

3450:223-002 Analytic Geometry-Calculus III

Dr. Laura Gross

Spring 2008

COURSE OBJECTIVES

- Advance beyond Calculus I and II by considering higher-dimensional geometry. Calc III will start with a unit on three-dimensional coordinate systems and vectors. At the end of the course, we will do *calculus* in the vector setting.
- Advance beyond the two-dimensional polar coordinates from Calculus II to (3-D) cylindrical and spherical coordinates.
- Advance beyond the parametric equations $x = f(t)$, $y = g(t)$ from Calc II, whose graph is a curve in the (two-dimensional) plane. In Calc III we add $z = h(t)$ to the list, so that we deal with a curve in 3-D. We'll expand Calc II ideas like arc length to the higher-dimensional setting. If t represents time, now we can mathematically model motion of a particle along a curve in three dimensions instead of only two.
- Learn “multivariable calculus” by moving beyond functions $y = f(x)$ to functions like $z = f(x, y)$. You have always graphed $y = f(x)$ by assigning a height y to each point x in the domain on the horizontal axis, tracing out a curve. To graph $z = f(x, y)$, you assign a height z to each point (x, y) in the domain in the x - y plane, tracing out a surface.
Functions of several variables appear commonly in science and engineering. We'll learn new calculus techniques to study the limits, continuity, derivatives, and integrals of multivariable functions.
- You will also further develop your analytical geometry skills by solving problems using both algebra and geometry together, this time including 3-D geometry.

COURSE MATERIALS

- Either (a) *Calculus*, Stewart, 5th ed., 2003 (Calc I-III) or (b) *Multivariable Calculus*, Stewart, 5th ed., 2003 (Calc III only): required
- Graphing calculator: (other than computer algebra systems) allowed on most exams and assignments (e.g. TI-86 or below)
- *How to Ace the Rest of Calculus: The Streetwise Guide*, Adams, Hass, and Thompson (**QA303.3 .A332 2001**): on reserve in Bierce Library and available at the circulation desk

CONTACT INFORMATION

Office: Arts and Sciences (CAS) 266
Phone: (330) 972-6829
Email: lkg@uakron.edu (**Don't use fancy fonts.**)
FAX: (330) 374-8630 (**Be sure to put my name on the document.**)
Web: <http://www.math.uakron.edu/~gross>

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OUTSIDE HELP

- **Tentative office hours** are
 - **Mondays:** 12:45–2:00 p.m.,
 - **Tuesdays:** 3:15–4:00 p.m.,
 - **Wednesdays:** 3:15–5:15 p.m.,
 - **Fridays:** 12:00–2:00 p.m.

Please see my web site for office-hour updates.

- In case you can't attend scheduled outside help, make an appointment, preferably at least one day in advance.
- If you wish, you may go to Bierce Library, Room 68 (in the basement), Monday through Friday and request additional free tutorial assistance. Call (330) 972-6552 for further information.

PREREQUISITES

You are responsible for having completed Analytic Geometry-Calculus II 3450:222 or equivalent with a grade of C- or better. If you have not met the prerequisite, you might be administratively withdrawn from the course without refund.

POLICIES

- **ATTENDANCE**
 - The course meets Mondays, Tuesdays, Wednesdays, and Fridays from 2:15 to 3:05 p.m. in Leigh Hall (LH) Room 312.
 - Attendance plays an important role in your grade: Good attendance helps you perform well in the course. People who attend infrequently rarely get promoted to differential equations.
- **WRITTEN ASSIGNMENTS**
 1. Written homework will be collected at random, generally on Fridays.
 2. You may submit late homework at your own risk. If the grader has already finished grading the papers upon receiving yours, you will generally receive a grade of zero.
 3. **Homework submitted by email will not be graded, in general.** Homework submitted by fax and received by the grader by the due date/time *will* be graded; please write my name on the fax.
 4. Many of the homework exam problems will be drawn from the list attached. The problems in parentheses will not be collected, but I encourage you to work *all* of the suggested problems for practice.
 5. Please keep a copy of your homework, so that you can refer to your work when the grader has your original.
 6. Please start writing on a new sheet of paper for each new section of problems you begin.
 7. To receive full credit, homework must be: on clean 8 1/2 by 11 inch paper, stapled, neat, and clear.

