MATH 2930: Differential Equations for Engineers

Spring 2025 Course Information and Syllabus

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Welcome to MATH 2930! Differential equations builds on concepts from calculus, modeling phenomena based on how they change. This document will provide you with essential details about the course and its operation, and serves as a quick reference throughout the semester.

Prerequisites

You should come into MATH 2930 with a background in multivariable calculus, such as MATH 1920. Consequently, you should be familiar with taking partial derivatives, and you should be comfortable with integration techniques such as those covered in MATH 1120 or 1910.

Note: Taking MATH 2930 and 2940 simultaneously is discouraged.

Course Goals

In addition to the factual knowledge you will obtain throughout MATH 2930, you will also:

- develop a conceptual understanding of the fundamental ideas and applications of differential equations,
- strengthen your critical thinking and problem-solving skills, and
- improve your ability to communicate mathematical ideas clearly, concisely, and correctly.

List of major topics

- first order equations (separable, linear, exact),
- mathematical modeling (e.g., population growth, terminal velocity),
- qualitative methods (slope fields, phase plots, equilibria and stability),
- numerical methods,
- second order equations (method of undetermined coefficients, application to oscillations and resonance, boundary value problems and eigenvalues),
- Fourier series, and
- separable first order partial differential equations (such as the heat equation, the wave equation, and Laplace's equation).

First steps

- Read through the course syllabus.
- Be familiar with course policies.
- Work on the first homework set and take the Grading System quiz.

Typical week

M: lecture
Tu: homework due
W: lecture, discussion?
Th: discussion?
F: lecture, discussion?

Course Format

MATH 2930 is a 4-credit course taught in large lectures. The lectures are paired with discussion sections so that you can develop a joyful, meaningful, and empowering community with your TA and classmates by actively doing mathematics in small groups. Both lecture and discussion sections provide opportunities to struggle with problems, come up with new ideas, make mistakes, and help each other work through confusion. To get the most out of these lessons, it's essential to be an active participant:

- Contribute to discussions in class, both with the entire class and in small groups.
- Intentionally make space for others to contribute; listen to others' ideas and build off of them.
- Check in with your group members to make sure that everyone understands the material.

You are expected to prepare for each class, participate in all scheduled classes, and solve problems that develop your understanding of the material. Plan to put in at least 9 hours of work into MATH 2930 each week (in addition to participating in lectures and discussion section).

Materials

- **Textbook:** MATH 2930 will cover assorted chapters from *Elementary Differential Equations & Boundary Value Problems* by Boyce, DiPrima, and Meade. Exercises will be pulled from the 12th edition.
- **Cornell Academic Materials Program (CAMP):** The textbook for MATH 2930 can be accessed via the CAMP webpage. Cornell automatically enrolls students in CAMP. For details of how to opt out, see this page.
- We recommend the free online math tools Desmos and the app *Slopes* (only available on mobiles).
- You will not be allowed to use a calculator (of any type) on any quiz or exam in MATH 2930.

Non-publication of course materials. Students must not publish course materials or recordings.

Resources

MATH 2930 and Cornell University offer a wide variety of options for you to receive academic and health-related support.

- **Ed Discussion:** A forum both for discussion among students and for communicating with the teaching team. You can ask questions–about lectures, homework, or anything else–but do not post assignment answers. You should post questions publicly and respond whenever possible so that everyone can benefit from the discussion. However, when appropriate, you can mark your question as "Private" and only the teaching team will see it.
- **Office Hours:** All teaching staff for MATH 2930 hold drop-in office hours for you to ask questions and improve your understanding of course material. You can attend anyone's office hours, no appointment required.
- **Study Groups:** The Learning Strategies Center has a service for finding study partners. You can also ask around in class or on Ed Discussion. Finding other people in the course that you work well with can make a significant difference in your experience in MATH 2930!
- **Academic Excellence Workshop (AEW):** Students may also sign up for the AEW for MATH 2930, with priority given to students in the College of Engineering. AEWs are optional 1-credit supplemental courses (graded S/U, based on attendance) which meet each week and are led by undergraduate peer educators (facilitators). If there are no spots available in a section that fits your schedule, use this link to indicate your interest and availability.
- **Tutoring:** The Math Support Center on the second floor of Malott Hall offers free tutoring to all students. The College of Engineering also offers one-on-one tutoring services restricted to students within the College of Engineering and BEE majors in CALS.

