Mathematics 211
Fall, 2010

Instructor: Dr. Michael Rogers.

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 and software:

- Colley, *Vector Calculus,* 3rd ed., Prentice-Hall.
- *Mathematica for Students,*
  http://www.wolfram.com/products/student/mathforstudents/licenses.html.
  A free screencast at http://www.wolfram.com/broadcast/screencasts/handsonstart/ teaches basic commands of *Mathematica*. Other tutorials are found at http://www.wolfram.com/broadcast/.

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 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: Grades will be based on the following written work:

Tests (3 @ 100 pts)	300 points
Problem sets (100, 150, 220 pts)	470 points
Quizzes (9 @ 20 pts)	180 points
Graphing portfolio	50 points
Total	1000 points

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

Tests: There are three out-of-class, self-scheduled, closed-book, timed tests, each worth 100 points. Approximate dates:

Test 1: Sep. 23/24
Test 2: Oct. 28/29
Text 3: Dec. 6/7

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 220 points respectively.

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 20 points. In total there will be 12 quizzes of which 9 will be counted. In each of the three testing units, one quiz will be dropped.

Graphing Project: Due Friday, November 19. Each student is to prepare a portfolio of at least 2 three-dimensional images created with *Mathematica*. The portfolio should exhibit all the types of graphs encountered in the course: Cartesian coordinates ($z = f(x, y)$), polar/cylindrical coordinates ($z = f(r, \theta)$), spherical coordinates ($\rho = f(\theta, \phi)$), parametrized curves ($(x, y, z) = \mathbf{r}(t)$), and parametrized surfaces ($(x, y, z) = \Phi(u, v)$). The portfolio will be worth 50 points.

There is a screencast that may be helpful:

http://www.wolfram.com/broadcast/screencasts/abbybrown/3D_Graphing/

There is a *Mathematica* notebook that contains an interface to make producing graphs easier. It is called "Graphing Project — Interface" on the course's Blackboard site, https://classes.emory.edu

Homework: Assignments from the text will be given as we cover each topic; 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 do not 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 timed 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*, available through Blackboard .

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.

Proposed Calendar

Date	Topic	Section
Wed 25 Aug	Vectors, Calculus, and Analysis	§1.1
Fri 27 Aug	Vectors	§1.2
Mon 30 Aug	Dot product	§1.3
Wed 1 Sep	Cross product **Quiz 1A**	§1.4
Fri 3 Sep	Planes, distance	§1.5
Mon 6 Sep	*Labor Day — No class.*	
Wed 8 Sep	n-dimensional geometry **Quiz 1B**	§1.6
Fri 10 Sep	Coordinates	§1.7
Mon 13 Sep	Review of matrices and coordinates **Quiz 1C**	§1.6, §1.7
Wed 15 Sep	Functions of several variables	§2.1
Fri 17 Sep	Limits	§2.2

Mon 20 Sep	Limits **Quiz 1D**	§2.2
Wed 22 Sep	Limits	§2.2
Fri 24 Sep	The derivative	§2.3
Mon 27 Sep	The derivative	§2.3
Wed 29 Sep	Derivatives	§2.4
Fri 1 Oct	Chain Rule **Quiz 2A**	§2.5
Mon 4 Oct	Chain Rule	§2.5
Wed 6 Oct	Directional derivatives, the gradient	§2.6
Fri 8 Oct	Parametrized curves **Quiz 2B**	§3.1
Mon 11 Oct	*Fall Break — No class.*	
Wed 13 Oct	Arc length and differential geometry	§3.2
Fri 15 Oct	Vector fields **Quiz 2C**	§3.3
Mon 18 Oct	Gradient, divergence, and curl **Quiz 2D**	§3.4
Wed 20 Oct	Taylor's theorem	§4.1
Fri 22 Oct	Extrema	§4.2
Mon 25 Oct	Lagrange multipliers	§4.3
Wed 27 Oct	Applications	§.4.4
Fri 29 Oct	Integration	§5.1
Mon 1 Nov	Double integrals	§5.2
Wed 3 Nov	Changing the order of integration **Quiz 3A**	§5.3
Fri 5 Nov	Triple integrals	§5.4
Mon 8 Nov	Change of variables (substitution)	§5.5
Wed 10 Nov	Applications **Quiz 3B**	§5.6
Fri 12 Nov	Line and path integrals	§6.1
Mon 15 Nov	Green's theorem	§6.2
Wed 17 Nov	Conservative vector fields	§6.3
Fri 19 Nov	Parametrized surfaces **Quiz 3C**	§7.1
Mon 22 Nov	Surface integrals	§7.2
Wed 24 Nov	*Thankgiving — No class.*	
Fri 26 Nov	*Thankgiving — No class.*	
Mon 29 Nov	Stokes's theorem **Quiz 3D**	§7.3
Wed 1 Dec	Gauss's theorem	§7.3
Fri 3 Dec	Vector analysis	§7.4
Mon 6 Dec	Last day	