Mathematics 211
Fall, 1998

Textbook: Howard Anton, *Multivariable Calculus,* 5th edition.

Instructor: Dr. Michael Rogers.

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Hours:	M–F 2–3 p.m. Also by appointment.

Course Content: Mathematics 211 is the third semester of calculus. It revisits and adapts the concepts from first-year calculus in the setting of three-dimensional space. The main topics are geometry in space; vectors; functions of more than one variable including vector fields; the limits, differentiation, and integration of such functions; and applications.

Course Goals: After this course, you should be able to do the following: to sketch three-dimensional graphs, to understand how the calculus of single-variable functions generalizes to multivariable functions, to evaluate limits of multivariable functions, to differentiate multivariable functions and vector fields, to integrate multivariable functions and vector fields, to discuss the roles of these processes of multivariable calculus in solving problems, to reduce a multi-dimensional problem to one-dimensional problems, to understand better the material of first-year calculus.

Classes: You are responsible for work covered in class. Furthermore you are expected to have done the reading for each class. Your ability to get the most out of each class is greatly diminished by a failure to be prepared.

Evaluation: Evaluation will be based on the following written work:

Tests (3 @ 10 pts)	30	points
Problem Sets (10, 15, 25 pts)	50	points
Commentaries (10 @ 1 pt)	10	points
Quizzes (7 @ $1\frac{1}{2}$ pts)	$10\frac{1}{2}$	points
Total	$100\frac{1}{2}$	points

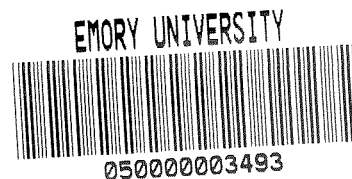A rough guide to grades: A: $\geq$ 9 pts. B: 8–9 pts. C: 7–8 pts. D: 6–7 pts. F: $<$ 6 pts.

Tests: There are three in-class, closed-book tests, each worth 10 points, as follows:

Monday, September 28
Monday, November 2
Monday, December 7

If a student has an excuse deemed legitimate by the instructor, arrangements will be made to take the test **prior to** the scheduled time.

Problem Sets: There are two midterm problems sets and a final problem set. The problem sets are take-home and open-book, but they are to be worked one's own. A midterm problem set will be handed out before each of the first two tests and due after it; at least a week will be allowed. During that time, the student is expected to keep up with the regular class work. The final problem set takes the place of a final examination. The problem sets are cumulative, increase in value, and are worth 10, 15, and 25 points respectively.

Final Examination: There will be no final examination. There is however a cumulative final problem set (see above).

Commentaries: Commentaries are assigned roughly weekly, excepting in weeks in which there is a test. Each is to be no more than two pages, typed, double-spaced, of a 12-point font or larger, and at most 750 words. Each is to comment on the ideas in the course. A commentary may provide alternate explanations of things, probe issues which cause the student confusion, or anything which shows serious thought about some part of the course. The best ten will be counted.

A comment is more than an off-hand reaction like "It was interesting." A comment is to be deep, critical, insightful, coherent, focussed; it is to amplify or clarify the successes or failures of the text. Outside sources are permissible; keep in mind that each commentary will be graded on the quality of the student's own reflections. If outside sources are used, be sure to cite them appropriately and to avoid plagiarism as defined in the Honor Code.

Quizzes: All quizzes are announced and take-home. The student must be present in class to receive her or his quiz. Each quiz must be worked at *one sitting* and use only *authorized materials*. In general neither books nor notes will be allowed. Quizzes are due by the next class meeting. Each quiz is worth $1\frac{1}{2}$ points. In total there will be 10 quizzes of which 7 will be counted. In each of the three testing units, one quiz will be dropped.

Homework: Assignments from the text for each unit are attached to this syllabus; these assignments will not be collected. **The purpose of calculation is insight** (Gauss). In general you need to spend at least six good hours per week on homework.

Calculators: Calculators which cannot differentiate, integrate, nor perform algebraic manipulations may be used to assist the student with any assignment or examination, provided that the solutions are carried out in exact, rather than approximate, form (e.g., π rather than 3.14, $10/\sqrt{3}$ but not 5.77). In general calculators are not recommended for the in-class tests.

