



THE BASICS

Instructor: George Melvin

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Office: Davis Science Center 212

Office hours: M 2.30-4pm, Tu 7-9pm, or by appointment.

Alternatively, you are welcome to chat with me when my office door is open and I am available.

Teaching Assistants: Qingyang Mu (qmu20@colby.edu), Christopher Toborg (ctobo21@colby.edu)

TA Office Hours: Su, M, Tu 7-9pm, Mudd 405.

Course website: <http://personal.colby.edu/~gwmelvin>

Announcements and handouts can be found at the course website. Please check frequently.

Moodle & Piazza: This course has a Moodle site accessible at <http://moodle.colby.edu>. Please ensure you contact me for access to the piazza.com forum for this class.

Important dates:

9/14: Last day to add course

10/9: Examination I

10/19: Last day to drop course

11/13: Examination II

12/15: Final

THE COURSE

Course description: This course has two distinct parts. In the first part we will consider exact and approximate representations of real numbers and real-valued functions via infinite series: this will entail a careful consideration of certain infinite processes and how to make sense of these processes rigorously. The second part is an introduction to the calculus of functions of several variables: we will extend the theory of differentiation and integration to functions whose graphs live in space and beyond.

Mathematical topics: Definition and properties of sequences, (non-)convergence, limits and convergence tests; definition and properties of series, limits, (non-)convergence tests, absolute and conditional convergence. Power series and radius of convergence, representation of functions by power series and their basic properties; Taylor series. Geometry of vectors in the plane and space: vectors, dot/cross products, lines and planes. Functions of several variables: limits, partial derivatives, linear approximations, directional derivatives; the gradient; extrema and optimisation, method of Lagrange multipliers; chain rule. Multiple integrals: definition and properties of double/triple integrals; iterated integrals, regions of integration. Coordinate transformations in multivariable calculus: polar, cylindrical, spherical coordinates.

Prerequisites: Math 122 builds on the material covered in Math 121. If you have taken *AP Calculus AB*, or a course introducing differentiation, optimisation problems, and integration of functions of a single variable then you will be suitably prepared. If you are concerned about your preparation for this course then arrange to meet with me as soon as possible.

Required Course Textbook: *Multivariable Calculus from Graphical, Numerical, and Symbolic Points of View* by Ostebee, Zorn (Freeman Custom Publishing, 2nd Edition).

THE SKINNY

Grading: Your overall grade is given by the following prescription:

Minimum of Exam I and II	15%
Maximum of Exam I and II	20%
Final	20%
Weekly homework assignments	15%
Quizzes	10%
Writing assignments	10%
Communication assignments	10%

Assignment of Grades: The assignment of grades will be (roughly) as follows: let x be your final (weighted) score out of 100.

$x \geq 90$	A
$80 \leq x < 90$	B
$65 \leq x < 80$	C
$50 \leq x < 65$	D
$x < 50$	F

Scores that are near a boundary will be assigned an appropriate decoration \pm . The appendage of a decoration (\pm) will be assigned at my discretion.

Examinations: Examinations I & II will be cumulative, though they might have a stronger focus on the material presented more recently in class. The Final will be cumulative and will cover material from throughout the semester. Examinations will take place at the following space/time locations:

What?	When?	Where?
Examination I	Tuesday, October 9th, 7-9pm	Keyes 105
Examination II	Tuesday, November 13th, 7-9pm	Keyes 105
Final	Saturday, December 15th, 1.30-4.30pm	TBA

Examination policy: You must take each Examination at the prescribed location/time. Known scheduling conflicts must be announced to me as soon as possible and additional arrangements will be made on a case-by-case basis. Failure to attend an Examination without excuse results in a failure for the Examination; there will be no make-up Examinations. Exceptions to this policy will only be granted in compelling circumstances.

Homework: The goal of homework in this course is to provide you with an opportunity to practice the skills, ideas and examples presented in class. It is crucial that you take homework very seriously. If you require further practice problems then ask me for additional resources.

Homework will be due for submission in class by 10.10am every Wednesday, beginning September 12th.

Late homework will not be accepted and exceptions to this policy will only be granted in exceptional and compelling circumstances. You are **strongly** encouraged to work with your peers on homework. You are warmly encouraged to discuss problems with me and/or Math 122 teaching assistants.

