

0 Calculus A Introductory Material

Spring, 2001

Tim McLarnan

0.1 Syllabus

Instructor: Tim McLarnan. When I'm at school, I live in D202G, x-1351. Feel free to call me at home at 966-0520 before 9 PM. e-mail to timm normally reaches me quickly.

Office Hours: I teach at 8 and 11 MWF, 2:30-4:30 W, and 1-2:30 TF. Otherwise, I'm usually in my office. If I'm there, I'm available to talk mathematics. If you want to make sure I'm available, it's always prudent to make an appointment after class or by phone or e-mail. Do come see me, though, in any case. One of the great virtues of Earlham is the opportunity for personal contact between students and faculty.

Text: Calculus with Analytic Geometry, 6 ed. by Larson, Hostetler and Edwards.

Class Schedule: We meet MWF at 8 in D214. There is also one meeting a week on Wednesday at 2:30 in D224, for a 2 hour "lab session." People who need to leave early (before 4:30) can finish the work at their leisure after class. It is worth being explicit that even though the Registrar marks this meeting as a lab, Calc A does not carry lab science gen ed credit.

Grading: There will be roughly weekly homework assignments, plus the weekly lab exercises, which together count 25% of the course grade. Three take-home tests on roughly January 26, February 26, and April 1 will together count 45%. The take-home final will count 30%.

A Tentative Course Plan: Any detailed schedule one makes up before a class start is to greater or lesser degree a fantasy. The fact that I haven't used the current text before adds to the level of uncertainty. An approximate course outline might be something like this, though:

- 1/10 Intro. to Calculus. Lab: Intro. to Maple; plotting functions.
- 1/12 Intro to Calculus II.
- 1/15 Plotting and trigonometry.
- 1/17 Trigonometry. Lab on trigonometry.
- 1/19 Section 1.1.
- 1/22 Section 1.2.
- 1/24 Section 1.3. Lab on limits.
- 1/26 Section 1.4.
- 1/29 Section 1.5.
- 1/31 Section 2.1. Lab on derivatives.
- 2/02 Section 2.2. A nice alignment.
- 2/05 Section 2.2.
- 2/07 Section 2.2. Lab on Power, Product, Quotient Rules.
- 2/09 Section 2.3.
- 2/12 Section 2.3.

2/14	Section 2.4. Lab on Chain Rule.
2/16	Sections 2.4, 2.5.
2/19	Section 2.6.
2/21	Section 3.1. Lab on extrema.
2/26	Section 3.2.
2/28	Section 3.3. Lab on slope, concavity, curve sketching.
3/02	Section 3.4.
3/05	Section 3.5. Another nice alignment.
3/07	Sections 3.6, 3.7. Lab on Newton's Method.
3/09	Section 3.7.
3/12	Section 3.7.
3/14	Section 4.1. Lab on Riemann sums.
3/16	Section 4.2.
3/26	Section 4.3.
3/28	Section 4.3, 4.4. Lab on area functions.
3/30	Section 4.4.
4/02	Review.
4/04	Section 4.5. Lab on Simpson's Rule.
4/06	Section 4.6. The last nice alignment.
4/09	Section 5.1.
4/11	Section 5.2. Lab on exponential functions.
4/13	Section 5.3.
4/16	Section 5.4.
4/18	Section 5.5. Lab on integration techniques, integration by parts.
4/20	Section 5.6.
4/23	Section 7.1.
4/25	Section 7.2. Lab time to work on final.

This schedule is very approximate.

Closing Comments: This document is only a dry recounting of mechanics. A real course consists of real people with intellectual and emotional lives. Let me try to roll together a few thoughts about this class, and about mathematics in general.

Calculus is one of the central mathematical discoveries of the human race. Large portions of the subject matter of this course have been discovered independently in England and France and Germany, in Greece, in India, in Japan, and probably in other places as well. Particularly in Europe, it has lain behind much of the mathematical, scientific, and technological development of the past 400 years, but it's a part of the common intellectual heritage of the human race. I hope people can approach it as an intellectual adventure, as a meditation on the quantitative foundations of modern society, as an inquiry into how humans think and reason. Calculus is a tool useful in many facets of many disciplines, but it is more than that. One can learn an enormous amount by getting involved in the questions asked in calculus, in attempting to answer them oneself, in analyzing how Newton or Euler or Bernoulli or Mahdava succeeded in answer-

ing questions one fails to answer. We're studying the deep structure of human thought and of the universe here, not memorizing algorithms. Get involved.