Assessment

Homework

The only way to develop a deep and flexible understanding of math is to constantly practice applying it in different contexts. Every week, you will be asked to solve problems and submit written solutions via Gradescope, an online grading platform.

- Written homework can be scanned or uploaded to Gradescope as a single PDF file (see Instructions).
  - To receive full credit, answers must be neatly presented and logically organized.
  - You are responsible for ensuring that your work is clear and easy-to-read.
  - Assign all pages to the single problem on Gradescope. (See this link for details.)
- Homework is typically due at 11pm on Tuesday evenings.
- Policies regarding late submissions and drops are discussed in Course Policies.

In MATH 2930, it is more important to demonstrate the correct reasoning and process behind arriving at a solution than to have the correct answer by itself. Always show your work and explain your reasoning (unless a problem specifies otherwise). We have shared a guide by Dr. Francis Su, a professor at Harvey Mudd College, on Canvas that you may find helpful.

Quizzes and Exams

This semester, we will hold four in-person quizzes in discussion section, two in-person preliminary exams, and one final exam. The material in MATH 2930 both naturally segments into units and builds on previous ideas, and these assessments give you opportunities to demonstrate your proficiency with these topics.

- You will have:
  - 50 minutes for each quiz,
  - 90 minutes for each preliminary exam, and
  - 150 minutes for the final exam.
- No calculators, other technology (e.g., phones and computers), books, or notes will be permitted during the exam.
- Your submitted work must be your own.
- Violation of exam policies are Academic Integrity violations.

Quiz and Exam Dates

- **Quizzes:** weeks 3, 6, 10, 14
- **Prelim 1:** Th, Mar. 13, 7:30-9:00pm
- **Prelim 2:** Th, Apr. 17, 7:30-9:00pm
- **Final:** TBD by Registrar

Please take care not to schedule travel away from Ithaca at exam times. Arrangements will be made for students with conflicts per university policy (see here and here). More details will be available closer to the exam.

Grading

This semester we will be using a grading system that incorporates elements of "standards-based" or "specifications" grading. Compared to a traditional points-based system:

- **This system acknowledges we all learn material at different rates.** You will have multiple attempts at most objectives and you only need to demonstrate proficiency once.
- **You will have a clear understanding of how you are progressing** and whether you are on track to receive a desired grade in the course.
- **You are rewarded for your individual understanding.** In many classes, success is relative to statistical performance. Using this system, others' success does not impact your ability to succeed.

The faculty committee overseeing the engineering math courses identified the essential content or "Learning Outcomes" (LOs) for MATH 2930. A full description of the 21 LOs can be found on the Learning Outcomes page of Canvas.

Scoring

Every attempt at an LO, whether on a quiz or exam, will be graded on the same qualitative scale. When the teaching team marks the problems on Gradescope, we must assign numerical values to represent these scores. However, they should be treated as grade markers as follows:

[3] Proficient	You demonstrated a clear and completely correct conceptual understanding of the outcome and you were able to follow necessary calculations to their completion.
[2] Revise	Your solution indicates a clear conceptual understanding of the outcome, but you made a small non-conceptual error. This score indicates that you will have an opportunity to revise your solution and resubmit it; a correct revision will change this grade to "Proficient."
[1] Growing	You have demonstrated substantial conceptual understanding of the outcome and necessary computations. However, there are gaps in your understanding. You will need to study this outcome further and attempt it again.
[0] Not Yet *or* Not Attempted	You demonstrated partial to no proficiency with this outcome, or you did not submit a solution for this problem. You should put significant effort into reviewing this topic and developing the essential techniques.

Note: Proficient does not mean "perfect" and small calculation errors do not undermine an overall demonstration of understanding. This means that a grade of "Revise" is rarely used and is reserved for solutions that demonstrate completely correct conceptual understanding, but the calculation error makes it incomplete.

