

**Generic Outline and Homework Assignments for  
VECTOR CALCULUS, Fifth Edition  
Marsden and Tromba**

Version: January 10, 2004

The outline below assumes a term with 13 Weeks with 3 lecture hours per week and weekly homework. You will need to adjust this according to your own term length, level of the class, exams, and holidays

Exercises below marked with \* have a SOLUTION in the *Instructor's Manual* (this may, for example, be a help for TA's.) Keep in mind that Exercises whose numbers are colored in the text have a *Solution* (sometimes only a partial solution) in the *Student Guide*. Many instructors will generally not assign these as homework since they can serve as useful self-study for the students.

There is a mix of assigned problems; some for which answers are available to the student (odd numbers in the back of the book) and those for which answers are not available (all even numbered ones).

## SYLLABUS AND HOMEWORK—13 Weeks

**Week 1.** Review: Vectors, Matrices, Cylindrical & Spherical Coordinates.

Section 1.1, #2, 5, 11, 16

Section 1.2, #4, 13, 19, 20, 26\*

Section 1.3, #4, 10, 24

Section 1.4, #1, 4\*, 12\*

Section 1.5, #1, 5, 12\*

If your class has no experience with  $2 \times 2$  &  $3 \times 3$  matrices, then you will need to spend 2 weeks or more on Chapter 1 and split the homework set.

**Week 2.** Functions, Continuity and Differentiability.

Section 2.1, #2c, 15\*, 30

Section 2.2, #6b, 8, 12a,b\*, 14\*

Section 2.3, #4d\*, 8c\*, 10\*, 15, 18

**Week 3.** Paths, Properties of Derivatives, Gradients.

Section 2.4, #4, 11\*, 18\*

Section 2.5, #2d, 3c, 8\*, 12\*, 27\*

Section 2.6, #3c\*, 5c, 6b, 16\*

Review Exercises, #7d, 17, 20\*, 22\*, 42\*

Section 2.7, entitled *Some Technical Differentiation Theorems* is in the Internet Supplement. If you are teaching an honors class or have selected good students, they should do exercises from this section.

**Week 4.** Iterated Derivatives, Taylor's Theorem and Extrema.

Section 3.1, #3a, 5, 9\*, 12\*, 22\*

Section 3.2, #2\*, 3\*, 6\*

Section 3.3, #1, 7\*, 17, 20, 25\*

**Week 5.** Lagrange Multipliers, Implicit Function Theorem, Acceleration

Section 3.4, #2\*, 7, 17, 20\*

Section 3.5, #3, 4\*, 6\*, 8\*

Review Exercises, #5\*, 6, 24\*

Section 4.1, #3, 7\*, 11\*, 14\*

There are two supplements to chapter 3: one on a second derivative test for constrained extrema and one on the proof of the implicit function theorem. Again, better students should be assigned problems from these sections.

**Midterm Exam:** Somewhere around now might be a good time for a midterm exam. Note that the Instructors Manual contains supplementary problems and practice midterm exam questions for the material through Chapter 3. Of course the timing and exact material you use for the midterm exam at your University will depend on local circumstances.

**Week 6.** Arc Length, Vector Fields, Divergence and Curl.

Section 4.2, #4\*, 7, 18\*

Section 4.3, #3, 11\*, 14\*, 19

Section 4.4, #3, 6, 10\*, 15, 23, 26\*

Review Exercises, #4\*, 11\*, 16\*, 27\*, 28\*

**Week 7.** Double Integrals.

Section 5.1, #1c\*, 4\*, 6, 11

Section 5.2, #2c, 4, 6\*, 8\*, 12

Section 5.3, #2a\*, 6\*, 9, 13

There are two supplements to Chapter 5, one giving an alternative definition of the integral and one that discusses the proofs of some of the theorems on integration. Again, better students should be assigned problems from these supplements.

**Week 8.** Changing the Order of Integration, Triple Integrals and Maps.

Section 5.4, #2a\*, 4, 8\*, 12

Section 5.5, #4\*, 10, 11\*

Review Exercises, #3, 7, 11, 14, 17, 19\*

Section 6.1, #3, 6\*, 8\*

**Week 9.** Change of Variables, Applications, and Improper Integrals.

Section 6.2, #1, 6\*, 8\*, 9, 19\*, 23\*

Section 6.3, #4\*, 5\*, 9, 13, 15, 16

Section 6.4, #1, 5, 8\*, 10\*

Review Exercises, #4b\*, 10, 17, 23, 27

**Week 10.** Path and Line Integrals, Parametrized Surfaces.

Section 7.1, #2\*, 4a\*, 5, 15\*

Section 7.2, #2\*, 6\*, 15, 18\*

Section 7.3, #2\*, 6\*, 15\*, 16\*

**Week 11.** Area and Surface Integrals.

Section 7.4, #1, 6\*, 15\*

Section 7.5, #1, 2\*, 4\*, 6, 15\*

Section 7.6, #3\*, 7\*, 15\*, 18\*

Review Exercises, #3b\*, 8, 11, 16\*, 26\*

Section 7.7 on applications should make extremely interesting reading for most students and should broaden their horizons. You will need to decide on what homework, if any, you wish to assign from this section.

**Week 12.** Green's and Stokes' Theorem, Conservative Fields.

Section 8.1, #3cd\*, 6a, 13, 18

Section 8.2, #3\*, 6, 7, 8, 10\*, 11, 23\*, 26

Section 8.3, #4, 7, 10, 14\*, 15\*, 25\*

**Week 13.** Gauss' Theorem, Practice Final Exam.

Section 8.4, #1, 2\*, 5, 7\*, 11\*, 14\*, 17

Review Exercises, #1, 3, 5, 10\*, 11\*, 15, 20

**Practice Final Exam.** There is a practice final exam at the end of the Internet Supplement as well as practice final exam questions at the end of the Instructor's Manual. Some instructors will want to assign the practice exam as part of the last week's homework.

Depending on time available and the level of the class, consider assigning Exercises for Sections 8.5 (Differential Equations of Mechanics and Technology) and 8.6 (Differential Forms). Certainly the better students should be encouraged to read these very interesting sections.

There are a lot of review problems and sample exams in the Student Guide and the Instructors Manual. The students will love you if you hand out a sample exam. Let us know if you need the tex files for any of them.

### **Further Remarks**

If you have to shorten this syllabus due to time constraints, we strongly recommend that you do so uniformly—in our view, it is critical that one makes it to the highlight of the course, namely, the theorems of Green, Stokes and Gauss.

Good luck in your teaching of this material and please let us know if you have any suggestions for improvement!

Jerry Marsden: marsden@cds.caltech.edu

Tony Tromba: tromba@cats.ucsc.edu