Mathematics 211
Fall, 2000

Instructor: Dr. Karen Rogers.
Office: 116 Seney Hall
Phone: x4-8419
Hours: **MWThF 1:30–2:30 p.m.** Also by appt.

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.

Textbook:

- Howard Anton, *Multivariable Calculus,* 5^{th} edition.

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 @ 100 pts)	300 points
Problem Sets (100, 150, 250 pts)	500 points
Commentaries (8 @ 10 pt)	80 points
Quizzes (8 @ 15 pts)	120 points
Total	1000 points

The plus/minus system will be used. A rough guide to grades: A: $\geq$ 900 pts. B: 800–899 pts. C: 700–799 pts. D: 600–699 pts. F: $<$ 600 pts.

Tests: There are three in-class, closed-book tests, each worth 100 points, as follows:

Tuesday, September 26
Tuesday, October 31
Tuesday, December 12

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 on 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 100, 150, and 250 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 covered in the previous week or so. Each may provide alternate explanations of things, probe issues which cause the student confusion, amplify or clarify the successes or failures of the text, or anything which shows serious thought about some part of the course. A comment is more than an off-hand reaction like "It was interesting." A comment is to be critical or questioning, wondering or insightful, coherent and focused. Outside sources are permissible; keep in mind that each commentary will be evaluated 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 15 points. In total there will be 10 quizzes of which 8 will be counted.

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 a good student will need to spend at least six good hours per week on homework.

It is the instructor's opinion that this course is about as hard as first year calculus with this important qualification: If you enrolled in a college-level calculus course with no previous calculus experience, then this course will require about as much work. If you "coasted" through calculus, this course will be different. Almost no one will have any familiarity with the new concepts in this course, except in as much as they resemble those from single variable calculus.

A routine exercise in multivariable calculus tends to take more time than one in single-variable calculus. Therefore it will not be possible to practice with the same level of repetition as in Math 111/112. Instead, the student must probe each exercise deeply. Take time to reflect on each problem as you complete it.

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.

Use Good Style: Thoughts are expressed by sentences: just so in mathematics. **Written work must be in complete sentences.** The same applies to daily homework. See Priestley, "Clean Writing in Mathematics," pp. 413–420 in *Calculus: An Historical Approach*, which is on reserve.

Honor Code: The Honor Code of Oxford College applies to all work submitted for credit in this course. To receive credit for work submitted you must place your name on it. By placing your name on such work, you pledge that the work has been done in accordance with the given instructions and that you have witnessed no Honor Code violations in the conduct of the assignment.

Mathematics 211
Study Guide

Thursday, 31 August — **Three-Dimensional Space, Vectors**

Text: Sections 14.1, 14.2
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

Tuesday, 5 September — **Dot Product, Projections, Cross Product**

Text: Sections 14.3, 14.4
Exercises: pp. 677–679: 1,3–11all,15,17,21,25,27,29,32–35all
pp. 685–686: 1,2,5–9all,11,15,16,17,24,25,29,31,35

Thursday, 7 September — **Lines, Planes**

Text: Sections 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
Quiz A

Tuesday, 12 September — **Surfaces, Coordinate Systems**

Text: Sections 14.7, 14.8
Exercises: pp. 706–708: 1–37odd,45,47,49,55,57
pp. 672–673: 1–31(odd)
Commentary 1 due

Thursday, 14 September — **Vector-Valued Functions**

Text: Sections 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
Quiz B

Tuesday, 19 September — **Change of Parameter, Arc Length, Tangent and Normal Vectors**

Text: Sections 15.3, 15.4
Exercises: pp. 734–736: 1–23odd,29,32
pp. 739–740: 1–13odd,29
Commentary 2 due, Problem Set 1 handed out
Quiz C

Thursday, 21 September — **Curvature, Motion along a Curve**

Text: Sections 15.5, 15.6
Exercises: pp. 745–747: 1–11odd,15–23odd,24,25,27,31,32,33,39,43,48,50,53–59odd,63
pp. 757–759: 1–11odd,15–21odd,39,41,45,47,51,59,63

