chapter 12, section 5: Divergence and curl of vector fields

- (a) You should be able to compute the divergence  $\nabla \cdot \vec{F}$  and the curl  $\nabla \times \vec{F}$  of a given vector field  $\vec{F}$ .
- (b) You should know the two identities  $\nabla \times \nabla f = \vec{0}$  and  $\nabla \cdot (\nabla \times \vec{F}) = 0$ . The first of these is used in the test for a conservative vector field, and the second can be used to answer questions of type given in problems 19 and 20 on page 947 in your textbook.

5. Chapter 10, section 5: Parametric Surfaces - You should know the definition of a parametric surface and how to use them in the sections that follow. I will not ask you to parametrize any surfaces on this test since you have done this already in Maple HW 6.

6. Pages 777-778: Be able to find an equation for the tangent plane to a given parametric surface.
7. Chapter 12, section 6: Surface Area of Parametrized Surfaces - You should be able to set up the Double Integral  $\int \int_D \|\vec{r}_u \times \vec{r}_v\| dA$  as a double iterated integral to compute the surface area of a parameterized surface S, **given** the parametrization for the surface. You will NOT have to compute the iterated integral.
8. Chapter 13, section 6: Surface Integrals. Given the parametrization for a given surface you should be able to set up the following two types of **surface** integrals as double integrals and then as iterated integrals:
  - (a)  $\int \int_S f(x, y, z) dS$  The surface integral of a function
  - (b)  $\int \int_S \vec{F} \cdot \vec{n} dS$  The surface integral of a vector field.