The more outcomes in which you demonstrate proficiency, the higher your course grade. The table below indicates how you can guarantee a specific grade in MATH 2930 this semester:

You will guarantee yourself a grade of…	…by doing **all** of the following:		
	"Proficient" LOs	"Not Yet" LOs	Homework average
A or **A-**	$\geq 90\%$	0	$\geq 90\%$
B+ or **B** or **B-**	$\geq 80\%$	≤ 1	$\geq 85\%$
C+ or **C** or **C-**	$\geq 65\%$	≤ 3	$\geq 80\%$
D	$\geq 50\%$	≤ 4	$\geq 75\%$

Note: This table lists the strictest cutoffs for each letter grade; exact cutoffs will be determined at the end of the semester.

Beyond these guarantees, the awarding of course grades will thoughtfully consider the following:

- the number of "Growing" scores you have earned,
- the number of provided attempts for a given LO, and
- the relative difficulty of each LO.

Accessibility

Cornell University is committed to ensuring access to learning opportunities for all students. Student Disability Services (SDS) is the campus office that collaborates with students to provide and/or arrange reasonable accommodations.

- If you have, think you have, or develop a disability in any area (including mental health, attention, learning, chronic health, sensory, or physical), please contact the SDS office to arrange a confidential discussion regarding equitable access and appropriate accommodations.
- Please ensure that **Jonathan Lafler (**`math2930-staff@cornell.edu`**)** receives documentation from SDS. You are responsible for reaching out to determine how your accommodations will be realized.

Students with Disabilities

Your access in this course is very important to us. In order to have adequate time to arrange your approved accommodation(s), you must request your SDS accommodation letter no later than the add/drop deadline for the semester.

- **Students currently registered with SDS:** Once you request your accommodation letter and it is approved by SDS, it will be emailed to you, your instructor, and the head TA. Processing time can be up to 48-hours.
- **Students not registered with SDS:** The registration process for new accommodations can take up to three weeks. Once you are approved by SDS for accommodations, you will be able to request your accommodation letter for this course.
- **If you are approved for accommodations later in the semester:** You must request your accommodation letter as soon as possible.

Students with Exam Accommodations

This course will be participating in the **Alternative Testing Program (ATP)**. All exams will be centrally managed and supported by the ATP Testing Coordinator in the Office of Student Disability Services and accessible in your SDS student portal.

ATP support includes:

- **Scheduling of accommodated quizzes and exams:** Evening prelim exams will begin promptly at 6:30 pm. Quizzes will typically begin at 8am or 5pm.
- **Notification of accommodated exam logistics:**
  - All exam logistics are managed by the ATP and will ONLY be communicated to you via email from `sds-testing@cornell.edu` and accessible in your SDS student portal. Please do not contact course staff with questions about exam logistics, as we will not be able to answer them.
  - *10-days prior to the exam date:* ATP will automatically send an email with the exam date, time, location.
  - *48-hours prior to the exam date:* ATP will send a reminder email about the exam.
- **Coordination of conflict exams** will be handled by the ATP if it will be on the same day. Otherwise, the course support coordinator will be coordinating the logistics for any approved conflict exams.

Inclusivity

The MATH 2930 teaching team accepts Federico Ardila-Mantilla's axioms:

- **Axiom 1:** Mathematical talent is distributed equally among different groups, irrespective of geographic, demographic, and economic boundaries.
- **Axiom 2:** Everyone can have joyful, meaningful, and empowering mathematical experiences.
- **Axiom 3:** Mathematics is a powerful, malleable tool that can be shaped and used differently by various communities to serve their needs.
- **Axiom 4:** Every student deserves to be treated with dignity and respect.

We, as human beings, members of the Mathematics Department at Cornell University, and the instructional team for this course, are committed to full inclusion in education for all persons. We recognize that our students represent a rich variety of backgrounds and perspectives; please tell a member of the teaching team if there are circumstances affecting your ability to participate.

In this course, you are expected to work independently and in cooperation across differences (e.g., cultural, social, personal, economic, values, and religious). You will find that there can be multiple correct solutions to a mathematics problem and diverse problem-solving strategies.

