Welcome to Math 272 Multivariable Calculus 1 – Winter 2016

10:00 - 10:50 M-F in Black 151, occasional Wednesdays in Bouillon 103

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Office Hours: MWTh 3-3:50 pm
and by appointment.

Required Text: *Calculus*, by McCallum, Hughes-Hallett, et al, **6th** ed.; Wiley
Assignments and grades will be posted to Canvas. We will be using WeBWorK for online homework.

Course Goals: While this course is called Multivariate Calculus 1, we actually start with Taylor Series for single variable functions which are ways of approximating functions and getting error estimates, both of which are very valuable topics in computing. From there we explore sequences, which are an ordered lists of numbers, and series and convergence, which is required to know that our Taylor Series approximation actually approximates what we want it to.

From there, we continue to multivariate calculus. Particle physicists believe we live in a 10 to 26 dimensional universe. We can readily observe 3 spatial and one time dimension in our day-to-day lives, yet most of the math you've learned up to now is restricted to one or two dimensions. Then there are phenomena like the wind, which give a vector at every point of space; these are called vector fields. In order to describe this world and phenomena that depend on more than one influencing factor, we need multivariate (more than one variable) mathematics, and this is the subject matter we will be investigating for the remainder of this quarter.

Upon successful completion of this course, a student will be able to:

- Be able to distinguish between sequences and series and determine when sequences converge or diverge, and what they converge to
- Compute partial sums
- Identify a geometric series, and, if it converges, compute its sum
- Apply various tests for convergence (integral, comparison, ratio)
- Determine the interval of convergence for a power series
- Find the Taylor Polynomial of degree n and the Taylor Series representation for a function
- Differentiate and integrate Taylor Series
- Perform algebraic computations involving vectors including finding
  - Magnitude of a vector
  - A unit vector that points in the same direction as a given vector
  - Dot product of two vectors
  - Cross product of two vectors
  - Vector projections
- Utilize the dot and cross product to
  - Answer questions about orthogonality
  - Compute work
  - Find the equation of a plane given 3 points on the plane, or a plane perpendicular to a given vector through a given point
  - Compute areas and volumes
- Describe and recognize graphs of functions of two variables
- Determine limiting and continuity properties of functions
- Compute partial derivatives, differentials, gradients and directional derivatives
- Geometrically interpret the gradient with respect to a contour diagram
- Find equations of tangent planes
- Find extrema
- Communicate verbally and in writing one's understanding of mathematical concepts to others

In terms of book chapters, we will be covering Chapters 9 through 15 (there is no chapter 11).

Occasionally, we will be using the computer lab in Bouillon 103. I will announce these lab days ahead of time.

Grades/Exams/Homework

Grades

Grades will be calculated using the following weighting system:
WebWork and Other Assignments: 15%
Quizzes: 20%;
Exams: 65% total, broken up as follows: 20% for each mid-term and 25% for the final
and the following scale:

	$87-89.9: B+$	$77-79.9: C+$	$67-69.9: D+$	below 60 $: F$
$93-100: A$	$83-86.9: B$	$73-76.9: C$	$63-66.9: D$	
$90-92.9: A-$	$80-82.9: B-$	$70-72.9: C-$	$60-62.9: D-$	

WebWork

WebWork is the online homework system for the math department at CWU. WebWork can easily be started early and worked on incrementally; deadlines are firm, no extensions will be given. You will have up to 5 attempts on any problem that requires a typed answer; for multiple choice and true-false questions you will only get one or two attempts, so check your answer before submitting it. The lowest two assignment scores will be dropped to take into account unexpected emergencies.

Quizzes

We will have a weekly in-class quiz on Friday (other days by announcement), over material recently covered in class up through Wednesday. Students may make back half of their missed points by presenting a complete and correct solution to the problem and a reflection.

Exams

There will be three exams: two in-class mid-terms and a final; the tentative schedule is with the course schedule below. If there are changes to the midterm dates, they will be announced in class and on Canvas. The Final Exam will be cumulative. You will be allowed to bring in one sheet of paper, filled out however they want, front and back, for use with exams. You should fill out your own note sheet; your note sheet should not be a photocopy of other materials.

Written Assignments

We will have a written assignment most weeks. Whether or not they are collected, they are assigned for the purpose of helping you learn the material, in particular, in how to apply critical thinking to it. Some problems will attempt to get at the trickier concepts in the course. Doing the homework is essential to success in this course.

Present your work neatly, in logical order. First restate the question, then present your solution. Use your words to explain what is going on, and always include a graph or diagram.

