

Math 106 Syllabus, Summer 2023

Due Dates:

- Attendance will be taken and counts as 10% of your course grade.
- Three take-home open-book midterms will be due on 8/14, 8/21, and 8/28. These will be available on Fridays at 12 PM and due on the following Mondays at midnight at Gradescope. You are required to use LaTeX to write your solutions. You can embed hand-drawn pictures into the LaTeX document or draw pictures in separate sheets and combine them with the LaTeX document into a single PDF file.
- The final exam is a closed-book Zoom-proctored exam on 9/1, from 9 AM to 12:30 PM.
- Homework assignments are given after every lecture and are due in three days at Gradescope.

Course Information

This course will be a Zoom-based synchronous class with lecture time MWF from 9:00 AM to 11:30 AM (7/31/2022 - 9/1/2022). **Lecture attendance is required and will count as 10% of your course grade.** Attendance is taken sometime within the first hour of the class in the form of a keyword quiz. You will be instructed to go to Canvas Quiz to take it at the beginning of class time. You access Zoom lectures/office hours from the Canvas **Zoom** tab. We use the **Gradescope** (see below) for submitting scanned homework assignments and exams. We use Canvas **Ed Discussions** for Q&A on homework problems and other questions. In Math 106, we will study systems of nonlinear differential equations that exhibit many interesting, unexpected nonlinear phenomena (phase portrait, limit cycles, chaos, etc.). Knowledge from the basic theory of linear algebra (Math 21) and ordinary differential equations (Math 24) is assumed. Prerequisite(s): [MATH 21](#)[Links to an external site.](#) or [AM 10](#)[Links to an external site.](#); and either [MATH 24](#)[Links to an external site.](#) or [AM 20](#)[Links to an external site.](#); and either [MATH 100](#)[Links to an external site.](#) or [CSE 101](#)[Links to an external site.](#).

Learning Outcomes: By taking this course, you will learn the following.

1. You will understand the difference between linear and nonlinear systems of differential equations and understand their basic methods of approach.
2. You will be able to study the global qualitative properties of nonlinear systems of the first-order differential equations,
3. You will be able to model various biological, engineering, physical, and natural phenomena by differential equations and analyze their behavior.
4. You will understand chaos in deterministic systems.

Important Deadlines (Summer Session II, 2023):

- Add/Swap - Thursday, August 3
- Drop - Monday, August 7 (tuition reversed)
- Request "W" Grade - Sunday, August 20 (no tuition reversal)
- Change Grade Option - Sunday, August 27
- Grades Due - Thursday, September 7

Summer is unique. You will not be dropped for non-attendance or non-payment. You must drop yourself. Dropping before the deadline results in a full tuition reversal/refund.

Withdraw posts a W for the grade, and full tuition is charged (no refund). For all dates and deadlines, here is the summer academic

calendar: <https://summer.ucsc.edu/studentlife/index.html>. [Links to an external site.](#) For questions about dropping, requesting a W grade for a course, or withdrawing from the summer quarter, email summer@ucsc.edu.

UC Santa Cruz Orientation Module for Summer 2023: Useful official orientation information from UCSC for summer session students can be found in the **Modules** tab.

Gradescope: We will use [Gradescope \(Links to an external site.\)](#) to grade your assignments/exams. Get familiar with this tool at https://www.gradescope.com/get_started [\(Links to an external site.\)](#). Especially check the video titled [For students: Submit PDF homework \(Links to an external site.\)](#) to review how to upload your scanned image files and PDF files to Gradescope. To submit your assignments/exams to Gradescope, you either (1) scan your work into multiple image files and upload them or (2) make a **single** PDF file out of your scan and upload it. Gradescope cannot accept multiple PDF files for uploading at this time. If you do not have scanning technology, contact slug support:

<https://deanofstudents.ucsc.edu/slug-support/program/contact.html> [Links to an external site.](#)

Time Zone: If you live in a different time zone, here is an instruction to set your time zone. [How do I set a time zone in my user account as a student? \(Links to an external site.\)](#) Especially please be careful about the time and date for the final exam.

Instructor

Instructor and Zoom Office Hours

Professor Hirotaka Tamanoi (tamanoi@ucsc.edu)	Mondays, Wednesdays, and Fridays, 11:30 AM to 12:30 PM (within the Office-Hour Zoom window, after the lecture Zoom window closes.)
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For my Zoom office hours MWF from 11:30 AM to 12:30 PM, you will need UCSC email addresses to join, and Zoom office hours will not be recorded. After the lecture Zoom window closes, we will take a short break and start the office-hour Zoom window.

