Mathematics 211
Fall, 2011

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. In addition to the regular class meetings, there will also be several tests scheduled on Tuesday or Thursday mornings. (See below).

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

Tests (3 @ 150 pts)	450 points
Quizzes (6 @ 15 pts)	90 points
Graphing portfolio	60 points
Final Examination	200 points
Total	800 points

The plus/minus system will be used. A rough guide to grades: A: $\geq$ 720 pts. B: 640–720 pts. C: 560–640 pts. D: 480–560 pts. F: $<$ 600 pts.

Tests: There are three tests, each worth 150 points, which begin before class to let you have enough time to recover from mistakes and to think.

8:30 a.m. Tuesday, September 20
8:30 a.m. Tuesday, November 1
8:30 a.m. Thursday, December 1

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. In each case, a quiz is handed out on Thursday and is due the next Monday. Each quiz is worth 15 points. In total there will be 9 quizzes of which 6 will be counted. In each of the three testing units, one quiz will be dropped.

Graphing Project: Due Friday, November 18. 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

Final Examination: (250 points.) A cumulative final examination will be given at the time scheduled by the Registrar.

Homework: Assignments from the text will be given as we cover each topic; these assignments will not be collected. "The purpose of computing is insight, not numbers." (R.W. Hamming) 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.

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
Thu 25 Aug	To the Student	pp. xiii–xv
	Vectors, Calculus, and Analysis	§1.1
	HW: All	
	Vectors	§1.2
	HW: 1–9 odd, 10, 11, 13–19, 21–27, 29, 31–35, 37	
Tue 30 Aug	Dot product	§1.3
	HW: 1–17 odd, 18–22, 24, 25, 28	
	Cross product	§1.4
	HW: 1–23, 25, 26, 37, 38	
Thu 1 Sep	Planes, distance	§1.5
	HW: 1–12, 13, 15, 17, 19–30, 32, 34, 35	
	Quiz 1	
Tue 6 Sep	n-dimensional geometry	§1.6
	HW: 1, 2, 3, 8, 9, 10, 15–21, 23 29 30 35	
Thu 8 Sep	Coordinates	§1.7
	HW: 7, 9–13, 15, 17, 18, 20, 23–35, 39–42	
	HW: All	§1.8
	HW: 8, 9, 16	§1.9
	Quiz 2	
Tue 13 Sep	Functions of several variables	§2.1
	HW: 1, 2, 6, 7, 8, 10–19, 24, 28–31, 33, 34, 36–42, 45, 47	
Thu 15 Sep	Limits	§2.2
	HW: 1–4, 6–23, 28–33, 37, 39, 40, 42–44	
Tue 20 Sep	**TEST 1, 8:30 – 11:15**	
Thu 22 Sep	The derivative	§2.3
	HW: 1–37 odd, 38, 45–47, 50, 51	
Tue 27 Sep	Derivatives	§2.4
	HW: 1–19 odd, 20, 21	
Thu 29 Sep	Chain Rule	§2.5
	HW: 1–23 odd, 26–31, 33	
	Quiz 3	
Tue 4 Oct	Directional derivatives, the gradient	§2.6
	HW: 1–9 odd, 10, 11–25 odd, 29, 33, 34, 37, 48, 49	
	HW: All	§2.7
	HW: 5, 7, 8, 9, 29, 32, 36	§2.8
Thu 6 Oct	Parametrized curves	§3.1
	HW: 2, 3, 4, 6, 9, 10, 11–18, 20, 21, 23, 27–30	
	Arc length and differential geometry	§3.2
	HW: 1, 3, 5, 7–17, 23–28, 30	
	Quiz 4 — due Wednesday, 12 Oct	
Tue 11 Oct	*Fall Break — No class.*	
Thu 13 Oct	Vector fields	§3.3
	HW: 1–4, 6, 8, 17–23, 25–28	
	Quiz 5	

Tue 18 Oct	Gradient, divergence, and curl	§3.4
	HW: 1–12, 14–21, 24, 26, 28	
	HW: All	§3.5
	HW: 1, 2, 9, 10, 15, 16, 27, 36, 39, 41, 43, 44	§3.6
Thu 20 Oct	Taylor's theorem	§4.1
	HW: 1–4, 6, 8, 10–15, 17, 19, 22–28, 31	
	Extrema	§4.2
	HW: 1–13, 21, 23–25, 28, 29, 33, 34, 35, 37, 39, 43, 46, 47	
	Quiz 6	
Tue 25 Oct	Lagrange multipliers	§4.3
	HW: 1–6, 11, 14, 17–19, 22, 24, 25, 36, 37	
	Applications	§4.4
	HW: 2, 3, 7, 9, 12, 13	
	HW: All	§4.5
	HW: 1, 5, 11, 19, 22, 23	§4.6
Thu 27 Oct	Integration	§5.1
	HW: 1, 3, 5, 6, 11, 13, 15	
	Double integrals	§5.2
	HW: 1, 2, 4, 5–17 odd, 20, 21, 25, 28	
Tue 1 Nov	**TEST 2, 8:30 – 11:15**	
Thu 3 Nov	Changing the order of integration	§5.3
	HW: 1—-18	
	Quiz 7	
Tue 8 Nov	Triple integrals	§5.4
	HW: 1–7 odd, 8, 9, 11–23, 25	
Thu 10 Nov	Change of variables (substitution)	§5.5
	HW: 7, 9, 13–18, 21, 23–32	
	Applications	§5.6
	HW: 2, 5, 7, 9–11, 14, 17, 20, 22, 27, 28	
	HW: All	§5.7
	HW: 1, 2, 5, 11, 12, 22	§5.8
	Quiz 8	
Tue 15 Nov	Line and path integrals	§6.1
	HW: 2–10, 13, 15–17, 19, 20, 22–24, 27, 29, 31	
	Green's theorem	§6.2
	HW: 5, 7, 10, 15, 17, 19, 23	
Thu 17 Nov	Conservative vector fields	§6.3
	HW: 3–15 odd, 19, 20, 25	
	HW: All	§6.4
	HW: 1, 3, 5, 14, 16, 17, 23, 38	§6.5
	Quiz 9	
Tue 22 Nov	Parametrized surfaces	§7.1
	HW: 1, 3, 7, 10, 11, 20, 21, 23, 24, 29	
	Surface integrals	§7.2
	HW: 1–22 except 4	
Thu 24 Nov	*Thanksgiving — No class.*	
Tue 29 Nov	Stokes's, Gauss's theorems	§7.3
	HW: 1–9, 11, 13, 16, 19, 20	
	HW: 1–26, 30	§7.5
	HW: 1–9, 11, 13, 17, 20, 28	§7.6
Thu 1 Dec	**TEST 3, 8:30 – 11:15**	
Tue 6 Dec	All Questions Answered*	