A big part of involvement is doing the homework in an engaged way. Think hard. Work with others. Ask questions. 98% of the learning in a math class happens when you are actually doing mathematics yourself, not watching someone else do it. Many students think they are bad at math because their teachers make it look easy, and then they find it much tougher than they expected to do problems on their own. This isn't a symptom of being bad at math, though—it's a symptom of being a human. It's not a statement about you; it's a statement about how humans learn math. Math looks easy when someone else is doing it; when you try it yourself, it looks confusing and impossible. That's how life is for everyone, but in that confusion is where learning and understanding are born. So take the homework seriously, and don't panic if you find it hard. Working with hard problems is how you learn.

As you write solutions to problems, remember that you are presenting an argument to a human being. Write to be read. Use sentences. Ask yourself, "Does my homework look like the sort of paper I could turn in to an English prof? Is it written in a style like that of the mathematical prose I see in the text or in other mathematical books, or from the professor? Is my thinking clear? Can a reader of good will read my handwriting and discern where the next word in each sentence is?" Try to make sure the answers are mostly, "Yes." If not, then you are not mastering a skill whose use is ultimately to communicate.

Communicate with me and with others in the class, too. I'm always willing to listen to your thoughts on the subject or on the class, and to share my own, as we work together to build a community of shared inquiry.

0.2 Thoughts on Academic Integrity

A central principle of Earlham College is that we treat one another as adults and as equals. We don't play games with one another. In particular, we don't assume students are going to cheat unless we take elaborate precautions to catch them. You are free moral agents, responsible to yourselves, and not to me, for your actions. It is hugely important to me that we continue to function in this manner.

Let me, however, encourage you to walk with integrity by stressing the importance and the seriousness of the responsibility I lay upon you to do your own work. All through your schooling, teachers have been telling you that in cheating, you cheat yourself. I hate to repeat this cliché, but it is worth noting that it is truer here than ever before. This course is costing you as much money as you could earn working the whole semester at \$5/hour. Don't elect to spend that kind of cash and not to learn anything.

There are deeper reasons for acting with integrity, though. The scholarly community, whose members have nothing to sell except ideas, depends for its existence on honest attribution of insights to their authors. Imagine a world in which this honesty had died, in which new ideas could not be published, in which discoveries had to be hidden in secrecy for fear of theft, in which openness

and community no longer existed. To cheat in a class is to cast a vote for this sort of society.

The Earlham community, also, benefits profoundly from the trust we are able to place in one another. Imagine what this course would be like if we had to have in-class exams with a professor patrolling the aisles hoping to nab miscreants. We would not be able to evaluate people's mathematical skills under normal conditions, and we would lose the precious ability to function as friends on the same side of the learning experience. To cheat in a class is to cast a vote for this sort of College.

The network of trust that makes possible the existence of scholarship, and of the College, gives us great strength, but it is a delicate organism which grows from a myriad of individual acts of trustworthiness by all of us at every time and in every place. No one manages to act with perfect integrity in every situation. Many of us, myself included, struggle daily with temptations of many sorts. I must tell you from my own experience and from that of those around me, though, how easily small deceptions lead to patterns of deceit and separation, poisoning communities, and relationships, and souls. As a friend and a fellow human being, I say to you, be careful how you walk.

Do not think that I write this out of the expectation that people will cheat if I don't lay down the law. On the contrary, I write it because at Earlham, I can assume the opposite. I write to celebrate life in a community in which I can assume that each of us, acting under the dictates of conscience, will seek and find the strength to live with integrity. We should all feel good about the decisions we have made to live with principle, and we should all help those who struggle with the temptations that afflict us all.

Should you find these arguments unpersuasive, let me out of fairness offer a last observation. I believe profoundly in allowing people to grow by acting as moral free agents. This does not, however, mean that I will fail to defend the values of the academic community if I detect that they have been violated. In recent years, I have had to confront about 10% of my students for violations of academic integrity. Last year, for instance, I sadly identified 8 students who had cheated on assignments in my classes. All these students failed the assignments in question and were reported to the Dean; 6 of them failed the class as well; 1 was nearly suspended; another was suspended and nearly expelled. Should you be contemplating cheating in this class, do read the Student Handbook about procedures and penalties resulting from lack of respect for our community. Notice, also, that the recommended penalties are described there as minimum penalties, and be advised that I will treat them as such.

To all of you, I offer my apologies for feeling a need to speak so bluntly. Do, please, believe that my forthrightness grows not from suspicion but from my commitment to maintaining Earlham as a community in which I can joyously regard you all as above suspicion.