<p align="center">**Welcome to Math 272 Multivariable Calculus 1 – Winter 2017**</p>

10:00 - 10:50 M-F in Black 134, frequent Mondays in Bouillon 103

Instructor: Dr. Jean Marie Linhart   **Office:** Bouillon 119
Phone: (509) 963-2123   **E-mail:** JeanMarie.Linhart@cwu.edu
Webpages: (course) http://canvas.cwu.edu   **Office Hours:** TBA
    (HW) http://webwork.math.cwu.edu   and by appointment.
    (me) http://www.cwu.edu/math/jean-marie-linhart

Required Text: *Multivariable Calculus*, by Rogawski and Adams, 3rd edition
We will cover material from Chapter 8 (section 8.4), Chapter 10, Chapter 12 (12.1-12.6), Chapters 11 and 13 (11.1-11.2, 13.1-13.3, 13.5), and Chapter 14.

Assignments and grades will be posted to Canvas. We will be using WeBWorK for online homework. Login to WebWorK the first time using your Canvas user name (all lowercase) as your user name and password. Please change your password immediately.

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. 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

We will be using Standards Based Grading this quarter, which means that the course is broken down into standards, or key learning areas, and student's must demonstrate their competency on the standards to get a C, B or A for the course. Students may retest on the standards if their first attempt was not successful. A limited number of attempts are available. Check the standard description in Canvas to see how many tests may be attempted for a given standard.

I have a list of 23 standards on Canvas for this course, with 13 identified as required areas. Standards will be graded with an A (40+, excellent) or B (30-39, very good) or C (20-29) or Not Yet (NY, 0-19) passed. Most, but not all standards will have a C pass available. Required standards have names on Canvas that end in R, e.g. "Limits R".

To get a C in the course, a student must pass 14 standards including all 13 required standards, with a C or better, and at least 11 must be with a B or better.

To get a B in the course, a student must pass 17 standards, including all 13 required standards, with at least 14 evaluated as an B or better.

To get an A in the course, a student must pass 20 standards, including all 13 required standards, with at least 16 evaluated as an A, and at least 2 more evaluated as a B or better. These standards must include an A or a B pass on all required standards, and at least one of the two standards on Optimization and Lagrange Multipliers. The Lagrange Multiplier standard must be passed with a C or higher.

Other grades will be assigned as logically as possible based on these criteria.

Standards Based Grading and Standards Testing

There will be two class days during the quarter that are devoted to testing, and testing will be offered on occasion in class as we finish up a unit. On challenging material, students should expect to test during office hours or by appointment. In order to take a test or re-test during office hours, students must email me or let me know on Canvas a day ahead of time so I can have the evaluation prepared for them. I may also, at my discretion, ask students to show practice or understanding and mastery of homework problems on that material. The **last** opportunities to test are Wednesday of the last week of the quarter and, after that, during the final exam period for our class.

- Email me a day ahead of time with the name of the evaluation you want to take to test or retest on during office hours or by appointment.
- In order to take a test or retest, you must have been to class that day or provide evidence of an excused absence.
- At my discretion, I may ask you to explain a homework problem or show evidence that you have been practicing problems based on the standard retested in order to retest outside of **this** class.
- If you are not successful in a retest on a standard, I recommend you take time to meet with me to go over the questions you missed so that you are better prepared to retest. **I recommend you retest as soon as possible, and continue retesting, if allowed, until you are successful.**

Attendance

Regular attendance, as is required for any job or area of endeavor. A student is tardy if they arrive after the beginning of class (10 am) but before 10:06 am. Students with exemplary attendance and punctuality records (less than 2.4 absences with a lates counted as 20% of an absence) may earn credit for an additional passed evaluation at the end of the quarter, at the discretion of the instructor. Students will be required to fulfill an additional standard at the level of B or higher for every 8 absences over the course of the quarter.

Excused absences will be handled on a case-by-case basis. If you must be out of class for a field trip, court date, work event or other planned event, contact me and provide documentation ahead of time. If you are absence due to illness or emergency, contact me and provide documentation within 2 working days of the absence.

Students are responsible for all material presented in class. If you miss a day, get notes from a classmate.

Homework
Completing required practice carefully and thoroughly is a (required) standard for the course. Most of the homework we do will be on WebWork, which is the online homework system for the Math Department at CWU. Understanding and being able to neatly, concisely and correctly deriver solutions to the WebWork problems are required for success in this course.

When written homework is assigned, it is expected that your work will be neat, complete, correct and well-explained **by the day the homework is due.** Assignments will be graded accordingly.

Students acquiring more than 75% of the offered homework points will be credited with a C on homework, with more than 80% of the points this will be a B, and with 90% or more, this will be an A.

Testing Days
Attendance at the Testing Days is **mandatory**, as it would be for an exam in a regular class. If you have an emergency or illness for one of these days, bring it documentation. Students who miss an in-class testing day will not be permitted to take or retake evaluations in office hours without an excused absence for that testing day until after the next testing day.

On testing days the first evaluations given to a student will be the oldest required evaluations. Once those are complete, students may use the remaining time to test and pass other evaluations.

Students will be given an opportunity in class and by email to let me know what optional evaluations they would like to take during the testing days.

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. Ask yourself *why* and make sure you have answers. The *why* is often more important than the *what*.
2. Read the book taking notes on what you read.
3. Keep in mind that the easiest way to tell that you are really studying is to see if your pencil is moving. If you are using your pencil to write math as you are thinking about it, then you are probably really studying. If the pencil isn't moving, you probably are not really studying.

4. Attend class daily, give class your full focus, and participate willingly, whether it is by anticipating what comes next, asking questions, answering questions, or working with others.

5. Budget time for homework – CWU expects you to spend 10 hours per week on work outside of class for a 5 credit class. It can help to have a regular times scheduled when you know you'll work on math.

6. Start on the homework problems as soon as you can.

7. 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 text messages, NetFlix, and Twitter. Then, set a timer for 15 minutes (5 or 10 if you are having a bad day) and resolve to give your math work your undivided attention and best effort for at least that length of time.

8. 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.

9. 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.

10. Explain what you are doing. Use your words. Ask why and answer your own question, with words. This will help you to understand the concepts critical to success in the class, and will help you get a higher grade.

11. 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.

12. 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 4 – Classes Begin
January 10 – Change of schedule period ends
January 16 – MLK Day – no classes
January 27 – (tentative) Testing Day 1
February 17 – Uncontested withdrawal period deadline
February 20 – President's Day – no classes
February 27 – (tentative) Testing Day 2
March 17 – Final exam at 10 am

Students with Disabilities
I am happy to work with students with disabilities. To set up academic adjustments in this class, you should give me a copy of your *Confirmation of Eligibility for Academic Adjustments* from the Disability Support Services Office and 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, Hogue 126 or dssrecept@cwu.edu or (509) 963-2171.

I need a minimum of 24 hours notice over one working day to arrange for and deliver exams to the Testing Center. Please plan accordingly.