Course Policies

Missing Discussion

If you know that you will have an absence from a regular (i.e., non-quiz) discussion section, you should get permission from **Jonathan Lafler (**`math2930-staff@cornell.edu`**)**, and the TA of the section you would like to attend **at least one day in advance**. Whether the TA can accept your attendance strictly depends on the reason for your absence and the room capacity in that section.

Missing Quizzes or Exams

- **If you have a reasonable conflict with an exam** (e.g., a university-sponsored event, overlapping exams, or a religious holiday), we will try to an alternative time for the exam. This alternative time will be before the main seating of the exam. We will provide a conflict form that you can fill out approximately two weeks before each exam.
  Note: We cannot guarantee resolutions to conflicts that we are told about after the form closes.
- **If you experience an illness or emergency** that prevents you from showing up to a preliminary exam you should:
  - Notify **Jonathan Lafler (**`math2930-staff@cornell.edu`**)**, and the course instructor as soon as possible.
  - If you test positive for COVID, you should forward your accommodation letter the course support coordinator.

  Students with excused absences will be dealt with on a case-by-case basis. The support coordinator and instructor will contact you about your specific situation within 36 hours of the completion of the regularly scheduled preliminary exam, once we have information from all students with emergencies or illnesses.
  Note: The policies regarding final exams are more strict. More guidance will be provided toward the end of the semester.

Flexibility

Written homework is typically due at 11pm every Tuesday. However, we realize that there are circumstances that may delay or otherwise impact your ability to meet these deadlines (illness, injury, travel, job interviews, performances, personal events, and so on). We accommodate these issues in three ways:

- Homework submitted to Gradescope within 30 minutes of the deadline will receive no late penalty. This grace period should cover any technical difficulties you experience when submitting the assignment.
- Your lowest written homework score will be dropped before course grades are calculated.
- You have three Late Days that you can use, without request, to submit your homework up to 24 hours after the original deadline (typically 11pm on Thursday) at no penalty. Save these late days for when you truly need them; additional late assignments may receive up to a 40% deduction. These penalties will be assessed at the end of the semester when we compute final grades.

After the late submission period has passed, assignments will not be accepted for credit under any circumstance. In the event of exceptional circumstances, we may offer to drop additional assignments. In such cases, you should reach out to **Jonathan Lafler (**`math2930-staff@cornell.edu`**)**. These may require accompanying documentation, usually a letter from an advising dean or from SDS.

Regrade Requests

- For all assignments, you will have one week from the date grades are published to review your work, compare your answers to the solutions, and submit a regrade request via Gradescope. You must submit requests within the week. We do not consider late requests to review the grading.
- If you think a rubric was applied incorrectly, you should request a regrade. Please respect the course staff's time, and carefully consider if the rubric was applied correctly before requesting a regrade.

Note: If you request a regrade, you are inviting us to look at not only the question at hand, but the entire assignment, to see if it was graded consistently with the rubric. After regrading, your score could go up, stay the same, or go down.

Academic Integrity

As with all other courses at Cornell University, we apply Cornell's Code of Academic Integrity. You are responsible for adhering to this code of conduct even if you have not read it. **Academic misconduct of any kind will result in an academic integrity report, as well as a grade penalty.**

Warning! Even a single violation of the AI code becomes part of your permanent confidential record at Cornell. For specific programs, this can derail your intended career!

As the code applies to MATH 2930:

- All work you submit in this course must be your own. You should be the only one creating the work you submit, and it has to be in your own words.
- You are allowed, even encouraged, to collaborate on written homework with classmates or to initiate class-wide homework discussions on Ed Discussion. However, this permissible cooperation may never involve one student having possession of a copy of all or part of the work done by someone else, in any form (e.g., photo, email, or a hard copy).

There are no circumstances under which it is acceptable to post homework, projects, or test questions on other websites. Even if they seem like honest resources, they tend to cross the line in terms of academic integrity. The teaching team and Cornell offers a wide range of free resources, with trained educators. Use these instead.

With heavy hearts we will investigate and penalize academic integrity violations.