Zoom Lectures, Videos, Notes

Synchronous Zoom Lectures and Yuja: My course is hosted on [CanvasLinks to an external site.](#) You do not need to sign up for an account, and you log in with your CruzID and Gold Password at [canvas.ucsc.eduLinks to an external site.](#) See [Canvas Getting Started Student Guide \(Links to an external site.\)](#). See the Zoom item in the navigation menu on the left pane for schedule and information. Your UCSC email address will be required to participate in Zoom lectures and Zoom office hours.

Lecture dates: July 31 to September 1, Mondays, Wednesdays, and Fridays from 9 AM to 11:30 AM.

Lecture Videos: Zoom lectures will be recorded and is available in **Yuja** on the left navigation pane. In **Yuja**, look for "All Courses" in the "Shared" section. Math 106 channel should contain Zoom lecture recordings. These recordings come with the complete captioning of the video, which takes a few hours of processing. So lecture videos will be available late in the afternoon.

Lecture notes will be posted in the Lecture Notes folder in the **Modules** item on the left navigation pane right after the class.

Textbooks: We have one required textbook and several reference textbooks.

(1) (Required) **Nonlinear Dynamics and Chaos, With Applications to Physics, Biology, Chemistry, and Engineering**, 2nd edition, by Steven Strogatz: CRC Press. (This textbook has many very interesting applications in physics, biology, and engineering in the substantial exercise section at the end of each chapter. Some mathematical details and proofs are briefly explained or skipped to maintain the flow of the discussion. Whenever this is done, references are mentioned with details.)

(2) (Reference) ***Elementary Differential Equations and Boundary Value Problems***, Eleventh (11th) edition, by William E. Boyce and Richard C. DiPrima, Publisher: John Wiley & Sons. (This is a textbook for Math 24. You can find a lot of details on the basics of differential equations and systems.)

(3) (Reference) ***Differential Equations, Dynamical Systems, and an Introduction to Chaos***, by M.W. Hirsch, S. Smale, and R.L. Devaney. (This textbook is also used as the main textbook for Math 106. This book has many proofs and mathematical details which were skipped in Strogatz's book.)

(4) (Reference) **Dynamics: The Geometry of Behavior**, by Ralph Abrams and Christopher Shaw. (Many pictures of chaos.)

(5) (Reference) **Chaos: Making A New Science**, by James Gleick. (A popular science book.)

Lecture Schedule: We plan to cover materials in chapters 2 to 12. Please read Chapter 1 before the class as an introduction. Here is a tentative plan.

Week	Monday	Wednesday	Friday
Week 1	Chapter 2	Chapters 2,3	Chapter 3
Week 2	Chapter 5	Chapters 5,6	Chapter 6
Week 3	Chapter 6	Chapter 6	Chapter 7
Week 4	Chapter 7	Chapter 8	Chapter 8
Week 5	Chapter 9	Chapter 12	Final Exam

Resources: In the **Module** section, you can find a folder containing the following apps.

- [Phase Portraits](#)
- [Direction Fields](#)
- [WolframAlpha](#)
- [Desmos Graphing Calculator](#)
- [dfield and pplane](#)

Homework Assignments

Homework Problems (Gradescope): After each lecture, a homework assignment will be given and posted in the Assignments tab as well as on the Gradescope. Due dates will be three days later, at midnight at the Gradescope. You go to the Gradescope tab to upload your assignments. You are encouraged to use LaTeX to write your solutions, but it is not required. **However, if your solution is not clearly written, your homework will not be read, and will not receive credits.**

Collaboration: It is allowed to collaborate with other students to work on homework problems. However, you have to write your own solutions. Copying from other sources is not allowed, and the identical solutions will receive no credits (both students who copied and students who allowed).

No Late Homework: Since the summer session goes very fast, it is important to submit your homework assignments on time to keep up with the class. So no late homework assignments will be accepted unless you have a documented family/medical emergency. The following is a tentative list of problems.

Dropping Assignments: **Three of the lowest score assignments will be dropped** from the course grade calculation. You can use this if you cannot submit your assignments on time.

Canvas Discussions (Q&A): You can ask various questions at Canvas **Ed Discussions**, and your fellow students and sometimes I will answer your questions.

LaTeX

You will be preparing midterm solutions using LaTeX. In the Modules tab, you will see some LaTeX resources. Among them, I find the "Short Math Guide" most useful.

Take-Home Midterms

(Take-Home) Midterms with Gradescope: There will be weekly take-home midterms available at 12 noon on Fridays, and due at midnight on Mondays. You are required to write solutions in LaTeX and upload PDF file of your solution to Gradescope. These exams are meant to review and master materials covered in the previous week(s).