8. The grader should be able to understand what you are doing in each homework problem without looking at the book. To receive full credit, you need to (1) indicate what the question is, (2) show your work, and (3) use complete sentences whenever discussion is required.
9. Feel free to work together on homework. Discussion with a classmate often helps you learn. However, **you must write up the homework by yourself.**
10. Each assignment will be graded out of 16 points. Four points will be based on the completeness of the assignment, and 12 points will be based on the careful grading of four problems chosen at random.
11. At the end of the semester, I will drop your lowest homework grade.

- ON-LINE ASSIGNMENTS

Approximately six on-line assignments will be given.

- EXAMS

- There will be three exams during the semester. The tentative exam dates are in the schedule below. Makeup exams are given at my discretion. Unless there is an emergency, you must contact me before the exam to be considered for a makeup.
- The comprehensive final exam will be **Monday, May 5, 8:00–9:55 a.m.** at a place to be announced. No make-up tests will be available.

- GRADES

- Course grades are determined by

three exams	15% each
written assignments	20 %
on-line assignments	10%
comprehensive final exam	25%
- The tentative grade scale is A 90-100%, B 80-89%, C 70-79%, D 60-69%, F 0-59% with cut-offs for plus/minus grades at my discretion.
- If you are unable to complete the course because of circumstances beyond your control, see me. You may be eligible for a grade of incomplete if your average on work completed is at least a C.
- You may contest any grade up until one week after the work was returned in class.
- When work is returned to you, save it. Also, keep a running log of your grades. If you have any questions about my records, you must be able to show the relevant work.

- REGISTRATION AND WITHDRAWAL

1. You must register during the first two weeks of school. To participate in the class, your name must appear the university's official class list by Monday, January 28, 2008.
2. The last day to withdraw from the course without "WD" appearing on your academic record is Monday, January 28, 2008.
3. Withdrawal from the course is permitted at any time on or before Friday, March 7, 2008 with your advisor's signature. After that date, my signature is also required. After Friday, April 11, 2008 at 4:30, University policy prohibits withdrawal from any class. All withdrawals must be processed by the registrar by that date.

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RESPONSIBILITIES

1. Adhere to academic honesty policies. (See handout.) They will be strongly enforced.
2. All pagers, cellular phones, etc. must be turned off during class time.
3. To remain in the class you must, of course, behave courteously and appropriately.

TIPS FOR SUCCESS

- Most successful calculus students rely on good study skills rather than in-born talent. In order to do well in this course, you must practice extensively— keep up with the homework, be patient, persevere, and ask questions.
- Aim for an A. Students who aim low usually fall short of their goals.
- Take an active approach to learning the material. Just watching me explain things won't work. **As you know, a standard rule for college mathematics is to spend about two hours outside of class for each hour in class.**
- Read the sections at least briefly before lecture, so the lecture will be more understandable.
- Attend the lecture, and pay attention. Failure to attend class is a very common cause of low course grades.
- Read the sections in detail after lecture and go back over your notes.
- Do all of the recommended homework and more if you need to.
- Study for exams, starting a week in advance. Follow the suggestions I'll post on my web page.
- Asking questions is one of the smartest things you can do! Coming to office hours for further discussion is also invaluable; I can't emphasize that enough. If you have a conflict, schedule an appointment for another time. One-on-one interactions with the professor are very valuable learning tools for you (AND a good way for us to get to know each other better AND important in getting your money's worth out of your education).
- Keep up to date. Come and see me right away if you have any difficulties or fall behind in the course.

I hope you find further exploration of calculus—as I do—both interesting and useful!

TENTATIVE SCHEDULE

Week	Date	Section	Title
1	14 Jan	13.1 13.2 13.3 13.4	Three-dimensional coordinate system Vectors The dot product The cross product
2	21 Jan	M. L. King Day 13.4 13.5	No class on Monday The cross product Equations of lines and planes
3	28 Jan	13.6 13.7	Cylinders and quadric surfaces Cylindrical and spherical coordinates
4	4 Feb	14.1 14.2 14.3	Vector functions and space curves Derivatives and integrals of vector functions Arclength and curvature
5	11 Feb	14.3 14.4 EXAM 1	Arclength and curvature Motion in space: Velocity and acceleration Friday, 15 Feb
6	18 Feb	President's Day 15.1 15.2	No class on Tuesday Functions of several variables Limits and continuity
7	25 Feb	15.3 15.4 15.5	Partial derivatives Tangent planes and linear approximation The chain rule
8	3 Mar	15.6 15.7	Directional derivatives and the gradient vector Maximum and minimum values
9	10 Mar	15.8 EXAM 2	Lagrange multipliers Friday, 14 Mar
	17 Mar	Spring break	No classes this week
10	24 Mar	16.1 16.2 16.3	Double integrals over rectangles Iterated integrals Double integrals over general regions
11	31 Mar	16.4 16.5 16.6	Double integrals in polar coordinates Applications of double integrals Surface area
12	7 Apr	16.7 16.8	Triple integrals Triple integrals in cylindrical and spherical coordinates
13	14 Apr	17.1 17.2 EXAM 3	Vector fields Line integrals Friday, 18 Apr
14	21 Apr	17.2 17.3 17.4	Line integrals The Fundamental Theorem for Line Integrals Green's Theorem
15	28 Apr	17.5 17.7	Curl and divergence Surface integrals
16	5 May	FINAL EXAM	8:00 – 9:50 a.m.

