Math 19: Multivariable Calculus
VL 106
MWF 12:45 - 1:50
Westmont College Fall 2006

Professor: Scott Taylor
Office: Math and Computer Science Building (near Post Office)
Office Hours: Monday 3:15 - 4:15; Wednesday 11:30 - 12:30;
Thursday 9 - 10 and 3 - 4; Friday 3:15 - 4:15; and by appointment
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Prerequisite: MA 10 or MA 10H

Catalogue Course Description: Elements of vector analysis. Functions of several variables. Differentiation, partial differentiation, gradient, implicit functions. Integration, multiple integrals, line integrals, Green's theorem.

Calculus and the Liberal Arts: Westmont College has recently approved a new GE. Two of its categories are specifically addressed in this course: reasoning abstractly (by looking carefully at mathematical theories and proofs), and quantitative and analytical reasoning (by modeling physical phenomena with data and applying mathematical models to those data). By studying the book *Flatland* by Edwin Abbott we will also look at connections between mathematics, literature, and faith.

Course Objectives:
- Understand functions $f : \mathbb{R}^n \to \mathbb{R}^m$
- Understand and use basic vector operations
- Understand and calculate various types of derivatives
- Find equations of tangent planes
- Find maxima and minima of real-valued functions
- Find volumes
- Set up and perform multiple integrals
- Calculate surface areas
- Understand vector fields
- Understand and use Green's theorem and Stoke's theorem

Text: Stewart, James. *Multivariable Calculus 5th edition.* Thomson.
Abbot, Edwin. *Flatland.*

Calculators: You will occasionally be required to use graphing software such as Maple or Mathematica. Such software is available in the computer lab in the Mathematics/Computer Science building.

Evaluation:
Your course grade will be determined by a weighted average as follows:

20 % Homework	15 % / 20 % Exam 1
10 % Essay on *Flatland*	20 % / 15 % Exam 2
10 % Group Projects	25 % Final Exam

However, earning fewer than 50 % of available points on the Final Exam will automatically result in a course grade of "F".

Course letter grades will be assigned (subject to above caveat) according to the following scale. Any curve will be determined at the end of the course, according to the discretion of the instructor.

93 - 100 %	A	73 - 77 %	C
90 - 93 %	A-	70 - 73 %	C-
87 - 90 %	B+	67 - 70 %	D+
83 - 87 %	B	63 - 67 %	D
80 - 83 %	B-	60 - 63 %	D-
77 - 80 %	C+	below 60 %	F

Attendance: Attendance is required. You are allowed 4 absences for any reason. Any absences beyond those four will result in the loss of one full letter grade in your final course grade. For instance, a B+ would be changed to a C+. This policy may be amended in the case of an emergency. Please contact the instructor as son as possible upon word of an emergency that will result in extended absence from class.

Group Projects: Two group projects will be assigned in the course. More details will be distributed later.

Homework: Homework is an integral part of this course. You have not learned the subject if you cannot work through problems on your own. Homework is your chance to be sure that you understand the material and your chance to discover questions pertaining to the subject matter. You are encouraged to work together on the homework. This does not mean, "You do problems 1 - 3 and I'll do problems 4 - 6 and we'll exchange answers". **All work must be your own.** Homework assignments will be given in class and will also be posted on the class website. You are strongly encouraged to check the website to be sure that you have the entire assignment.

Homework will be due at the beginning of the class period indicated (usually on a Friday). If you are absent from class on the day homework is due, you should send the assignment with a friend or arrange to turn it in early. Late assignments will not be accepted unless cleared with the instructor in advance. Except in cases of emergency, extensions will not be granted.

Homework must be **very readable**. This means **no** messy scratchwork, no huge eraser marks, no loose pages. Problems must be in order with the section and problem number clearly indicated. **You must show all of your work**. Your work is your answer. Again, you must show all of your work.

Exams: The two midterm exams will be in-class on the days indicated in the schedule. The lower score of the two exams will be worth 15 % of your course grade and the higher will be worth 20 % of your course grade.

The final exam, which is cumulative, will be on **Friday, December 15** from **12 PM - 2 PM**. The final exam may not be rescheduled for personal convenience, airline reservations, etc. Requests to reschedule a final because you have three scheduled in one day or because of a special situation must be completed and turned into the Student Records Office by Monday, November 27th. Exams will be designed to test your understanding of the material, not just your computational capabilities. You must understand, and communicate, the material.

Class	Day	Date	Topics	Comments
1	Mon.	Aug. 28	Vectors & Inner products	
2	Wed.	Aug. 30	The cross product	
3	Fri.	Sep. 1	Eqns of Lines and Planes	HW # 1 Due
4	Mon.	Sep. 4	Quadratic surfaces	Tues. is the last day to drop.
5	Wed.	Sep. 6	Polar, Cylindrical, Spherical coordinates	
6	Fri.	Sep. 8	Vector Functions	HW # 2 Due
7	Mon.	Sep. 11	Group Project 1	
8	Wed.	Sep. 13	Derivatives, Arc Length	
9	Fri.	Sep. 15.	Curvature	HW # 3 Due
10	Mon.	Sep. 18	Velocity & Acceleration	
11	Wed.	Sep. 20	Kepler's Laws	

Class	Day	Date	Topics	Comments
12	Fri.	Sep. 22	Functions of multiple variables & limits thereof	HW # 4 Due
13	Mon.	Sep. 25	*Flatland 1*	HW # 5 Due
14	Wed.	Sep. 27	*Flatland 2*	HW # 6 Due
15	Fri.	Sep. 29	*Flatland 3*	HW # 7 Due
16	Mon.	Oct. 2		
17	Wed.	Oct. 4	Review	
18	Fri.	Oct. 6	**Exam 1**	
	Mon.	Oct. 9		Holiday
19	Wed.	Oct. 11	Directional Derivatives & Partial Derivatives	
20	Fri.	Oct. 13	Tangent Plane Approx. & Chain Rule	HW # 8 Due
21	Mon.	Oct. 16	Maxima & Minima	
22	Wed.	Oct. 18	Integrals over [a,b] x [c,d]	
23	Fri.	Oct. 20	Integrals over $D \subseteq R^2$	HW # 9 Due
24	Mon.	Oct. 23	Double Integrals in Polar Coordinates	
25	Wed.	Oct. 25	Surface Area	
26	Fri.	Oct. 27	Triple Integrals	HW # 10 Due
27	Mon.	Oct. 30	Group Project 2	
28	Wed.	Nov. 1	Change of Variables	
29	Fri.	Nov. 3	Change of Variables	Last day to withdraw. HW #11 Due
31	Mon.	Nov. 6	Catch-up/Review	
30	Wed.	Nov. 8	Review	

Class	Day	Date	Topics	Comments
32	Fri.	Nov. 10	Exam 2	HW #12 Due
33	Mon.	Nov. 13	Vector Fields	
34	Wed.	Nov. 15	Line Integrals	
35	Fri.	Nov. 17	FTC revisited	HW #13 Due
36	Mon.	Nov. 20	Green's Theorem	
	Wed.	Nov. 22		Holiday
	Fri.	Nov. 24		Holiday
37	Mon.	Nov. 27	Review	
38	Wed.	Nov. 29	Curl & Divergence	
39	Fri.	Dec. 1	Parameterized Surfaces	HW #14 Due
40	Mon.	Dec. 4	Surface Integrals	
41	Wed.	Dec. 6	Stoke's Theorem	
42	Fri.	Dec. 8	Review	HW #15 Due
	FRI.	**Dec. 15**	**12 PM - 2 PM**	**FINAL EXAM**