Math 427J: Differential Equations with Linear Algebra
Math Honors

Unique Number 53390

Spring Semester 2016

Where am I?

You are in Professor Dan Knopf's *427J Math Honors* class. Your Teaching Assistant is Mayank Manjrekar.
Lectures meet 9:30–10:45 Tuesdays and Thursdays in NOA 1.102.
Problem sessions meet 4:00–4:50 Mondays and Wednesdays in CPE 2.206.

Why am I here?

Ordinary and partial differential equations are fundamental tools with utility in pure mathematics as well as scientific and engineering applications. Those disciplines use differential equations to model complex physical phenomena. Whether in pure or applied math, it is seldom enough merely to know that a differential equation has solutions. It is more important to know when these solutions are unique and how to understand and approximate their behaviors. In applications, such understanding gives insight into the physical processes the differential equations are supposed to model.

Linear algebra is one of the most useful branches of mathematics. Although it was originally developed as a tool for studying systems of algebraic equations, linear algebra expanded well beyond its roots and today has deep structural connections to the study of differential equations. This course will introduce you to the beauty of linear algebra, and will explore those connections by developing important techniques used to find and qualitatively analyze solutions of systems of algebraic equations and ordinary and partial differential equations.

Because this is a *Math Honors* course, we will study these topics in greater breadth and depth than in a usual section of M427J. To achieve this, we will devote more class time to new material and less to review. Consequently, you should plan to attend problem sessions regularly and to devote extra time outside of class to supplemental reading and study.

What are the prerequisites for this course?

The basic prerequisites for M427J are Math 408D, 408L, or 408S (or equivalent) with a grade of at least C-. But this is an honors course, so registration is restricted.

Is there a mandatory textbook?

No — the course will be taught from lecture notes available to you for free on Canvas (see below). Those notes are solely for the use of students enrolled in this class, so you should not copy, distribute, or otherwise make them available to others.

Although *optional,* the following two supplemental texts are useful resources that may help you better learn the material and study for exams.

- *Differential Equations,* Second Edition, by John Polking, Albert Boggess, and David Arnold; Pearson Prentice Hall, Inc.

- *Elementary Differential Equations and Boundary Value Problems,* Ninth or Tenth Edition, by William E. Boyce and Richard C. DiPrima; John Wiley & Sons, Inc.

Copies of Polking–Boggess–Arnold 2$^{\text{nd}}$, Boyce–DiPrima 9$^{\text{th}}$, Boyce-DiPrima 10$^{\text{th}}$, and a solutions manual for Boyce–DiPrima 9$^{\text{th}}$ will be kept on reserve in the Kuehne Physics–Math–Astronomy Library (PMA) on the ground floor of RLM.

How can I get extra help?

- The contact information for your professor and Teaching Assistant (TA) is below. We encourage you to come to us for individualized help if needed!

Name	E-mail	Office	Office hours
Dan Knopf	danknopf@math.utexas.edu	RLM 9.152	1:30–3:30 Thursdays
Mayank Manjrekar	mmanjrekar@math.utexas.edu		

- This course will use CANVAS. This syllabus, class announcements, lecture notes, assignments, answer guides, and supplementary learning materials will be posted there.

- This course is supported by PLUS (Peer-Led Undergraduate Studying). PLUS study groups provide opportunities to collaboratively practice skills and apply knowledge you need for success in the course. Attending study groups regularly is a great way to ensure you are keeping up with the material so that you don't fall behind. Feel free to attend any study group at any point in the semester; more information on times and locations will be available through CANVAS and also announced in class. For more on PLUS, please see

  www.utexas.edu/ugs/slc/support/plus

- The syllabus may be updated during the semester for pedagogical reasons. A current version will always be available under the *Syllabus* tab on CANVAS, as well as through a link from my home page:

  www.ma.utexas.edu/users/danknopf

- Contact information for the Mathematics Advising Center may be found at:

  www.ma.utexas.edu/academics/undergraduate/advising/

How will the course be graded?

There will be homework, quizzes on homework, and three midterm exams. There will not be a final exam.

This course carries the *Quantitative Reasoning* flag. Quantitative Reasoning courses are designed to equip you with skills that are necessary for understanding the types of quantitative arguments you will regularly encounter in your adult and professional life. You should therefore expect a substantial portion of your grade to come from your use of quantitative skills to analyze real-world problems.

