MATH 255 - Vector Calculus
Fall 2014

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Office Hours: M 10:30-11:30 & 2:30-3:30, T 1:00-2:00, F 10:30 - 11:30
and by appointment
TA: Toby Hall (tthall@smcm.edu) and Dylan Weber (djweber@smcm.edu)
TA Hours: Monday and Wednesday Evenings

Course Content
This is one of those math classes that has the potential to blow your mind (in mostly good ways). We'll cover a fantastic smorgasboard of topics, including what has been described as "the most important theorem in all of analysis," and my own, personal favorite theorem of all time–not to mention a ton of other great stuff.

Vector calculus (or *multivariable calculus*, as its also known) ties together these concepts in an attempt to generalize the techniques and ideas you learned about in (single variable) calculus. Our two main areas of focus will be integration and differentiation, only this time around we will learn them so that they can be used in more general settings where one, two, or even a kabillion* different variables are involved.

As is the case with the best television show ever, *Lost*, learning all of this material raises as many fascinating questions as it answers. This will allow you to develop a good sense of what other, more abstract and modern areas of mathematics are trying to accomplish and how your strengths and interests may fit in with them. (I suppose this analogy also suggests that you may find yourself frustrated with the semester final(e)...) Lastly, students interested in biology, chemistry, and physics will find a plethora of relevant examples and applications not merely buried in the book and lectures, but on display and used as motivation for the incredible mathematics we'll learn. Indeed, vector calculus was more or less invented to help phrase and answer questions scientists naturally encounter.

Draw a picture of the point $(-2, e)$. Write down an equation for a circle in the plane whose radius is 2 and whose center is $(1, 1)$. Write down an equation for the line that passes through the points $(1, 2)$ and $(1, -3)$.

In a nutshell, this class can be a game-changer. Here is a (rough) list of topics I plan to cover:

- 2- and 3-dimensional Space (points, vectors, dot product, cross product, planes, surfaces, different coordinate systems))
- Differentiation (partial derivatives, directional derivatives, gradients, LaGrange multipliers, Hessian matrices, and discussions about *The Inverse and Implicit Function Theorems*)
- Integration (double integrals, triple integrals, change of variables, line integrals, surface integrals)
- Integral Theorems (Fundamental theorem for Path Integrals, Green's Theorem, Stokes' Theorem, and the Divergence Theorem)

Textbook
Multivariable Calculus (5th Edition) by James Stewart
Note: I plan to deviate from this textbook every now and then, and I apologize for its relatively high price. Draw a picture of the set of points in $\mathbb{R}^3$ that satisfy the equation $x^2 + y^2 = 1$. However, I chose this text because if you decide to hold onto it, it will serve you well as a reference in the years to come: it strikes a good balance, managing to be both readable and fairly precise. Describe (either in words or with a picture) the set of points in $\mathbb{R}^3$ whose z-coordinate is zero. Describe (either in words or with a picture) the set of points in $\mathbb{R}^3$ whose x-coordinate equals 1.

Homework
Homework will be assigned and collected on a weekly basis. You are encouraged to work together on homework problems, but the final preparation and write-up of your work must be your own. Your submitted work should be stapled together and should have your name on every page. Please be neat. **Late homework will not be accepted for credit.** Homework will be graded for **correctness, clarity, and justification**. To receive full credit, you must show all of your work, explain your work when necessary, and, you know, write everything so that its readable.

Exams
There will be three midterm exams and a cumulative final. The midterms will take place at 6:00 pm on the dates listed below. Once the location is determined, I will let you know. If you are unable to take an exam at these times, let me know and I will find a way to accommodate your schedule.

Grades and Tentative Exam Dates
Grades will be computed as follows:

- Homework: 30%
- Exam 1: 10.01.14: 15%
- Exam 2: 10.29.14: 15%
- Exam 3: 12.10.14: 15%
- Final Exam: 12.15.14 (8am Section), 9-11:15am & 12.16.14 (noon Section), 2-4:15pm: 20%
- Class Participation: 5%

Review Sessions
Review sessions / TA Office Hours are scheduled as indicated below:

- Mondays and Wednesdays

Bonus Questions and Extra Credit
Many of the homework assignments will offer bonus questions. These additional exercises are optional and **should be handed in to me directly, not the TA**. These bonus problems (completed and correct) will add extra points to your exam(s) and/or homework grades. Find the equation of the plane that passes through the three points $(0, 1, 0), (2, 1, 1)$, and $(1, 0, 2)$.

Success
Here are some tips for making a good grade in this awesome but often overwhelming course:

- Attend every class
- Read the book and review your notes on a daily basis
- Do all of the homework assignments
- Ask questions if or whenever something is not clear
- Ask questions even if everything is clear (this is a good way to slow down lectures)

Students with Disabilities
Any student with a disability requiring accommodations in this class is encouraged to contact me. Students with a disability may also wish to contact Dr. Don Stabile in the Office of Academic Services.