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# Multivariable Calculus

Math 212 §2 Fall 2014  
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Fowler 309 MWF 11:45am - 12:40pm  
<http://faculty.oxy.edu/ron/math/212/14/>

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**INSTRUCTOR** Ron Buckmire ~ Fowler 313 ~ x2536 ~ [ron@oxy.edu](mailto:ron@oxy.edu) ~ MadProfessah

**OFFICE HOURS** I am almost always in my office (Fowler 313) until at least 5pm on days that I am teaching.

My official office hours for Fall 2014 are **MWF 11:00am-11:30am and 4-5pm**.

You can make individual appointments at <http://ronbuckmire.youcanbook.me>

I am readily accessible by electronic mail at [ron@oxy.edu](mailto:ron@oxy.edu) and by phone at 323-259-2536. My Twitter handle is **MadProfessah** and my Google Chat name is **Mad-Professah**. If you need to see me at a time not specified here, do not hesitate to contact me and make an appointment and I'll be happy to meet with you. I think out-of-classroom student-faculty interactions are important. You are also strongly encouraged to visit me in office hours several times during the semester or chat with me whenever you have a question. If you don't interact with your professors individually you really aren't getting your money's worth at Occidental College! In addition, you should work together with your classmates to succeed together in the course.

**CLASSROOM** We will meet in Fowler 309 from 11:45am to 12:40pm on Mondays, Wednesdays and Fridays.

**TEXTBOOK** *Calculus: Multivariable (6th Edition)*, by W. McCallum, Deborah Hughes-Hallett, Andrew Gleason et al. (2013), Wiley.

**SYLLABUS** The official syllabus for this course is on the web at  
<http://faculty.oxy.edu/ron/math/212/14/syllabus.pdf>.

**WEBSITE** <http://faculty.oxy.edu/ron/math/212/14/>

## LEARNING OBJECTIVES

- to provide familiarity and facility with various operations on vectors (addition, dot product, cross product, scalar multiplication) and understanding their geometric implications (i.e. visualization and interpretation)
- to develop an understanding of various representations of functions of several variables
- to extend certain concepts from single-variable calculus (such as limit, continuity, differentiation and integration) to functions of several variables
- to introduce concepts and important results from vector field theory (gradient, divergence, curl, path independence, line integrals, Green's Theorem)
- to appreciate applications of all of the above to real-world situations  
and (hopefully) much more!

**COURSE DESCRIPTION** Calculus of functions of several variables, parametric curves and surfaces, and vector fields in 2- and 3-space, with applications. Vectors, graphs, contour plots. Differentiation, with application to optimization. Lagrange multipliers. Multiple and iterated integrals, change of variable and the Jacobian. Line and surface integrals. Vector analysis, Green's, Gauss', and Stokes' Theorems. Applications to physics, economics, chemistry, and mathematics.

**FORMAT OF THE CLASS** I believe strongly in collaborative learning, active engagement and peer instruction. Collaborative learning means that students collaborate together to learn the material in the course. Active engagement by students means that you accept the responsibility for your own learning of the material and do not perceive the instructor (professor) as the primary source of course content. Peer instruction is when students in the class learn from each other by explaining concepts and demonstrating their own understanding to their student peers. My intention is to structure class time so that students can participate in all of these activities. I hope that every single student will have met with me in my office *at least* once and probably several times, by the end of the semester. *Multivariable Calculus* is not a class that you should expect to "do well" on your own.

**STUDENT PARTICIPATION** I expect (a lot of) participation in class from every student in the class and will facilitate this through the use of daily class formats (worksheets), hands-on explorations, collaborative group work, in-class computer exercises, abbreviated lectures and online communication. In the past I have used classroom voting (where all students respond individually to questions posed to the entire class, often using personal response devices) and peer instruction (where students discuss the material with each other in order to collaboratively share their understanding of the material and foster student interactions).

**GRADES** Your course grade will be composed of the following:

- Two (2) Tests **20%**
- Final Exam **20%**
- Quizzes and Problem Sets **40%**
- Class Participation **20%**

**TESTS** There will be **three (3)** exams in this course. To be precise, two in-class tests and a final exam. The tests are scheduled for

- TEST 1: **Friday October 3, 2014**
- TEST 2: **Friday, November 7, 2014**
- FINAL EXAM: **Tuesday, December 9, 2014 (1:30pm-4:30pm)**

Of course, these dates are subject to change (with at least one week's notice). It should be noted that students generally think that my tests are too hard. (This is primarily because I often assess students' understanding of material by including questions which have the concepts in new contexts which they have not seen before.