Instruction for the Take-home Midterm (using LaTeX) and Gradescope submission

1. The exam will be available at 12 PM on Fridays, 8/11, 8/18, and 8/25, and is due on Mondays, 8/14, 8/21, and 8/28, at midnight 11:59 PM at Gradescope. You can submit multiple times until the deadline.
2. You can go to the Gradescope website from the Assignments tab or the Gradescope tab on the left pane of the Canvas to access the exam. At Gradescope, click on "Edit Outline."
3. You must use LaTeX to write solutions and produce a PDF file for submission. You can embed hand-drawn pictures into the LaTeX document or draw pictures on separate sheets of paper and combine drawings and the LaTeX document into a single PDF file and then upload it to Gradescope.
4. You are allowed to review textbooks, class notes, lecture videos, etc., while working on the midterms. But you must work on these exams on your own. Cooperation with other students by email or through discussion websites is not allowed. Asking questions at homework websites such as Chegg is prohibited. Students who use Chegg and/or other homework sites to work on written assignments may fail the course. (These websites cooperate with us.) You cannot use other websites, such as WolframAlpha, to obtain answers.

Final Exam (Closed-Book, Zoom Proctored)

(NOTE: No make-up Final Exam)

Date: 9/1, 9 AM - 12:30 PM

The Final Exam will take place on Friday, 9/1, from 9 AM to 12:30 PM, including upload time. Note that you will have one hour more than the class time. This will be Zoom proctored. Before the exam, when you arrive, you will be placed in the Zoom waiting room and admitted to the Zoom exam "room" one by one after checking your photo ID. So please arrive with your photo ID 30 minutes earlier than the exam time. The final exam

problem sheet will be available at Gradescope at 9 AM once everybody has been checked in. Please have sufficiently many white papers ready to write your solutions. Write clearly in an organized way with explanations. Keep track of the order of your solution sheets. Before the end of the exam period, you must scan your solutions and upload them into your account in Gradescope. You should allow at least 20 minutes for uploading. You are allowed to use a tablet to write your solutions.

Late Submission: You can submit your final exam even after the deadline of 12:30 PM until 1 PM. However, every 10 minutes of late submission, your score will be reduced by 10%. After 1 PM, your submission will not be accepted.

This is a **closed-book exam**, and no notebooks, textbooks, collaborations with other students, help from websites, etc., are not allowed. You work on the final exam just like the usual in-class final exam. No electronic devices are allowed except for viewing the exam and writing solutions on your tablets.

No make-up Final Exam: **No make-up final exam for summer session courses will be given.** For midterms, make-up may be possible with prior arrangements. But not the final exam. If you miss it, you may fail the course.

Warning: *If your scanner has a high resolution, your solution files will be huge in size, and Gradescope may take a long time to upload. So use a moderate-resolution scanner. This has happened in every quarter in the past.*

Academic Integrity: To maintain academic integrity, you **MUST** supply sufficient explanations for each problem. If you simply write answers without sufficient explanation, I will regard them as copied from another source, and you may receive no credits. In serious cases, cheating investigations may be launched.

Course Grades

Here is a tentative scheme for the course grade.

Homework Assignments 30%	Attendance 10%	Take-Home Midterms 30%	Final Exam 30%
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At the end of the course, class averages for the above categories will be calculated, and raw scores will be rescaled so that the above percentage distribution is reflected. Then the total scores of individual students will be calculated, and the course grades will be determined.

Academic Resources

DRC Remote Accommodations: The Disability Resources Center reduces barriers to inclusion and full participation for students with disabilities by providing support to individually determine reasonable academic

accommodations. Operations continue via remote appointments. If you have questions or concerns about exam accommodations or any other disability-related matter, email the DRC Schedulers at drc@ucsc.edu for an appointment. You can also contact DRC by phone at 831-459-2089.

Academic Integrity: All members of the UCSC community benefit from an environment of trust, honesty, fairness, respect, and responsibility. You are expected to present your own work and acknowledge the work of others in order to preserve the integrity of scholarship. Academic integrity includes:

- Following exam rules
- Using only permitted materials during an exam
- Viewing exam materials only when permitted by your instructor
- Keeping what you know about an exam to yourself
- Incorporating proper citation of all sources of information
- Submitting your own original work

Academic misconduct includes, but is not limited to, the following:

- Disclosing exam content during or after you have taken an exam
- Accessing exam materials without permission
- Copying/purchasing any material from another student, or from another source, that is submitted for grading as your own
- Plagiarism, including use of Internet material without proper citation
- Using cell phones or other electronics to obtain outside information during an exam without explicit permission from the instructor
- Submitting your own work in one class that was completed for another class (self-plagiarism) without prior permission from the instructor.
- Violations of the Academic Integrity policy can result in dismissal from the university and a permanent notation on a student's transcript. For the full policy and disciplinary procedures on academic dishonesty, students and instructors should refer to the [Academic Misconduct page Links to an external site.](#) at the [Division of Undergraduate Education Links to an external site.](#)

