Math 122 Fall 2020

Series and Multivariable Calculus

Section D: MTWF 11:00-11:50AM Mudd 405
Section E2:MTWF 12:00-12:50PM Mudd 405

Professor:	Evan Randles
Email:	evan.randles@colby.edu
Office:	Davis Science Center 209
Drop-In Office Hours:	Monday 4:00-5:00PM & Tuesday 7:00-8:00PM:
	(Zoom link available on the course Moodle page)
Individual Office Hours:	Many individual time slots:
	`https://calendly.com/erandles/ioh`
Teaching Assistants:	Ryan Curry rtcurr22@colby.edu
	Anna Piermattei afpier21@colby.edu
	Curtis Haas chaas22@colby.edu
	Jordyn Kim jkim22@colby.edu

(TA office hours are posted on Moodle)

It is impossible to be a mathematician without being a poet in soul. − Sofia Kovalevskaya

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Course Description: This second-semester course in calculus focuses on two major topics, both connected under the umbrella of approximation. The first topic, infinite series, explores an essential and powerful method to approximate functions (of one variable) by polynomials. Through this study, we are led to the concept of power series, that is, functions defined by infinite sums of monomials. There we will confront some delicate questions surrounding what it means to consider infinite sums of functions (and numbers) and study conditions under which these infinite sums make sense; this is the notion of convergence. The second major topic is multivariable calculus, which is an entire subject in its own right. In this study, we will explore familiar notions of limits, continuity, derivatives and integrals for functions of several variables. Together we will study the essential ideas behind this subject and its major theorems while taking a glimpse into the subject's myriad applications.

Course Objectives:

- Understand what it means for a sequence to converge and be able to calculate limits of common sequences

- Understand what it means for a series to converge (as the limit of partial sums) and be able to determine whether or not certain series converge using several convergence tests, and be able to calculate the sum of certain convergent series

- Be able to approximate common functions by their Taylor polynomials and determine the accuracy of approximation (via the remainder), compute the Taylor series for common functions and determine their intervals of convergence

- Understand and perform basic operations on vectors, including the dot product (for vectors in $\mathbb{R}^n$) and cross product (for vectors in $\mathbb{R}^3$)

- Understand the utility of basic vector operations for doing geometry in $\mathbb{R}^n$, e.g., the computations of angles, areas of parallelograms, volumes of parallelepipeds and equations of planes

- Be able to sketch and interpret graphs and contour diagrams of functions mapping from $\mathbb{R}^2$ to $\mathbb{R}$

- Understand (and be able to define) what it means for a function of several variables to be continuous and differentiable

- Understand and calculate partial derivatives, directional derivatives and gradients of functions of several variables, and use the chain rule

- Use the tools of multivariable calculus to solve optimization problems (derivative tests and Lagrange multipliers)

- Understand and be able to calculate double and triple integrals using Riemann sums, iterated integrals and change of variables.

Textbook: Calculus by Taalman and Kohn (combined Single & Multivariable)

Course Structure
The material for this course is divided into four units:

1. Sequences and Series (Chapters 7 & 8)

2. Intro to Vectors and Multivariable Functions (Chapters 10 & 12.1)

3. Derivatives of Multivariable Functions (Chapter 12.2-12.7)

4. Integrals of Multivariate functions (Chapter 13)

Grading: Your grade will be calculated as follows:

Reading (preview) questions and participation*	20%
Homework assignments:	20%
Unit projects:	20%
Midterm Exam:	20%
Final Exam:	20%

* "Participation" means attending and participating in the in-class group activities when possible, or at-home completion of these activities when not possible due to quarantine.

Weekly Format Each week is divided into two blocks (so, week 2 will have block 2.1 and 2.2). In a single block, you will do the following:

- submit homework from the previous block

- read sections from the book

- watch two videos

- answer "preview" questions

- Attend one in-class group session

- Start work on the block's homework set

The progress of (for example) Week 2 will look as follows:

Day	**Mon**	**Tue**	**Wed**	**Fri**
In class:	Group A	Group B	Group A	Group B
Due:	Reading 2.1	HW 1.2 due	Reading 2.2	HW 2.1 due
Assigned:	Reading 2.2	HW 2.1	Reading 2.3	HW 2.2

Preview Questions: For each block, you will have a reading assignment. Based on your reading, you will take a "preview" reading quiz on Moodle. You should not think of these as quizzes, but rather as reading "checks" and they will also give you an opportunity to ask questions. These will be graded *on completion*. The preview quizzes must be completed before the block begins.

Videos Lectures: Video lectures take the place of one of your in-class days each block. There will be around 2 videos per block, usually around 10-15 minutes. We use the videos to talk through examples and clarify material in the book.

Exams: This course will have a midterm exam and a final exam. The final exam will be cumulative. To do well on exams, you will need to understand the material at a conceptual level. Though you will need to be able to calculate quickly and accurately, the exams will test your understanding of the material at a level which goes well beyond simple computation. The exams will be at the following dates and times:

Exam	Date and Times	Location
Midterm 1	**October 8, 7pm-9pm**	TBA
Final Exam	**December 4, 9am-Noon**	Remote

It is crucial that you reserve these time slots for these exams. If you have a conflicting course, please talk to me as soon as possible.