- **Homework:** There will be eleven homework assignments. Each will be posted under the *Assignments* tab on CANVAS approximately one week before it is due. Assignments will be due on most Wednesdays; see schedule below. Homework will consist of two types of problems: *learning problems* and *honors problems*. The learning problems will not be collected, but you are expected to complete them (see below). The honors problems will be collected and graded; they will determine **15%** of your grade.

  - **A late assignment counts as a missed assignment.** Late homework is not accepted under any circumstances. (The sole exception is a conflict with a religious holiday, in which case you must notify me in advance; see below.)
  - **Your assignments must be legible, neat, and <u>stapled.</u>**

- **Quizzes:** There will be a short quiz during problem session each Wednesday that homework is due. *Each quiz will consist of one or two learning problems from that week — verbatim.* So if you have worked diligently on the homework, you will be well prepared to get good quiz grades.

- **There will be no make-up quizzes.** A missed quiz counts as a zero. (The sole exception is a conflict with a religious holiday, in which case must notify me at least two weeks in advance.)

  - **The lowest two quiz scores will be dropped**, to allow for illness, emergencies, and other valid excuses. The remaining nine scores will be averaged to determine **10%** of your grade.

- **In-class midterm exams:** There will be three in-class midterm exams. (See schedule below.) Each will determine **25%** of your grade.

  - **No exam scores are dropped.**
  - If you miss an exam, you must contact me beforehand and provide a valid written **serious** excuse in order to be allowed to take a make-up exam. *I reserve the right to give oral make-up exams.*

Your overall grade will be computed according to a scale at least as generous as this:

F	D-	D	D+	C-	C	C+	B-	B	B+	A-	A
0–50	51–55	56–63	64–65	66–67	68–75	76–77	78–79	80–87	88–89	90–91	92–100

Can you give me some tips for the course?

- **Attend lectures.** I have posted my lecture notes under the *Files* tab on CANVAS. They are a resource to help you study, but they are not a substitute for attending lectures. If you skip class, you rob yourself of opportunities to hear explanations of difficult material, to ask questions, and to get valuable experience working in groups on strategically selected examples.

- **Attend problem sessions.** Because I must introduce new concepts during lectures, there simply isn't time to work as many examples as would be pedagogically ideal. Problem sessions offer many more opportunities to learn from examples, clarify ideas, and practice using new concepts. Problem sessions are valuable resources for learning and review. Note in particular that the session immediately before each exam reviews the upcoming exam topics.

- **Ask questions** — in lecture, during problem sections and office hours, and/or using the CANVAS *Discussions* tab.

- **Do the homework.** No students, no matter how talented, can learn mathematics without working examples themselves. The most important component of success in virtually every math course is diligence in doing practice exercises.

- **Do supplemental reading.** To get the most benefit from the lectures and problem sessions, you should read relevant sections of the lecture notes as they are covered in class. *Some sections may not be (fully) covered in class, so you must be willing to read those on your own.* You may also find it helpful to read relevant parts of the supplemental texts listed above. Because this is an honors course, you should also expect to review basic concepts (like series and complex numbers) by reading on your own.

- **Come to office hours.** Office hours offer valuable opportunities to reinforce concepts, clarify confusing issues, work more examples, and get individualized feedback. Both your TA and I are happy to see students in our office hours.

- **Study together.** You are encouraged to study together with your peers enrolled in the class. Get to know your classmates, and make arrangements to share notes in case you miss class due to illness. Take advantage of the organized collaborative learning opportunities provided by PLUS.

- **Learn to work problems either with or without electronic aids.** You may use a calculator or mathematical software on homework problems — but not during quizzes or exams.

- **Be honest.** Any academic dishonesty will be severely penalized. In this regard, please note that **no books, notes, calculators, computers, or mobile phones are allowed in quizzes or exams**.

What is the lecture schedule?

The following lecture schedule may be altered for pedagogical reasons. **It is your responsibility to be aware of any changes announced in class.** You should attend problem sessions each Monday and Wednesday, even though Mondays are generally not listed on the schedule below.