Suggested collaboration policy:

- You are strongly encouraged to collaborate with your peers. However, you should write up solutions *on your own* and *in your own words*.
- Any collaboration undertaken to obtain a solution on submitted work must be explicitly acknowledged; such acknowledgements will not be penalised. For example, write ‘*I worked with E. Noether, Archimedes, C. F. Gauss*’ on your submission.
- You are strongly encouraged to be an active participant in the `plazza.com` forum for this class.
- Other online forums (eg `math.stackexchange.com`) must not be utilised to complete or check your solutions to submitted work. Consulting Solutions Manuals is **verboten**. Violation of this policy is considered *cheating* in this class and will result in College Academic Violations being issued.

Homework policy: Homework assignments will generally comprise of two distinct parts. The first part will generally consist of computational textbook problems you should do (and I'll expect you to do) but are not to be submitted. The second part will be more conceptual in nature. You are expected to solve, write up and submit all of the problems in the second part of the homework. There is an essential difference between writing up a problem and simply writing down the answer. I expect your solution to each problem to be written out correctly and your work should follow a coherent logical structure. **Write in complete English sentences** whenever possible. Do not submit solutions containing incoherent and/or unstructured calculations.

- All write-ups are to be submitted in hard copy.
- Your write-ups should be single-sided with no more than one problem per page, i.e., if a homework assignment has 5 problems, you should turn in at least 5 pieces of paper.
- Each paper you turn in should have your name, your statement of collaboration and the due date printed clearly at the top.
- Your write-ups should be stapled. It is your responsibility to make sure that your homework is complete and all pages are accounted for.
- If you used technology in the solution of the problem, please provide the complete printout showing all code, inputs and outputs in sequence, and annotate the printout with comments explaining what is being done in each step.

Quizzes: There will be a quiz administered at the beginning of class on each Friday during the semester, beginning Friday, September 14th. The quizzes will be limited to one or two problems each and they will parallel, in content and style, the problems seen in the homework. **There are no make-up quizzes.** I will, however, drop your lowest quiz score on the condition that you attend one Mathematics & Statistics Department Colloquium. **Calculators are not allowed in quizzes.**

Writing assignments: There will be four mathematical writing assignments assigned throughout the semester. For these assignments, you will practice mathematical writing while attacking longer and more challenging problems - think of them as mathematical essays. Solutions to the writing assignment problems are expected to be correct, well-written, and presented in good mathematical prose. Your grade will depend on the correctness of your solutions and the quality of your writing. This means that your writing should follow a coherent logical structure which makes use of complete sentences and follows standard rules of grammar. These are different than homework problems in the following ways: You must work on them individually (with the exception of one group project); there are far fewer of them (4); for each assignment, you will be able to turn-in one draft for feedback and a chance to edit and revise before the assignment's official deadline. Finally, more is required for a perfect grade beyond merely a correct answer.

After the beginning of the semester, you will be given a specific write-up concerning these writing assignments, including grading policies and a thorough description of expectations.

Communication assignments: There will be several opportunities for you to think more about the history and culture of mathematics in society. You will be asked to communicate your thoughts and interpretations of aspects of mathematics from beyond the classroom. This will include: writing short responses to general statements about mathematics; summarising the historical development of ideas and/or techniques you have seen in the course and their applications; formulating and communicating your opinions on the role of mathematics in aspects of society. These writing assignments will not be focused on problem-solving (in contrast to the mathematical writing assignments described above).

After the beginning of the semester, you will be given a specific write-up concerning these communication assignments, including grading policies and a thorough description of expectations.

Attendance: Timely attendance of lectures is mandatory. If you expect regular class attendance to be a problem then let me know immediately and we can discuss your situation. In particular, this applies to athletics-explained absences. Persistent lateness/absence (i.e. ≥ 3 classes) will result in grade penalties, academic warnings and eventual dismissal from the class. Changes to the attendance policy will only be granted in exceptional and compelling circumstances.

Learning diary: Please purchase a small (2"×3") notebook to be used for your learning diary.

THE IMPORTANT STUFF

Classroom etiquette: You are expected to be seated at your desk and ready to engage by the beginning of the class. You are expected to be courteous to your classmates and to help foster an inclusive, safe learning environment. Do not talk over each other; do not disregard someone's viewpoint; avoid the use of phrases like *'that's easy'*. Our learning environment will not be competitive. These remarks also apply to the `piazza.com` forum.

Mobile devices must be kept silent and non-vibrating throughout the duration of class. Use of your mobile device in-class is not permitted *unless otherwise specified*; if you are expecting a call then let me know. If you wish to use a laptop to take notes and/or document the class then let me know and we can discuss. You must only use your computer as a note-taking device *unless otherwise specified*. Laptops should be silent throughout the class. Repeated violation of this policy will reflect negatively on your final score.