Tuesday, 26 September — **Test 1 (in class)**

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

Thursday, 28 September — **Limits and Continuity**

Text: Section 16.2
Exercises: pp. 789–790: 1,3,9–31odd,37,38,39,41,42,43

Monday, 2 October -- Problem Set 1 due

Tuesday, 3 October — **Partial Derivatives, Differentiability, Chain Rule**

Text: Sections 16.3, 16.4
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
pp. 807–809: 1-5all,7–41odd,45,53,54,55,57,59,61,62,63
Commentary 3 due

Thursday, 5 October — **Tangent Planes, Total Differentials, Gradients**

Text: Sections 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
Quiz D

Tuesday, 10 October — **Differentiability, Chain Rule: Functions of 3 Variables, *n* Variables**

Text: Sections 16.7, 16.8
Exercises: pp. 827–828: 1–19odd,23–29odd,33,35,37
pp. 831–833: 1,3,7,11,21–29odd,34,35
Commentary 4 due

Thursday, 12 October — **Maxima and Minima**

Text: Section 16.9
Exercises: pp. 841–834: 1,3,9–21odd,25–35odd,41,45,47
Quiz E

Tuesday, 17 October — ***Midsemester Break***

Thursday, 19 October — **Lagrange Multipliers, Double Integrals**

Text: Sections 16.10, 17.1
Exercises: p. 849: 1–15odd
pp. 857–858: 1–31odd

Tuesday, 24 October — **Double Integrals over Nonrectangular Regions**

Text: Section 17.2
Exercises: pp. 864–866: 1–27odd,31,35,39,47,49–65odd
Commentary 5 due
Quiz F
Problem Set 2 handed out

Thursday, 26 October — **Double Integrals in Polar Coordinates, Applications**

Text: Section 17.3
Exercises: pp. 871–872: 1,3,7,11,13,15,19–27,35

Tuesday, 31 October — **Test 2 (in class)**

Triple Integrals

Text: Section 17.5

Exercises: pp. 883–885: 1–13odd,17,21,23,25–29all,31,33

Thursday, 2 November — **Applications**

Text: Section 17.6

Exercises: pp. 893–894: 1,3,7,11,19,23,25,27,36,37

Monday, 6 November -- Problem Set 2 due

Tuesday, 7 November — **Triple Integrals, Change of Variables, Jacobians**

Text: Sections 17.7, 17.8

Exercises: pp. 903–905: 1–7odd,11,13,15,23,27,29,31,37,45
pp. 915–916: 1–11odd,12,13,15,29,35

Commentary 6 due

Thursday, 9 November — **Surface Area Integrand as a Jacobian**

Text: Section 17.4

Exercises: pp. 877–878: 1,3,5,11–19odd

Quiz G

Tuesday, 14 November — **Vector Fields, Line Integrals**

Text: Sections 18.1, 18.2

Exercises: pp. 926–927: 1–19odd,20,23,25,26,27,29,31
pp. 936–938: 1–13odd,17,20,21,23,25,33,34

Commentary 7 due

Thursday, 16 November — **Independence of Path**

Text: Sections 18.3

Exercises: pp. 945–946: 1–11odd,17–25odd,29,33,35

Quiz H

Tuesday, 21 November — **Green's Theorem**

Text: Section 18.4

Exercises: pp. 951–952: 1–11odd,17,23,25

Commentary 8 due

Thursday, 23 November — ***Thanksgiving Holiday***

Tuesday, 28 November — **Surface Integrals, Flux**

Text: Sections 18.5, 18.6

Exercises: pp. 957–958: 1-7odd,11,13,15,23,25
pp. 965–966: 3–17odd,18,22,23

Commentary 9 due

Quiz I

Thursday, 30 November — **The Divergence Theorem**

Text: Section 18.7
Exercises: p. 974: 1–19odd
Problem Set 3 handed out

Tuesday, 5 December — **Stokes Theorem**

Text: Section 18.8
Exercises: pp. 980–981: 1–13odd,14
Commentary 10 due
Quiz J

Thursday, 7 December — **Vector Fields and Differential Equations, Applications**

Text: Handout
Exercises: TBA

Tuesday, 12 December — **Test 3 (in class)**

Problem Set 3 due at Final Exam time