**QUIZZES** There will be quizzes given most weeks. These quizzes will almost always be take-home, weekend quizzes given out on class on Friday to be handed in at the beginning of class on the next class day. They will consist of problems similar to the homework problems, past exam questions or conceptual questions from the textbook which you work on by yourself (under exam conditions) and will be a way in which you can assure yourself you are keeping up with the course. Quizzes are written and graded by the professor and used to gauge understanding of various key concepts by individual students and the class as a whole.

**HOMEWORK** Homework should be done in **pencil**. Homework will be collected in **PROBLEM SETS** that will be due every week (typically on Wednesdays). You are **strongly** encouraged to work on the homework together. However, whatever you hand in must represent your own understanding of the material. Copying homework is an example of academic dishonesty and will be dealt with accordingly. The official list of assigned homework due each week is also available on the course website. Homework is graded by a fellow undergraduate from a solution guide.

**COURSE POLICIES** This is a non-exhaustive list of course policies:

- Make-up tests will not be given except for compelling reasons which have been communicated to me well-in advance (i.e. at least 7 days) of the test date.
- If you are late to a test, you will only be allowed the time remaining in which to complete your test.
- Late quizzes (or homework) will not be accepted under any condition since the solutions are generally made available to everyone on the same day that they are collected to be graded.

**COLLEGE POLICIES** Here are some official policies of Occidental College which you should be aware of

**Disabilities:** Accommodation of disability-related needs is available on request. Students with documented disabilities who are registered with Disability Services are required to present their accommodation verification card to the instructor at the beginning of each semester or as soon as possible thereafter. Students who experience significant physical or mental impairments can contact Disability Services at (323-259-)2969 to learn about available services and support.

**Honest Academic Work:** Shared commitment to ethical principles is essential to the educational purposes and fairness of the academic enterprise. Occidental College assumes that students and faculty will embrace a high ethical standard for academic work. Fundamental to academic ethics is a spirit of honor. A spirit of honor thrives when students challenge each other to attain the highest levels of scholarship, civility, and responsibility. For more information, see <http://www.oxy.edu/student-handbook/academic-ethics/academic-ethics>

**Classroom Conduct:** The goals of this course can only be accomplished in a setting of mutual respect. Although the study of mathematics rarely lends itself to too much controversy, we must still provide a safe environment that is conducive to learning. All are welcomed and encouraged to actively participate in the learning of differential equations, regardless of gender, race, nationality, native language, sexual orientation, gender identity, political ideology, and

especially personal mathematical history. Any student who feels she or he is experiencing a hostile environment should speak to me immediately.

**Electronic Devices:** Please remember that common courtesy dictates turning off all electronic devices and cell phones (or place in silent mode) before coming to class; these devices can be a distraction for other students (and me!) in the class and thus should not be in use during class time unless I give you explicit permission to do so. **Classroom Voting** is an exception to the Electronic Devices policy.

**CANCELLED CLASSES** We will not have class on the following dates:

Monday September 1, 2014 (Labor Day).

October 13-14, 2014 (Fall Break).

November 26-28, 2014 (Thanksgiving Break).

November 24, 2014 (tentatively).

I will let you know at least one week ahead of time if there may be other days on which I am absent or when class is cancelled.

**ATTENDANCE** Class attendance is not mandatory, but if you are going to be absent from a class, common courtesy suggests you should contact your professor by email or chat beforehand to apprise me of absences in advance. Also, 20% of the course grade is class participation and it is impossible to participate in class if you are not present! Please try to attend on time as a courtesy to your classmates and the professor.

**ON-LINE MATERIALS** I have set up a web page for the course, where the official version of this syllabus and all class materials will be available. The URL is <http://faculty.oxy.edu/ron/math/212/14/>. Also there is a class mailing list, which all students are on, at [math212sec2-L@oxy.edu](mailto:math212sec2-L@oxy.edu).

**CLASSROOM VOTING** I am hoping to use the *i>clicker* Go app as a tool for classroom voting to foster peer instruction and student discussion during the class. This may mean students need to purchase the smartphone app (for \$9.99) and register themselves for the class. If you already have an *i>clicker* device I believe it will be compatible with the system I intend to use. See <https://iclickergo.com> for more information.

**PEDAGOGICAL RESEARCH PROJECT** I am participating in a pedagogical research project funded by the National Science Foundation under grant DUE-1246094 called **Raising Calculus to the Surface**. This involves the use of “physical models of multivariable functions with a dry-erase surface and accompanying instruments that allow students to draw, measure, and grasp concepts geometrically.” The intent is to improve student learning of concepts in multivariable calculus. This research is being conducted under human subjects review from the Institutional Review Board for Winona State University.