Learning etiquette: Be honest in your approach to learning. Ask questions: whenever you struggle with a topic, if an explanation is unclear, if notation is not defined; you will not be the only one with that question. Direct questions: to yourself, to your classmates, to me.

Ask questions even if you think they are stupid.

One of the most difficult tasks to undertake when learning is asking a *useful* question. You can help yourself by adopting the following 3RA strategy when asking questions:

- REFLECT: Ask yourself the question: does the question answer itself?
- WRITE: Write down your question down as a coherent sentence: does this help you see your way to a solution?
- REFORMULATE: Having constructed a coherent formulation of your question: can you ask a more pointed question?
- ASK: Ask your question!

Get to know your classmates and form study groups: discuss the material, work through problems, ask questions, help each other. If you understand something then challenge yourself by trying to explain your understanding to your peers. If someone struggles with your explanation then reformulate your argument: use examples, visual aids, simple analogies. The onus lies more greatly on the teacher to provide an adequate explanation than it does on the student to comprehend that explanation. If you are seeking explanation then *formulate your question as a coherent sentence*.

"What I cannot create, I do not understand"

Richard Feynman, 1918-1988

Renowned physicist, educator and Nobel Laureate.

Anti-discrimination commitment: I am firmly committed to diversity and equality in all areas of campus life. In this class we will promote an anti-discriminatory environment where everyone feels safe and welcome. I recognize that discrimination can be direct or indirect and take place at both institutional and personal levels. I believe that such discrimination is unacceptable and I am committed to providing equality of opportunity for all by eliminating any and all discrimination, harassment, bullying, or victimization. The success of this policy relies on the support and understanding of everyone in this class. We all have a responsibility not to be offensive to each other, or to participate in, or condone harassment or discrimination of any kind.

Accommodations: Students in this class who have Letters of Accommodation from the Dean of Studies Office are encouraged to contact me as early in the semester as possible to ensure that such accommodations are implemented in a timely fashion. For those without Letters of Accommodation *please meet with me within two weeks of the start of the semester* so that we can work together to make arrangements for you. Kate McLaughlin, Associate Director of Access and Disability Services (kmclaugh@colby.edu) is the primary contact for accommodations and questions related to educational testing and documentation.

Academic Integrity: Honesty, integrity, and personal responsibility are cornerstones of a Colby education and provide the foundation for scholarly inquiry, intellectual discourse, and an open and welcoming campus community. These values are articulated in the Colby Affirmation and are central to this course. You are expected to demonstrate academic honesty in all aspects of this course. If you are clear about course expectations, give credit to those whose work you rely on, and submit your best work, you are highly unlikely to commit an act of academic dishonesty.

Academic dishonesty includes, but is not limited to: violating clearly stated rules for taking an exam or completing homework; plagiarism (including material from sources without a citation and quotation marks around any borrowed words); claiming another's work or a modification of another's work as one's own; buying or attempting to buy papers or projects for a course; fabricating information or citations; knowingly assisting others in acts of academic dishonesty; misrepresentations to faculty within the context of a course; and submitting the same work, including an essay that you wrote, in more than one course without the permission of the instructors.

Academic dishonesty is a serious offense against the College. Sanctions for academic dishonesty are assigned by an academic review board and may include failure on the assignment, failure in the course, or suspension or expulsion from the College.

For more on recognizing and avoiding plagiarism, see the library guide:

<http://libguides.colby.edu/avoidingplagiarism>

THE COLBY AFFIRMATION

Colby College is a community dedicated to learning and committed to the growth and well-being of all its members.

As a community devoted to intellectual growth, we value academic integrity. We agree to take ownership of our academic work, to submit only work that is our own, to fully acknowledge the research and ideas of others in our work, and to abide by the instructions and regulations governing academic work established by the faculty.

As a community built on respect for ourselves, each other, and our physical environment, we recognize the diversity of people that have gathered here and that genuine inclusivity requires active, honest, and compassionate engagement with one another. We agree to respect each other, to honor community expectations, and to comply with college policies.

As a member of this community, I pledge to hold myself and others accountable to these values.

Finally, a parting thought: Please remember that MATHEMATICS IS DIFFICULT! We will strive towards a high level of rigor and it can be a struggle to wade through the mathematical marsh of complex concepts, technical tricks, and difficult definitions. However, if you are dedicated to your work, exercise your problem-solving abilities frequently, and talk about mathematics with your peers then I guarantee that you will be able to achieve your goals for this course.