Tuesday, January 19 Part I, Chapters 1–2

Wednesday, January 20 *First problem session — no quiz*

Thursday, January 21 Part I, Chapters 3–4

Tuesday, January 26 Part I, Chapters 5–6

Wednesday, January 27 *Quiz 1*

Thursday, January 28 Part I, Chapters 6–7

Tuesday, February 2 Part I, Chapter 8

Wednesday, February 3 *Quiz 2*   *(Twelfth class day: last day to drop with a possible refund)*

Thursday, February 4 Part II, Chapters 9–10

Tuesday, February 9 Part II, Chapter 10

Wednesday, February 10 *Quiz 3*

Thursday, February 11 Part II, Chapter 11

Tuesday, February 16 Part II, Chapter 12

Wednesday, February 17 *Quiz 4*

Thursday, February 18 Part II, Chapter 13

Tuesday, February 23 Part III, Chapter 14

Wednesday, February 24 *No quiz — exam review*

Thursday, February 25 <u>Exam 1 (Parts I–II) — during regular class time in NOA 1.102</u>

Tuesday, March 1 Part III, Chapter 14

Wednesday, March 2 *Quiz 5*

Thursday, March 3 Part III, Chapter 15

Tuesday, March 8 Part III, Chapter 15

Wednesday, March 9 *Quiz 6*

Thursday, March 10 Part IV, Chapter 16

Monday, March 14 – Friday, March 18 *Spring break: no classes*

Tuesday, March 22 Part IV, Chapter 16–17

Wednesday, March 23 *Quiz 7*

Thursday, March 24 Part IV, Chapter 17

Tuesday, March 29 Part IV, Chapter 17–18

Wednesday, March 30 *Quiz 8*

Thursday, March 31 Part IV, Chapter 18

Monday, April 4 *(Last day to drop)*

Tuesday, April 5 Part V, Chapter 19

Wednesday, April 6 *No quiz — exam review*

Thursday, April 7 <u>Exam 2 (Parts III–IV) — during regular class time in NOA 1.102</u>

Tuesday, April 12 Part V, Chapter 20

Wednesday, April 13 *Quiz 9*

Thursday, April 14 Part V, Chapter 21

Tuesday, April 19 Part VI, Chapters 22–23

Wednesday, April 20 *Quiz 10*

Thursday, April 21 Part VI, Chapter 23

Tuesday, April 26 Part VI, Chapter 24

Wednesday, April 27 *Quiz 11*

Thursday, April 28 Part VI, Chapter 24   *(Read Part VI, Chapter 25 on your own.)*

Tuesday, May 3 Part VI, Chapter 26

Wednesday, May 4 *No quiz — exam review*

Thursday, May 5 <u>Exam 3 (Parts V–VI) — during regular class time in NOA 1.102</u>

Policies

Academic integrity Any academic dishonesty will be severely penalized. Your assignments, quizzes, and exams must be your own work.

Accommodations The University of Texas at Austin provides, upon request, appropriate academic accommodations for qualified students with disabilities. For more information, contact the Division of Diversity and Community Engagement, Services for Students with Disabilities (phone 512.471.6259, video phone 866.329.3986). For more information, please see

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ddce.utexas.edu/disability/

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If you fall under the University's Learning Disability Policy, it is your responsibility to deliver the SSD certification of that fact to me as early in the semester as possible, and no later than one week prior to the first exam.

Religious holidays By UT Austin policy, you must notify me of your pending absence at least fourteen days prior to the date of observance of a religious holiday. If you must miss a class, an assignment, a quiz, or an examination in order to observe a religious holiday, you will be given an opportunity to complete the missed work within a reasonable time after the absence.

Safety recommendations Please note the following guidelines:

- Occupants of buildings on the University of Texas at Austin campus are required to evacuate buildings when a fire alarm is activated. Alarm activation or announcement requires exiting and reassembling outside.

- If you require assistance in evacuation, please inform me of this fact in writing during the first week of class.

- Familiarize yourself with all exit doors of each classroom and building you may occupy. Remember that the nearest exit door may not be the one you used when entering the building.

- In the event of an evacuation, follow the instruction of faculty or instructors.

- Do not re-enter a building unless given instructions by one the following: Austin Fire Department, the University of Texas at Austin Police Department, or a Fire Prevention Services officer.

- If you have concerns about your own stress levels or those of a classmate, you are encouraged to contact the university's *Behavior Concerns Advice Line* at 512.232.5050.

- For further information, see `www.utexas.edu/emergency` or contact the Office of Campus Safety and Security, `www.utexas.edu/safety/` at 512.471.5767.