Honor Code: The Honor Code of Oxford College applies to all work submitted for credit in this course. All such work will be pledged to be yours and yours alone. This is the case when you place your name on work submitted. The Honor Code applies to all tests, projects, quizzes, the computer project and any work you may submit.

Mathematics 211
Study Guide for Unit 1

<u>Wednesday, 26 August</u>   **Three-Dimensional Space, Vectors**
    Text: Section 14.1, 14.2
                Drawing Three-Dimensional Figures (handout, hereafter *3D*)
    Exercises: pp. 662–663: 1–7odd,13,17,19,21,31,33–41odd
                pp. 670–672: 9,11,15,19,20,23,25,29–37odd,41,45–61odd,65,69,71,75
                3D, §1: all

<u>Friday, 28 August</u>   **Dot Product, Projections**
    Text: Section 14.3
    Exercises: pp. 677–679: 1,3–11all,15,17,21,25,27,29,32–35all

<u>Monday, 31 August</u>   **Cross Product**
    Text: Section 14.4
    Exercises: pp. 685–686: 1,2,5–9all,11,15,16,17,24,25,29,31,35
    Commentary 1 due

<u>Wednesday, 2 September</u>   **Lines, Planes**
    Text: Section 14.5, 14.6
    Exercises: pp. 690–691: 1–23odd,27–43odd,46,47–53odd,57
                pp. 696–698: 1,3,5–19all,21–33odd,37,39,44,45
                3D, §4: all
    Quiz A

<u>Friday, 4 September</u>   **Surfaces**
    Text: Section 14.7
    Exercises: pp. 706–708: 1–37odd,45,47,49,55,57
                3D, §5: all

<u>Monday, 7 September</u>   *Labor Day Holiday*

<u>Wednesday, 9 September</u>   **Coordinate Systems**
    Text: Section 14.8
    Exercises: pp. 672–673: 1–31(odd)
                3D, §6: all
    Commentary 2 due

<u>Friday, 11 September</u>   **Vector-Valued Functions**
    Text: Section 15.1, 15.2
    Exercises: pp. 719–720: 1–23odd,29–45odd
                pp. 726–728: 1–39odd,43,49,51,53,57,58,59,65
                3D, §2: all
    Quiz B

Monday, 14 September — Change of Parameter, Arc Length
Text: Section 15.3
Exercises: pp. 734–736: 1–23odd,29,32
3D, §3: all

Wednesday, 16 September — Differential Geometry
Text: Section 15.4, 15.5
Differential Geometry (handout)
Exercises: pp. 739–740: 1–13odd,29
pp. 745–747: 1–11odd,15–23odd,24,25,27,31,32,33,39,43,48,50,53–59odd,63
3D, §7: all
Commentary 3 due
Quiz C
Problem Set 1 handed out

Friday, 18 September — Motion along a Curve
Text: Sections 15.6
Exercises: pp. 757–759: 1–11odd,15–21odd,39,41,45,47,51,59,63

Monday, 21 September — Test 1 (in class)

Mathematics 211
Study Guide for Unit 2

Wednesday, 23 September — Functions of Many Variables
Text: Section 16.1
Exercises: pp. 781–783: 1–15odd,25–35odd,41,43,45,49–63odd,64,65,67,69
            3D, §8: all

Friday, 25 Sepetember — Limits and Continuity
Text: Section 16.2
Exercises: pp. 789–790: 1,3,9–31odd,37,38,39,41,42,43

Monday, 28 September — Partial Derivatives
Text: Section 16.3
Exercises: pp. 796–799: 1–9odd,13–27odd,31,33,35,39,43,45,47,49,53,54,55,57,59,61,68,69,71
            3D, §14: all
Problem Set 1 due

Wednesday, 30 September — Differentiability, Chain Rule: Functions of Two Variables
Text: Section 16.4
Exercises: pp. 807–809: 1–5all,7–41odd,45,53,54,55,57,59,61,62,63
Commentary 4 due

day, 2 October — Tangent Planes, Total Differentials, Gradients
Text: Section 16.5, 16.6
Exercises: pp. 814–815: 1–25odd,29,31,39
            pp. 820–822: 1–19odd,23,25,27,31,35,41,43,48,50,54
            3D, §12: all
Quiz A

Monday, 5 October — Differentiability, Chain Rule: Functions of Three Variables
Text: Section 16.7
Exercises: pp. 827–828: 1–19odd,23–29odd,33,35,37
            3D, §9: all

