MTH 223 Winter 2016 Calculus III Syllabus
MTWR 9:30-10:20

Instructor: Dr. David Folk
E-mail: David.Folk@emich.edu
Webpage: http://www.emunix.emich.edu/~dfolk
Office: 504-K Pray-Harrold
Phone: 734-487-1645 (during office hours)

Office hours: MWTR 12:00 pm-1:30 pm
other times by appointment

Text: *Multivariable Calculus*, 6^{th} edition
McCallum, Hughes-Hallett, Gleason, et. al
ISBN 9780470888674

Calculator: TI-83, 84, 85, 86, 89, or 92 or newer is required

Grading Scheme	Activity	Percent of Final Grade
	Homework and quizzes	10%
	Chapter 12 (functions) in-class test	10%
	Chapter 13 (linear algebra) take-home test	5%
	Chapter 14 (derivatives) take-home test	10%
	Chapter 14 (derivatives) gateway exam	10%
	Chapter 15 (optimization) in-class test	10%
	Chapter 16 (integrals) gateway exam	10%
	Chapter 17-18 take-home test	10%
	Final Exam	25%

Final Exam Information: You will receive, prior to the final exam, an entire actuarial exam, which consists of review problems from calc I, II, III and linear algebra. The exam will be in two parts. The first part will be individual, and will consist of problems chosen from the actuarial exam. The second part will be group, and will be problems taken from, roughly, chapters 17-20. The Final Exam will be given on Tuesday, April 26, 2015, 9:30 am-11:15 am.

Tutor info: There is free math tutoring available on a walk-in basis in the Math Lab (411 Pray-Harrold). Their hours for tutoring are 8 am to 8 pm Monday through Thursday, and 8 am to 2 pm on Friday. They will also offer tutoring on Sundays from 1 pm to 5 pm in 302 Halle Library. You can find much more information about the lab at www.emich.edu/math/tutoring/

Some important notices:

Students with Disabilities:
Eastern Michigan University has a tradition of providing access to education for students with disabilities that began long before the enactment of federal or state law governing accommodations. To see an outline of the accommodation information for faculty and students provided by the Disability Resource Center, visit the DRC homepage: /www.emich.edu/drc/

Important Notice for Foreign Students:
Foreign students should be aware of the requirements of the SEVIS program. For information about maintaining your visa, go to www.emich.edu/ois/immigrationstatus.html

Academic dishonesty:
Academic dishonesty, including all forms of cheating, falsification, and/or plagiarism, will not be tolerated in this course. **For the purposes of this course, cutting-and-pasting will be regarded as cheating**. Penalties for an act of academic dishonesty may range from receiving a failing grade for a particular assignment to receiving a failing grade for the entire course. In addition, you may be referred to the Office of Student Conduct and Community Standards for discipline that can result in either a suspension or permanent dismissal. The Student Conduct Code contains detailed definitions of what constitutes academic dishonesty but if you are not sure about whether something you are doing would be considered academic dishonesty, consult with the course instructor. You may access the Code online at: www.emich.edu/studentconduct/.

Student conduct:
Students are expected to abide by the Student Conduct Code and assist in creating an environment that is conducive to learning and protects the rights of all members of the University Community. Incivility and disruptive behavior will not be tolerated and may result in a request to leave class and referral to the Office of Student Conduct and Community Standards (SJS) for discipline. Examples of inappropriate classroom conduct include repeatedly arriving late to class, using a mobile/cellular phone while in the class session, or talking while others are speaking. You may access the Code online at www.emich.edu/studentconduct/.

Religious holidays:
Current University policy recognizes the rights of students to observe religious holidays without penalty to the student. Students will provide advance notice to the instructor in order to make up work, including examinations, they miss as a result of their absence from class due to observance of religious holidays. If satisfactory arrangements cannot be made with the instructor, the student may appeal to the school director or head(s) of department(s) in which the course(s) is / are offered.

MATH 223 Calculus Course Notes

- This will be a ‘problem-solving’ based course, not a ‘lecture-based’ course, nor a ‘theorem-based’ course
- Every day that is not a test day, there will either be a quiz or homework problems to hand in.
- During a normal semester, you would normally be expected to work about 15 hours/week outside of class to complete your homework.
- You will be expected to get together with class members outside of class for completing homework, and completing group assignments. You will be expected to complete *all* of the homework before the next class day. No late work will be accepted, nor will missed quizzes be made up
- As group work will be an integral part of the course, after at most two weeks we'll hopefully select permanent groups.
- Each class day will be a mixture of some lecture, problem solving, and group work. I will try to keep the lecturing down to 15 minutes at a time. Much of the group work will either be in the form of extra credit, or starting to solve problems that will be assigned as homework.
- In my experience, running the class in this way allows many more people to complete the course successfully. If you have serious disagreements with the philosophy behind this, I would strongly encourage you to transfer sections.
- A *gateway exam* is a test of basic skills that most universities require you to pass to get credit for the course. In this course, there are two gateway exams, one for multivariable derivative skills, the other for multivariable integral skills. For each a passing score will give you 100% for that exam; a failure to pass that exam will result in 0% for that exam. The derivative test will be given a total of 5 times (a passing score will be 4/5), the integral test will be given a total of 10 times (a passing score will be 5/6). For each, the first one will be given in class, the rest will be given every day M-TH in the testing room (411 P-H) and must not be taken during class time.
- As a general rule, the only homework that will be discussed is that for which I have sufficient evidence to conclude that most of us were unable to finish the problem. One option that may be exercised is to put the solution on my web page.