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TENTATIVE HOMEWORK

- Your Day-1 homework is to read §13.1–§13.3 for tomorrow. Start working on problems for those sections.
- The problems from the list below for §13.1 and §13.2 are due on Friday.

Section	Problems
13.1	1, 3, 6, 10, 11, 15, 18, 19, 20, 25, 28, 30, 33, 34, 35, 38, 40, 41
13.2	2, 5, 11, 15, 19, 22, 25, 26, 27, 29, 31, 37, 39, 40
13.3	1, 5, 8, 9, 12, 13, 14, 18, 19, 23a, 23c, 24c, 26, 31, 34, 40, 41, 45, 49, 52, 59
13.4	5, 8, 9, 10, 12, 14, 15, 18, 25, 29, 31, 33, 35, 39, 40, 45
13.5	1, (3), (5), (12), 16, 19, 22, (26), 27, 30, (31), 37, (39), (40), 41, (43), 45, 48, (51), (53), 57, 59, 63, 65, 69, 71
13.6	3, 4, 5, 7, 9, 11, 14, 15, 17, 20, 21–27, 28, 29, 32, 33, 36
13.7	3, 6, 7, 11, 15, 21, 26, 27, 30, 31–33, 36, 37–39, 42, 45, (47), 49, 52, 57, 58, 61, 65
14.1	1, 6, 9, 11, 14, 15, 19–24, 25, 34, 35
14.2	3, 7, 12, 14, 18, 20, 23, 26, 34, 35, 36, 39, 45
14.3	4, 11, 12, 16, 19, 20, 23, 26, 29, 37, 39, 41, 45
14.4	4, 7, 11, 14, 15, 19, 20, 23, 25, 34
15.1	6, 9, 18, 26, 30, 31, 37, 40, 46, 53–58, 59
15.2	1, 7, 10, 11, 13, 15, 17, 20, 23, 27, 29, 31, 34, 35–37, 38, 39
15.3	1, 9, 14, 23, 27, 29, 30, 37, 43, 45, 48, 55, 58, 61, 67, 68e
15.4	4, 5, 6, 11, 16, 17
15.5	3, 5, 6, 9, 11, 12, 13, 14, 15, 17, 21, 26, 29, 30, 39, 46
15.6	1, 3, 4, 6, 7, 10, 13, 17, 19, 21, 22, 24, 32, 36, 39, 43, 47, 52, 59
15.7	1, 3, 7, 8, 13, 16, 28, 32, 33, 37–39, 40, 45
15.8	3, 4, 10, 18, 38, 39
16.1	2, 3, 4, 9, 11, 12, 14, 17
16.2	5, 7, 9, 14, 15, 18, 19, 27, 29, 33, 34
16.3	3, 5, 8, 11, 13, 15, 18, 19, 21, 23, 24, 25, 27, 37, 41, 43, 47, 49, 52, 54
16.4	1, 3, 5, 10, 15, 16, 17, 18, 25, 28, 29, 30, 31, 35
16.5	3, 7, 9, 11, 12, 15, 17, 21, 22
16.6	1, 3, 4, 6, 11, 12
16.7	2, 5, 7, 10, 13, 16, 17, 18, 25, 27, 28, 31, 35–36 (mass), 39 (mass), 47
16.8	1, 2, 5, 7, 12, 13a, 15 (mass), 17, 19, 20, 23, 30, 32, 33, 35
17.1	1–9 odd, 11–14, 15–18, 21
17.2	1, 2, 3–7, 8, 11, 16, 17, 19, 21, 22, 37, 39
17.3	3, 6, 7, 10, 13, 14, 15, 18, 21, 22
17.4	1, 4, 7, 10, 13, 14
17.5	1, 3, 5, 7, 12, 13, 17
17.7	5, 6, 9, 10, 14, 35, 36