Attendance and Class Participation: To learn mathematics, it is essential to communicate it and to discuss it with others. As much of your work this semester will take place outside of class (watching videos, reading, doing homework) it is vital that we use every bit of group work time to your advantage. Your attendance to the in-class (or remote group-work) portions of this course is therefore very important, and required when possible. I understand that this semester is highly unusual and you may at any point be required to quarantine; please keep me informed of your status in this regard. If you are quarantining, but in good health, you should still complete the activities; of course, excuses will be granted for critical emergencies (normally verified by the Dean of Students) and illness (normally verified by the College Health Center). Absences for official Colby activities require prior approval and absences for religious reasons will be considered excused if the policy in the college catalogue is followed.

Problems worthy of attack
prove their worth by hitting back. – Piet Hein

Homework: Homework is the most important part of this course. It is where you will grapple with new ideas, come up with creative solutions and communicate your thoughts and understanding to others (your peers, your TA and me). Consequently, it is crucial that you take homework very seriously. You should start homework early, work diligently and talk to your peers and the teaching assistants. If you are having substantial difficulty with a particular problem, please email me or come talk to me during office hours. I am here to help! You are permitted and encouraged to discuss homework with your classmates and to consult other textbooks, however, I discourage you from searching for solutions on the internet – such behavior will only hinder your learning experience. What you turn in must be your own work.

Homework Structure and Schedule: Homework is due twice a week, on Tuesdays and Fridays. The homework assignments will generally be broken into two distinct parts. The first part of the homework will consist of problems you should do, but you needn't turn in. This group of problems will generally be computational in nature and mostly consist of odd-numbered textbook problems. As these problems will not be graded, if you would like help with them or just want to make sure you're doing them correctly, you should (always) feel free to virtually attend office hours (mine or the TAs'). The second part of the homework will be more conceptual in nature. You are expected to solve and write up all of the problems in the second part of the homework. There is an essential difference between writing up a problem and just 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, making use of complete sentences whenever possible. Please do not submit solutions containing incoherent and unstructured calculations. You should be proud of the material you turn in!

It is crucial to keep up with the homework in this course. Therefore, short of the circumstances discussed in the attendance policy above, late homework will not be not accepted. To account for one legitimate illness/absence, your lowest homework score will be dropped.

Unit Assignments:
In addition to homework, there will be four unit assignments throughout the semester. For these assignments, you will practice mathematical communication (writing or making videos) while attacking longer and more challenging problems. As with the homework, your grade will depend on the correctness of your solutions and the quality of your presentation. For written assignments, you will be able to turn in one draft for feedback, and have a chance to edit and revise before the assignment's official deadline. For video projects, your group may request a meeting with me to check your video plan ahead of time. 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 my expectations for them.

Office Hours:
This semester, to maintain best practices of social distancing, office hours will be held exclusively online. For my office hours, I have set aside two "drop-in" time slots, Mondays 4:00-5:00PM & Tuesday 7:00-8:00PM, where you will be able to join an active Zoom call and ask questions with

your peers. These drop-in times are open to all and can be accessed through the course Moodle page. I have also set aside a large block of time for individual office hour appointments. These 15-minute individual appointments can be reserved at `https://calendly.com/erandles/ioh`. The individual appointments must be reserved and the reservations must be made at least 4 hours in advance and I ask that students not reserve more than one individual appointment per block. I strongly encourage all of you to regularly take advantage of both "drop-in" and "individual" office hours. The teaching assistants for the course will also hold weekly "drop-in" office hours. These will be held on Sunday, Monday, Tuesday and Thursday nights. Details for these office hours can be found on the course Moodle page.

Contacting Me: I love to talk about mathematics and, while I usually prefer to do it in-person, meeting virtually is a good approximation and is beneficial to the safety of the Colby community. Consequently, I strongly encourage you to take good advantage of the many office hour times I have, both "drop-in" and individual. If you cannot attend (at least some of) these virtual office hours, please let me know immediately. Though I strongly prefer meeting over Zoom, you can also start a Moodle discussion or email me directly about small logistical things and I will do my best to get back to you as soon as possible. At present, I am receiving around 50 emails per day and so I ask that you give me 24 hours to respond; if I do not respond in that window, it is likely that I have missed your email and you should feel free to send another one.

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 person's work or a modification of their 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.

Academic Accommodations: I am available to discuss academic accommodations that any student with a documented disability may require. Please note that you'll need to provide a letter from the Dean of Students Office documenting your approved accommodations. Please meet with me within two weeks of the start of the semester to make a request for accommodations so that we can work together with the College to make the appropriate arrangements for you. Kate McLaughlin, Associate Director of Access and Disability Services (kmclaugh@colby.edu) is the primary contact for accommodations and any questions related to educational testing and documentation.

Mental health: I care about my students' well-being and understand they may face mental health

challenges. Students are encouraged to seek support from the College's available resources, including your advising dean and Counseling Services. (For immediate care, please call 207-859-4490 and press "0" to reach the on-call counselor.) I am willing to discuss reasonable accommodations during a crisis, but to fulfill our educational mission, students are expected to adhere to the attendance policy. Failure to do so because of mental health challenges may require consultation with the Dean of Studies Office.

Athletic Participation: While Colby College is supportive of athletic participation by its students, academics takes priority over athletics. Both NCAA and Colby rules prohibit missing class for competitions; the student must meet with the professor as soon as possible to discuss these overlaps. The student may request permission to miss class and make up the missed work, but the instructor has final authority either to grant or to withhold permission. If you are on an athletic team, you should speak with me in person about any potential absences as soon as possible.