MATH 211: Multivariable Calculus

Fall 2015

Instructor: Benjamin Purkis

MWF 12:00-1:05pm, Seney Hall 208

Instructor Information:

Email: benjamin.purkis@emory.edu
Office: Pierce 121
Office Hours: Thursday 2-4 or by appointment; drop-ins are encouraged!
Drop-in policy: If my office door is open, you are always welcome to come in and ask whatever questions you may have. If my office door is closed, you are welcome to knock; I may answer, but I may also ask that you come back at another time. The best way to see me is to come during office hours or email me to set up an appointment.

Course Information and Policies:

Description: Roughly speaking, calculus is the mathematics of *change*. In particular, calculus is a powerful tool for understanding change in physical quantities and phenomena that *depend on*, or are *related to*, each other. The dependence of a given quantity upon another (or others) is often described mathematically by a *function*. Thus, the heart of calculus *is* the study of functions, and how they change. Differential calculus studies the instantaneous change of a function as quantities vary, and integral calculus measures the cumulative effect of the change of a function.

Textbook: *Vector Calculus*, 4th Edition, by Susan Jane Colley
Software: *Mathematica*. Instructions for obtaining Mathematica are available at `it.emory.edu/software/mathematica_access%20.html`.

Content: We will cover chapters 1-7 of the textbook, including:

1. **Vectors** - We will introduce three-dimensional space and the concept of vectors, including dot and cross products. Vector functions will be utilized to describe curves and surfaces in 3-space. We will also consider functions of several variables.

2. **Partial Derivatives** - We will extend the familiar concept of derivative into 3-space by considering partial derivatives. We will briefly consider limits and continuity in 3-space, as well as applications of partial derivatives, including tangent planes, directional derivatives and the gradient, and optimization in multiple variables.

3. **Multiple Integration** - We will extend integration to 3-space by considering double, triple, and iterated integrals. Topics include alternate coordinate systems for 2- and 3-space, namely polar, cylindrical, and spherical coordinates, as well as change of variables to arbitrary coordinate systems.

4. **Vector Calculus** - As time permits, we will examine several versions of the Fundamental Theorem of Calculus for multiple dimensions, including Green's Theorem,

Stokes' Theorem, and Gauss's Theorem. Along the way we will see related topics such as vector fields, parametrized surfaces, line and surface integrals, and curl and divergence.

Course Expectations:

Grading: Quizzes and exams will be graded based on *correctness*, *completeness*, and *legibility*. Your grade for this course will be calculated as follows:

1. **Quizzes: 8 of 10** for 25%
2. **Graphing Portfolio:** 12.5%
3. **Midterms:** Three at 12.5% each
4. **Final Exam:** 25%

Grades will be assigned by the following scale:

A	≥ 93	A-	90-92	B+	87-89
B	83-86	B-	80-82	C+	77-79
C	73-76	C-	70-72	D+	67-69
D	63-66	D-	60-62	F	≤ 59

Classes: While attendance will not be taken directly, it is essential that you come to class on time every day, *having read the sections to be covered.* Your ability to get the most out of a class lecture is greatly hampered if you are not prepared. Calculus is a class that builds on itself very quickly, so if you miss even one class period, you can get behind very quickly. You are responsible for all the material covered in class, even if you are absent.

Homework: Homework problems will be assigned daily in-class. While they usually will not be collected, you should still complete them! Solving problems and practicing their solutions is the only good way to learn mathematics. You are welcome and encouraged to ask questions about the homework, but the instructor may also ask to see that homework.

It is important to complete assigned exercises in a timely fashion. Calculators may be used where appropriate, but remember that they are *not* allowed on quizzes or exams. Therefore you should not be dependent on a calculator! Collaborate with your fellow classmates, but keep in mind the end goal is for you to be able to solve problems unaided by notes, the textbook, a calculator, or other people. In general you should spend at least 8 hours a week on study, not counting the time spent in class or reviewing for tests.

Quizzes: All quizzes will take place at the end of a class period, and are announced in advance. Each quiz will be worth 25 points, and the best 8 out of 10 total quizzes will count towards your score. However, you may not drop more than one quiz from any of the three testing units. All quizzes are closed nook and notes, and *calculators are banned.*

Graphing Project: Each student will 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, polar/cylindrical coordinates, spherical coordinates, parametrized curves, and parametrized surfaces.