Religious Accommodation: UC Santa Cruz welcomes diversity of religious beliefs and practices, recognizing the contributions differing experiences and viewpoints can bring to the community. There may be times when an academic requirement conflicts with religious observances and practices. If that happens, students may request reasonable accommodation for religious practices. The instructor will review the situation in an effort to provide a reasonable accommodation without penalty. You should first discuss the conflict and your requested accommodation with your instructor early in the term. You or your instructor may also seek assistance from the [Dean of Students' office Links to an external site.](#)

Principle of Community: The University of California, Santa Cruz expressly prohibits students from engaging in conduct constituting unlawful discrimination, harassment, or

bias... [More here Links to an external site.](#) I am committed to providing an atmosphere for learning that respects diversity and supports inclusivity. We need to work together to build this community of learning. I ask all members of this class to:

- be open to and interested in the views of others
- consider the possibility that your views may change over the course of the term
- be aware that this course asks you to reconsider some “common sense” notions you may hold
- honor the unique life experiences of your colleagues
- appreciate the opportunity that we have to learn from each other
- listen to each other’s opinions and communicate in a respectful manner
- keep confidential discussions that the community has of a personal (or professional) nature
- ground your comments in the texts we are studying. Refer frequently to the texts and make them the focus of your questions, comments, and arguments. This is the single most effective way to ensure respectful discussion and to create a space where we are all learning together.

Title IX/Care Advisory: The [Title IX Office Links to an external site.](#) is committed to fostering a campus climate in which members of our community are protected from all forms of sex discrimination, including sexual harassment, sexual violence, and gender-based harassment and discrimination. Title IX is a neutral office committed to safety, fairness, trauma-informed practices, and due process. Title IX prohibits gender discrimination, including sexual harassment, domestic and dating violence, sexual assault, and stalking. If you have experienced sexual harassment or sexual violence, you can receive confidential support and advocacy at the Campus Advocacy Resources & Education (CARE) Office by calling (831) 502-2273. In addition, Counseling & Psychological Services (CAPS) can provide confidential, counseling support, (831) 459-2628. You can also report gender discrimination directly to the University’s Title IX Office, (831) 459-2462. Reports to law enforcement can be made to UCPD, (831) 459-2231 ext. 1. For emergencies call 911.

Difficult Conversations: In our in-class and online discussions and dialogues, we will have the opportunity to explore challenging, high-stakes issues and increase our understanding of different perspectives. Our conversations may not always be easy. We sometimes will make mistakes in our speaking and our listening. Sometimes we will need patience or courage or imagination or any number of qualities in combination to engage our texts, our classmates, and our own ideas and experiences. We will always need respect for others. Thus, an important aim of our classroom interactions will be for us to increase our facility with difficult conversations that arise inside issues of social justice, politics, economics, morality, religion, and other issues where reasonable people often hold diverse perspectives. This effort will ultimately deepen our understanding and allow us to make the most of being in a community with people of many backgrounds, experiences, and positions.

Student Services: [Counseling and Psychological Services Links to an external site.](#) Many students at UCSC face personal challenges or have psychological needs that may interfere with their academic progress, social development, or emotional wellbeing. The university offers a variety of confidential services to help you through difficult times, including individual and group counseling, crisis intervention, consultations, online chats, and mental health screenings. These services are provided by staff who welcome all students and embrace a philosophy respectful of clients' cultural and religious backgrounds, and sensitive to differences in race, ability, gender identity, and sexual orientation.

Student Success and Engagement Hub [Links to an external site.](#) The Division of Student Success provides campus-wide coordination and leadership for student success programs and activities across departments, divisions, colleges, and administrative units.

Tutoring[Links to an external site.](#) and **Learning Support:** At Learning Support Services (LSS), undergraduate students build a strong foundation for success and cultivate a sense of belonging in our Community of Learners. LSS partners with faculty and staff to advance educational equity by designing inclusive learning environments in Modified Supplemental Instruction, Small Group Tutoring, and Writing Support. When students fully engage in our programs, they gain transformative experiences that empower them at the university and beyond.

Slug Support Program [Links to an external site.](#)[Links to an external site.](#) College can be a challenging time for students and during times of stress, it is not always easy to find the help you need. Slug Support can give help with everything from basic needs (housing, food, or financial insecurity) to getting the technology you need during remote instruction. To get started with SLUG Support, please contact the [Dean of Students](#)[Links to an external site.](#) Office at 831-459-4446 or you may send us an email at deanofstudents@ucsc.edu.

Slug Help/Technology[Links to an external site.](#) The ITS Support Center is your single point of contact for all issues, problems, or questions related to technology services and computing at UC Santa Cruz. To get technological help, simply email help@ucsc.edu.

On-Campus Emergency Contacts: Slug Help/[Emergency Services](#)[Links to an external site.](#) For all other help and support, including the health center and emergency services, start [here](#) [Links to an external site.](#) Always dial 9-1-1 in the case of an emergency.