- All work must be shown on every problem to get full credit for that problem.
- *No* individual homework will be accepted.
- *All* homework will be due at the very beginning of class. *No* late homework will be accepted.
- You will be allowed to submit corrections on the in-class exams (not gateways nor the final exam) for chapters to get some credit back on those exams.
  Important: Your corrections must be in the same order as the problems on the exam, the corrections must be on separate paper, and by 'correction' it is meant that you provide a complete correct solution for the problem
- If you're stuck on homework problems, try
  a) Working with each other is by far the best choice. Although your homework is due in particular groups, you'll find the best way to learn is get as many people in the class involved in active problem-solving *together* as possible.
     Note: This does *not* mean that simply copying other group's homework will be allowed.
  b) Going to the student resource center (in and around room 411 Pray-Harrold).
  c) Going to the math den (corner room 501 on 5th floor P-H)
  d) Seeing me during office hours
  e) e-mailing me
- As much as possible, every problem will be solved numerically, algebraically, graphically, with explanations given in complete sentences.
- The final exam will be the only exam curved. The grading scale for all of the other exams will be 90/80/70/60.

What is multivariable calculus about?

- Chapter 12: Overview to representations of functions (graphical, algebraic, numerical, and contour diagrams)
- Chapter 13: Linear Algebra Tools
- Chapter 14: Introduction to first and second derivatives: numerical, algebraic, graphical, contour interpretation, and contextual interpretation (with units)
- Chapter 15: Optimization: How do you find the top or bottom of a function, with or without constraints? Second derivative test?
- Chapter 16: Integration: 2-variable and 3-variable integration. Rectangular, polar, rectangular and spherical coordinate systems. Interpretations of volume and mass.
- Chapter 17: Introduction to Parametric Equations: If a particle is traveling along a curve, or a curve in space, how could you find functions for x and y (and z, when needed) to tell you at which point the particle is at at any given time? Velocity and acceleration *vectors* begin here.
- Chapter 17(b): Vector Fields. How do you describe, algebraically, numerically, and graphically a *flow?* You could put a vector at each point that points the direction of the flow, and the length of the vector could represent the speed of the particle. If you know slope fields from Calc II, this is just a little more general.
- Chapter 18: (Line integrals and Green's Theorem) If you have the flow of a river described, and you had to push a particle around a *circuit* (a lap around a closed curve) in the river, how would you calculate the work that was needed? Or if the closed curve was the boundary of a mesh, how would you calculate the flow per second through the boundary?
- Chapter 19: Flux integrals. If you had any kind of surface, and a flow described through the surface, how would you measure the flow through the surface? As a nice side result, we get how to find the surface area of any of our surfaces.
- Chapter 20: (The Divergence Theorem and Stokes' Theorem) The Divergence Theorem asks if you a have a closed *surface* and a flow, how do you measure the flow through it? (Classically this arose when trying to define charge (electric or magnetic) at a point, and it involves both integrals and limits. Physicists lived with this definition for a very long time, and it is still the definition in one of the branches.) Stokes' Theorem is just a generalization of Green's Theorem.
- The last three chapters together form the Fundamental Theorem of Calculus for 2 and 3 variables. They do have purely mathematical derivations, but no one in their right mind would ever have thought of them, so we'll be using the geometric interpretations.

Why linear algebra?

- From chapter 17 on we'll be using vectors very heavily, so familiarity with them as arrows pointing the way of a flow and their length being a measurement.
- Chapter 14 makes a lot more sense if you remember that when zoom-in on a surface, it gets flatter and flatter, i.e., it looks like a plane. All the stuff you learned about equations of planes, dot product, etc., from linear algebra (and from chapter 11) will be useful here. Also, the chain rule can be expressed in terms of linear transformations
- In chapter 15, there's a calc III second derivative test for functions of two variables. In order to understand where in the world this would come from, one really needs (a) linear transformations and (b) eigenvectors and eigenvalues, which are in MTH 122, but usually at the end. (So we will do some reviewing of this)!
- In chapter 16, when we do substitutions, there's an area-adjustment needed. This involves determinants (in fact, we will *define* the determinant of a 2×2 matrix to be the (signed) area of the parallelogram formed by the two column vectors). The basic algebra of differential forms also has its roots here
- When we're calculating work being done pushing an object around a circuit, we're really generalizing what happens when you push an object along a vector $\vec{d}$ with a force $\vec{F}$. This will require us to remember stuff about dot product, but really the *geometric* properties far more than the algebraic.
- When we're calculating flow of a vector field through a surface, we'll want to zoom-in onto a little parallelogram on the surface, calculate its area and find a vector that's perpendicular to it. The cross-product solves both of these problems, and so we'll be using it extensively (the *geometric* aspects almost exclusively!).

Playdough recipe:
1 cup flour
1/2 cup salt
1 tablespoon alum
1 cup boiling water
1 tablespoon vegetable oil
Food coloring (several packs of kool-aid work nicely!)

Mix dry ingredients in a large bowl. If color is desired, add food coloring (it will need a large amount to color vibrantly!) to boiling water. Add vegetable oil to water and stir into dry mixture. Mix to include all dry materials. As soon as it has cooled sufficiently, begin kneading with hands; it is ready as soon as it is all mixed together.