

# MATH 249 -01 & -02: Multivariable Calculus, Fall 2010

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<b>Office Hours:</b>	Monday 2:15-3:30pm (Bistro), Wednesday 2:15-3:30pm, Thursday 1:00-2:00pm	
<b>Math Tutoring:</b>	6:30-9:30 pm Sunday-Thursday in the Math Hearth	
<b>Class Listserv:</b>	<a href="mailto:math-249-01@willamette.edu">math-249-01@willamette.edu</a> and <a href="mailto:math-249-02@willamette.edu">math-249-02@willamette.edu</a>	
<b>Class Website:</b>	Course information, assignments, due dates, and policies are all available on the course website under WISE	
<b>Class Meetings:</b>	Section 01 meets in Ford 301 every Monday, Wednesday and Friday from 9:10-10:10 am. Section 02 meets in Ford 201 every Monday, Wednesday and Friday from 10:20-11:20 am	

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*“Mathematics is not a careful march down a well-cleared highway, but a journey into a strange wilderness, where the explorers often get lost. Rigor should be a signal to the historian that the maps have been made, and the real explorers have gone elsewhere.” -W.S. Anglin*

## Class Objectives

Multivariable calculus lies in the intersection of three of the most important branches of mathematics: algebra, analysis, and geometry. It demonstrates the elegance and beauty of mathematics, as well as its sublime utility. By extending the concepts of one-variable calculus to higher dimensions, we encounter a variety of new issues and subtleties, many of which require a deep geometric understanding to resolve. Through this course you will: learn vector calculus; strengthen your geometric visualization skills; practice translating between algebraic, analytic, and geometric perspectives; and develop your technical writing skills. Your grade will be based on your level of achievement in each of the following student learning outcomes:

- Your content knowledge<sup>1</sup>  
As demonstrated on in-class exams and quizzes
- Your geometric reasoning and visualization skills  
As demonstrated on exams and supplemental geometry problems
- Your technical writing ability  
As demonstrated on the supplemental geometry problems

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## Required Course Materials:

*Calculus: Multivariable*, 5<sup>th</sup> ed., by McCallum, Hughes-Hallett, Gleason, et al.

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<sup>1</sup>Including your demonstrated ability to make judgments and draw appropriate conclusions based on quantitative information.

## Course Components

**Exams:** There will be three in-class exams worth 100 points each, and one cumulative final worth 150 points. The final for section 01 is **Friday, December 17, from 8-11am**. The final for section 02 is **Thursday, December 16, from 8-11am**.

Students are expected to have a working calculator for each exam. Calculator swapping is not permitted during tests.

**Quizzes:** There will be eight quizzes. These brief, in-class quizzes are each worth 6 points, and your lowest quiz grade will be dropped.

**Geometry Problems:** In addition to the homework there will be seven supplemental geometry problems, each worth 8 points. These puzzle-like problems are designed to increase your geometric reasoning and technical writing skills. Writing technical explanations of mathematical ideas is an important part of this course, and a valuable skill in many different fields. These geometry problems are small writing assignments due roughly every two weeks. Your lowest geometry problem grade will be dropped.

**Homework:** Readings from the textbook and WISE site will be assigned to complement class lecture. Lectures format will assume students have completed the appropriate reading before class. Because of the accelerated pace of this course, it is essential that you start exploring the ideas before class and use lecture to strengthen and clarify your understanding. Problem sets for each covered section of the text will be assigned using WeBWork, and will count towards 60 points of your final grade. The goal of these assignments is to give you practice applying concepts covered in class, and a means for checking your understanding. WeBWork is an online homework distribution and grading system. The best feature of WeBWork is that when you enter an answer to a homework problem, the system immediately tells you whether the answer is correct. You can try a problem as many times as you like. Once you get the answer right, that fact is immediately recorded (provided it is before the due date), and any wrong answers are not counted in your grade. Here are some tips on using WeBWork:

- Get started early on WeBWork, and enter some answers at least a couple days before the due date. That way you will have time to seek help on the harder problems (and the ones that looked easy at first but turned out to be tricky) before the set is due. Avoid the last-minute rush. The system often becomes overloaded and slow in the last couple hours before a set is due, since everyone is trying to enter their answers at the same time.
- WeBWork usually requires very precise answers. For instance, if the correct answer is 1.60045 and you enter 1.6, the system will say that's incorrect. If you are entering a decimal answer, give at least five digits of accuracy. On most problems, you can enter answers like  $\cos(9.81\sqrt{340})$  instead of a messy decimal, and WeBWork will do the calculation for you.
- Some WeBWork problems require formulaic answers, like  $x \wedge (2/3)$ , which means  $x$  raised to the power of  $2/3$  (two-thirds). However, if you enter  $x \wedge 2/3$ , the system will say that's wrong, since WeBWork interprets that as one third of  $x$  squared. So be careful and check your syntax. (WeBWork Set 0, which is recommended but not counted in your grade, will help you learn about entering formulaic answers.)
- WeBWork has a previewing feature which allows you to see how a complicated formula you just entered is actually interpreted by WeBWork. The previewer will help you track down syntax errors and ensure that your answer is being interpreted the way you want without having to add three hundred parentheses.
- Last, and MOST IMPORTANT, do not spend large amounts of time guessing random answers and entering them into WeBWork. This is a waste of your time! If you don't know how to do a problem, please come to office hours. If you think you are doing everything correctly and WeBWork doesn't accept your answer please come to my office hours, or email me with an explanation of what you

have done, so I can help. Banging your head against the computer, yelling at it, or throwing the computer out the window does not change whether or not WeBWork accepts your solution.

**Colloquium Talks:** Students are expected to attend 2 of the Math Colloquium Talks given throughout the semester. These talks will be announced in class and a schedule can be found on the Math Department web site [http://www.willamette.edu/~emcnicho/Math\\_Colloquium.htm](http://www.willamette.edu/~emcnicho/Math_Colloquium.htm). An excellent essay on how to approach math colloquium talks is available here: [http://www.willamette.edu/~emcnicho/courses/Multi249/How\\_to\\_listen\\_to\\_a\\_Math\\_Lecture\\_Korner.pdf](http://www.willamette.edu/~emcnicho/courses/Multi249/How_to_listen_to_a_Math_Lecture_Korner.pdf). The goal of this attendance requirement is to introduce students to the diversity and vitality of current mathematics research, and to include them in the Math Department culture. Colloquium attendance accounts for 20 points towards your final grade.

**Grades:** Your grade will be based on the percentage of points you earn out of 620 total possible points. 90% and above guarantees you an A-, 80% and above guarantees you a B-, 70% and above guarantees you a C-, and 60% and above guarantees you a D.

### **Student Responsibility:**

Most of you already know this, but previous experience has shown that a friendly reminder is sometimes helpful. You are all adults and responsible for your own education. I will do everything in my power to help you learn. You should always feel free to stop by my office or make an appointment to meet with me. You should also feel free to ask me questions in class. Stop me if you are confused and ask me to explain things again. I welcome student questions! Although I will do everything in my power to help you through this class, you are ultimately responsible for your grade. The following is a list of things I expect from you.

- **READ THE TEXTBOOK.** This class is formatted under the assumption that you have completed the assigned reading before class. Class time will consist of lectures highlighting the main points of the section, ConcepTests, and in-class examples. It will be difficult to engage in the material during class if you have not looked over the content ahead of time.
- **DO THE ASSIGNMENTS.** Mathematics is not a spectator sport. You will only learn mathematics by practicing, that is what homework is for. I encourage you to work with your fellow students on homework assignments. Make it a social activity and you will not only learn a great deal, you will have fun doing it.
- **THINK CRITICALLY.** Your goal in this class should be to understand the concepts and strengthen your mathematical reasoning skills. Mimicking problem solving strategies, or working through processes you don't understand is a waste of your time. Throughout the course you should be asking yourself "Why are we doing this? Why does this method work? How is this related to other topics I've learned?"
- **ASK QUESTIONS & SEEK HELP!** Ask questions in class, after class, during office hours, whenever! If you are confused or having problems with a certain section of the material see me **AS SOON AS POSSIBLE**. I am happy to help you but it is impossible to go over several weeks worth of material right before an exam.
- **STUDY.** The standard rule of thumb is that you should spend *three hours outside of class on course work for each hour spent in class*. To master the content of this course and to earn a good grade you will need to invest time and effort. Set aside time for both homework and studying.