Wednesday, 7 October — Functions of n Variables
Text: Section 16.8
Exercises: pp. 831–833: 1,3,7,11,21–29odd,34,35
            3D, §13: all
Commentary 5 due
Quiz E

Friday, 9 October — Maxima and Minima
Text: Section 16.9
Exercises: pp. 841–834: 1,3,9–21odd,25–35odd,41,45,47
            3D, §7: all

Monday, 12 October   *Midsemester Break*

Wednesday, 14 October   Lagrange Multipliers
    Text: Section 16.10
    Exercises: p. 849: 1–15odd
    Commentary 6 due

Friday, 16 October   Double Integrals
    Text: Sections 17.1
    Exercises: pp. 857–858: 1–31odd
    Quiz F

Monday, 19 October   Double Integrals over Nonrectangular Regions
    Text: Section 17.2
    Exercises: pp. 864–866: 1–27odd,31,35,39,47,49–65odd

Wednesday, 21 October   Double Integrals in Polar Coordinates
    Text: Section 17.3
    Exercises: pp. 871–872: 1,3,7,11,13,15,19–27,35
    Commentary 7 due
    Problem Set 2 handed out

Friday, 23 October   Applications
    Text: —
    Exercises: TBA

Monday, 26 October   Test 2 (in class)

Mathematics 211
Study Guide for Unit 3

<u>Wednesday, 28 October</u>   **Triple Integrals**
 Text: Section 17.5
 Exercises: pp. 883–885: 1–13odd,17,21,23,25–29all,31,33
     3D, §10: all

<u>Friday, 30 October</u>   **Applications**
 Text: Section 17.6
 Exercises: pp. 893–894: 1,3,7,11,19,23,25,27,36,37
     3D, §11: all

<u>Monday, 2 November</u>   **Triple Integrals in Cylindrical and Spherical Coordinates**
 Text: Section 17.7
 Exercises: pp. 903–905: 1–7odd,11,13,15,23,27,29,31,37,45
 Problem Set 2 due

<u>Wednesday, 4 November</u>   **Change of Variables, Jacobians**
 Text: Section 17.8
 Exercises: pp. 915–916: 1–11odd,12,13,15,29,35
 Commentary 8 due

<u>day, 6 November</u>   **Surface Area Integrand as a Jacobian**
 Text: Section 17.4
 Exercises: pp. 877–878: 1,3,5,11–19odd
 Quiz G

<u>Monday, 9 November</u>   **Vector Fields**
 Text: Section 18.1
 Exercises: pp. 926–927: 1–19odd,20,23,25,26,27,29,31
 Problem Set 2 due

<u>Wednesday, 11 November</u>   **Line Integrals**
 Text: Section 18.2
 Exercises: pp. 936–938: 1–13odd,17,20,21,23,25,33,34
 Commentary 9 due

<u>Friday, 13 November</u>   **Independence of Path**
 Text: Section 18.3
 Exercises: pp. 945–946: 1–11odd,17–25odd,29,33,35
 Quiz H

<u>Monday, 16 November</u>   **Green's Theorem**
 Text: Section 18.4
 Exercises: pp. 951–952: 1–11odd,17,23,25

Wednesday, 18 November   Surface Integrals
     Text: Section 18.5
     Exercises: pp. 957–958: 1-7odd,11,13,15,23,25
     Commentary 10 due

Friday, 20 November   Surface Integrals of Vector Fields, Flux
     Text: Section 18.6
     Exercises: pp. 965–966: 3–17odd,18,22,23
     Quiz J

Monday, 23 November   The Divergence Theorem
     Text: Section 18.7
     Exercises: p. 974: 1–19odd
     Problem Set 3 handed out

Wednesday, 26 November   *Thanksgiving Travel Day*
Friday, 28 November   *Thanksgiving Holiday*

Monday, 30 November   Stokes Theorem
     Text: Section 18.8
     Exercises: pp. 980–981: 1–13odd,14
     Quiz K

Wednesday, 2 December   Vector Fields and Differential Equations
     Text: Handout
     Exercises: TBA
     Commentary 11 due

Friday, 7 December   Applications & Review

Monday, 7 December   Test 3 (in class)

Monday, 14 December   Problem Set 3 due