A screen cast that can help you get started is located at
`http://www.wolfram.com/broadcast/screencasts/abbybrown/3D_Graphing/`.
More information about the Graphing Project will be available when it is assigned.

Exams: You will have three midterm exams and a cumulative final exam this semester. Your exam dates are:

- Midterm 1: **Friday, September 25th**
- Midterm 2: **Monday, October 26th**
- Midterm 3: **Friday, December 4th**
- Final Exam: **Monday, December 14th at 2pm**

Midterm exams are not cumulative and are held in-class on the specified day. The final exam will be cumulative. All exams are closed book and notes, and *calculators are banned.*

Makeups: In general, makeups are not allowed for exams or assignments. However, if you have a valid reason for a makeup exam, inform me as soon as possible. Valid reasons include medical emergency, a death in the family, or religious observations. Extensions will only be granted for emergency situations.

A Word on Technology: Please leave all iPods, MP3 players, netbooks, etc. stowed and off for the duration of the class. Cell phones should be silenced. Return all seats and tray tables to the upright and locked position.

Honor Code: The Honor Code of Oxford College applies to all work submitted for credit in this course. In order to receive credit for your work, you must place your name on it. By placing your name on submitted 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.

Tentative Schedule: On the following page is a general outline of how the course will proceed. Note this is tentative in the sense that, while the topics covered for the course will not change, the specific topics and activities on a given day may vary.

This syllabus is a guide for effective learning in this class; it is not a legal contract. The instructor reserves the right to modify the syllabus as needed.

Date	Topics	Test	Sections
Wed, Aug 26	Vectors in two and three dimensions		1.1
Fri, Aug 28	Vectors in two and three dimensions		1.2
Mon, Aug 31	The Dot and Cross Products		1.3, 1.4
Wed, Sep 2	Applications of the Dot and Cross Products		1.3, 1.4
Fri, Sep 4	Vector geometry problems	Quiz 1	1.5
Mon, Sep 7	*Labor Day Holiday*		
Wed, Sep 9	n-dimensional Geometry		1.6
Fri, Sep 11	New coordinate systems	Quiz 2	1.7
Mon, Sep 14	Functions of several variables		2.1
Wed, Sep 16	Limits and Continuity		2.2
Fri, Sep 18	Limits and Continuity	Quiz 3	2.2
Mon, Sep 21	The Derivative		2.3
Wed, Sep 23	Review for Exam 1		
Fri, Sep 25		**Exam 1**	
Mon, Sep 28	Higher-order Partial Derivatives		2.4
Wed, Sep 30	The Chain Rule		2.5
Fri, Oct 2	Directional Derivatives and the Gradient	Quiz 4	2.6
Mon, Oct 5	Parametrized Curves		3.1
Wed, Oct 7	Arclength and Differential Geometry		3.2
Fri, Oct 9	Vector Fields	Quiz 5	3.3
Mon, Oct 12	*Fall Break*		
Wed, Oct 14	Gradient, Divergence, Curl, and the Del Operator		3.4
Fri, Oct 16	Differentials and Taylor's Theorem	Quiz 6	4.1
Mon, Oct 19	Extrema of Functions		4.2
Wed, Oct 21	Lagrange Multipliers		4.3
Fri, Oct 23	Finish Optimization and Review for Exam 2		
Mon, Oct 26		**Exam 2**	
Wed, Oct 28	Areas and Volumes		5.1
Fri, Oct 30	Double Integrals		5.2
Mon, Nov 2	Changing Order of Integration	Quiz 7	5.3
Wed, Nov 4	Triple Integration		5.4
Fri, Nov 6	Change of Variables		5.5
Mon, Nov 9	Applications of Integration	Quiz 8	5.6
Wed, Nov 11	Scalar and Vector Line Integrals		6.1
Fri, Nov 13	Green's Theorem		6.2
Mon, Nov 16	Conservative Vector Fields	Quiz 9	6.3
Wed, Nov 18	Parametrized Surfaces		7.1
Fri, Nov 20	Surface Integrals		7.2
Mon, Nov 23	Stokes's Theorem	Quiz 10	7.3
Wed, Nov 25	*Thanksgiving Holiday*		
Fri, Nov 27	*Thanksgiving Holiday*		
Mon, Nov 30	Gauss's Theorem		7.3
Wed, Dec 2	The FTC and Review for Exam 3		
Fri, Dec 4		**Exam 3**	
Mon, Dec 7	Review for Final Exam		
Mon, Dec 14	Final Exam at 2pm	**Final**	