Late and Make-up Policy for Graded Assignments, Quizzes and Exams

Field trips, illnesses, accidents and deaths in the family are a part of life. I will arrange to take late work or for a make-up or an alternative if you contact me either ahead of time or within 24 hours and provide documentation.

Because everyone can run into an occasional conflict, I will drop at two WebWork assignments. Likewise, your lowest quiz grade will be dropped. I will allow a makeup quiz on the next class day with a reasonable excuse and documentation.

Emailing me with information about absences and late work will help to make sure there's a documentation trail in case I don't remember a verbal conversation.

Academic Integrity

You have to do your own practice in order to gain a new skill; we all know this. Most of academic integrity is simply making the work you hand in reflect the undestanding in your brain. Since understanding

something while you are reading it or looking at or having someone explain it to you it is often different from being able to explain or produce it yourself, try to write up your home work by yourself when you've put all the other resources away. Likewise, take the time to understand, answer, and write-up the WebWork assignments solo.

All in-class quizzes and tests are expected to be done without any resources except those explicitly authorized by the instructor. Do not discuss exams and quizzes with others who may not yet have taken the exam or quiz or within earshot of anyone who may be taking the exam or quiz at a later time. It is entirely possible for someone to be taking an exam or quiz at a later time than you are.

Cheating will result in at minimum a zero on the assignment, quiz or exam. Cheating will be reported to the office of student conduct. Egregious offenses may result in a failing grade for the course and/or more serious consequences as merited by the situation.

Getting Help:

We've all needed help with something. Working with students on math is one of the best parts of my job. If you find yourself feeling uncertain, wanting a deeper understanding, wanting to get better grades, or struggling to learn and succeed, please ask questions in class, post questions on Canvas, and come see me. I want to answer all your questions thoroughly, even though it may not be possible to answer every question during class itself. Please give me a chance to help. If you can't attend office hours, please send me an email and suggest several times when you are available so we can find a mutually convenient time to meet.

Secrets for success:

1. Read the book before class and take notes on what you read.
2. Attend class daily and participate willingly, whether it is by asking questions, answering questions, or working with others.
3. Budget time for homework – a minimum of 10 hours per week for work outside of class. It can help to have a regular times scheduled when you know you'll work on math.
4. Start on the homework problems as soon as you can.
5. Focus on understanding why things work the way they do, rather than on what "the answer". Understanding and correctly applying the method of getting the answer is what is truly important.
6. Attempt to work on your math every day or at least every other day. The hardest part is usually getting started. Find a quiet place to work, get your book and notes together. Put away distractions such as your cell phone, TV, or laptop. Then, set a timer for 30 minutes (or 15 if you are having a bad day) and resolve to put your best effort in for at least that length of time.
7. Discussing problems and solutions with peers and using the internet is encouraged, with two caveats.
   - Before you go ask or look for a solution, make an honorable effort to solve the problem on your own. Spend time thinking and strategizing before asking or searching for help.
   - You must write up your understanding of a solution **on your own**. Practice makes perfect! See my guide to group work and using outside resources, `http://www.cwu.edu/math/group-work-and-using-outside-resources`, on the web.
8. As you progress in your university studies and in your career, problems get more and more difficult to solve. You may have to start with easier (possibly unassigned) problems before you are even ready to start to work on an assigned problem. Some problems may take more than an hour to solve. Persistence pays off.
9. Explain what you are doing. Use your words. This will help you to understand the concepts critical to success in the class, and will help you get a higher grade.
10. I am always happy to help you if you are stuck. You will get the most out of my help and the University Math Center if you attempt the problem on your own or with your peers before asking an expert.
11. Do your scratch work before you do a final write-up of your work. What you hand in should be neat and professional and all pages should be stapled together.

Important Dates

January 5 – classes begin
January 8 – self-study day
January 11 – Last Day for Add/Drop
February 2 – (tentative) first mid-term exam
February 15 – President's Day Holiday (no class)
February 22 – (tentative) second mid-term exam
March 4 – last day of classes
March 10 - final exam at 8 am in our usual classroom

Students with Disabilities

I am happy to work with students with disabilities. To set up academic adjustments in this class, you should give or email me a copy of your *Confirmation of Eligibility for Academic Adjustments* from the Disability Support Services Office. **You must also come see me in office hours or make an appointment to come see me as soon as possible so we can discuss how the approved adjustments will be implemented in this class.** Students without this form should contact the Disability Support Services Office, Bouillon 140 or dssrecept@cwu.edu or (509) 963-2171. **Testing requests with testing services must be submitted at least 48 hours before an exam is given or you will have to take exam with the rest of the class.**