### Late Assignments and Missed Classes:

I expect everyone to attend all classes and turn in all assignments. If for some reason you are unable to attend class or turn in an assignment, please let me know as soon as possible, preferably *before* the missed class or assignment.

### Cell Phone/Screen Policy:

No laptops, iPads, or other devices which take your eyes off your fellow classmates and the class discussion. Electronic devices such as cell phones, pagers, iPods, etc. must be turned off during class meetings. *If your cell phone goes off during class you will be responsible for bringing treats for the entire class at the next class meeting.* Papers should not be read during class, though I applaud your efforts to stay abreast of current events and tackle the latest crossword or sudoku puzzle.

### Academic Integrity:

In accordance with Willamette University CLA catalog: "Plagiarism and cheating are offenses against the integrity of the courses in which they occur and against the College community as a whole... Ignorance of what constitutes plagiarism shall not be considered a valid defense. If students are uncertain as to what constitutes plagiarism for a particular assignment, they should consult the instructor for clarification." Cheating is unethical and I take it very seriously. The Deans Office will be notified if anyone is found cheating and appropriate sanctions will be given. If you are unsure of what constitutes cheating, please ask me.

### Tentative Schedule

The following schedule is subject to change.

Day	Class Activities & Discussions	Assignments
W (9/1)	Ch. 13 Vectors	
F (9/3)	Ch. 13 Vectors	
M (9/6)	No Class: Labor Day	
W (9/8)	Ch. 13 Vectors	
F (9/10)	Ch. 12 Functions of Several Variables	GP 1 & Quiz 1
M (9/13)	Ch. 12 Functions of Several Variables	
W (9/15)	Ch. 12 Functions of Several Variables	
F (9/17)	Ch. 12 Functions of Several Variables	Quiz 2
M (9/20)	Ch. 12 Functions of Several Variables	
W (9/22)	Exam 1	
F (9/24)	Ch. 14 Derivatives	
M (9/27)	Ch. 14 Derivatives	GP 2
W (9/29)	Ch. 14 Derivatives	
F (10/1)	Ch. 14 Derivatives	
M (10/4)	Ch. 14 Derivatives	Quiz 3
W (10/6)	Ch. 14 Derivatives	
F (10/8)	Ch. 16 Integration	
M (10/11)	Ch. 16 Integration	
W (10/13)	Ch. 16 Integration	
F (10/15)	Ch. 16 Integration	GP 3
M (10/18)	Ch. 16 Integration	
W (10/20)	Exam 2	
F (10/22)	No Class: Mid-semester break	

M (10/25)	Ch. 17 Parameterization and Vector Fields	
W (10/27)	Ch. 17 Parameterization and Vector Fields	
F (10/29)	Ch. 18 Line Integrals	Quiz 4
M (11/1)	Ch. 18 Line Integrals	GP 4
W (11/3)	Ch. 18 Line Integrals	
F (11/5)	Ch. 18 Line Integrals	Quiz 5
M (11/8)	Ch. 19 Flux Integrals	GP5
W (11/10)	Ch. 19 Flux Integrals	
F (11/12)	Ch. 19 Flux Integrals	Quiz 6
M (11/15)	Exam 3	
W (11/17)	Ch. 20 Calculus of Vector Fields	
F (11/19)	Ch. 20 Calculus of Vector Fields	GP 6
M (11/22)	Ch. 20 Calculus of Vector Fields	
W (11/24)	Ch. 20 Calculus of Vector Fields	
F (11/26)	No Class: Thanksgiving Holiday	
M (11/29)	Ch. 20 Calculus of Vector Fields	Quiz 7
W (12/1)	Ch. 20 Calculus of Vector Fields	
F (12/3)	Ch. 20 Calculus of Vector Fields	GP 7
M (12/6)	Ch. 20 Calculus of Vector Fields, the Three Fundamental Theorems	
W (12/8)	Ch. 20 Calculus of Vector Fields, the Three Fundamental Theorems	Quiz 8
F (12/10)	Review for Final	
Th (12/16)	Final Exam, Section 02, 8-11am in Ford 201	
F (12/17)	Final Exam, Section 01, 8-11am in Ford 301	