Kennesaw State University
College of Science and Mathematics
Department of Mathematics
Fall Semester 2022
MATH 2306 (Section 54): Ordinary Differential Equations

1. Basic Information

Instructor: Dr. Timothy Faver
Email: `tfaver1_AT_kennesaw.edu` (this is the best way to contact me)
Website: `https://tefaver.com/teaching/math-2306`
Lecture time/location: MWF 12:20 pm – 1:10 pm, Room D209
Office: D248
Office hours: (tentative) M 1:00 – 2:00 pm, W 3:00 pm – 4:00 pm

1.1. Learning outcomes. Upon completing this course, students will be able to

1. Solve special types of first order ordinary differential equations including equations which are linear and separable, and use these methods to solve applied problems.

2. Solve second and higher order homogeneous and nonhomogeneous linear ordinary differential equations, and use these methods to solve applied problems.

3. Solve a system of linear ordinary differential equations with constant coefficients.

4. Find Laplace transforms and inverse Laplace transforms and apply these to solve linear ordinary differential equations.

This course is really about *how to predict the future*. We will do so by casting our questions about the future in the language of differential equations and then solving those equations. Setting up a differential equation to model a particular phenomenon is itself a nontrivial task. "Solving" an equation will involve three related approaches. In the *analytic* approach, we find explicit formulas for solutions to problems; this is probably what we think "solving" an equation means (and for good reason), but only very special equations have explicit solution formulas. In the the *qualitative* approach, we use certain features of problems to guarantee the existence of solutions and then predict their behavior; often knowing how a solution behaves over long times is more useful than knowing its precise formula. In the *numerical* approach, we convert our "continuous" problems to "discrete" ones that a computer can be taught to solve with results that a human brain can be taught to interpret.

1.2. Necessary background. The official prerequisite is Calculus II, and therefore Calculus I. We definitely will not need *everything* from those courses, but what we do need, you will need to *know very well*. In particular, you *must* be comfortable with the following topics: properties of limits; the definition of continuity; formulas for elementary (anti)derivatives; the power, product, and chain rules; properties of increasing/decreasing functions and concavity;

what the fundamental theorem of calculus says about definite integrals; u-substitution and integration by parts. If you have concerns about your background, talk with me *at once*.

1.3. Course materials. Most material (notes, readings, exam solutions) will be posted to the course website. More sensitive information and grades will appear on D2L.

1. I will write comprehensive daily lecture notes and post them regularly on the course website. These notes will be the source that most accurately reflects our course content.

2. Our primary reference will be *Fundamentals of Differential Equations (Ninth Edition)* by R. Kent Nagle, Edward B. Saff, and Arthur David Snider (Pearson 2018). An older edition is probably fine, as is the longer version with "and Boundary Value Problems" in the title.

3. We will use *A First Course in Differential Equations (Third Edition)* by J. David Logan (Springer 2015) as a supplement. A free copy is available from the author's website and D2L.

4. We will occasionally use Geogebra apps and run numerical simulations in the program DE Tools (for which you need a current version of Java); a link to a free download is on D2L.

5. You should have paper (of any kind/size) available for in-class work each day.

2. Grading

Your final numerical grade will be based on your daily attendance, two projects, weekly problem sets, three in-class exams, and a cumulative final exam. Each component will be scored out of 100 points. The following weights will determine your final numerical grade.

Component	**Weight**
Attendance	5%
Projects	15%
Problem sets	25%
Lowest in-class exam*	10%
Middle in-class exam	15%
Highest in-class exam	15%
Final exam	15%

* *This grade can be replaced by your final exam score if your final exam score is higher. See details and exceptions to this possibility in Section 2.4.*

Your final letter grade will be determined by the interval to which your final numerical grade belongs.

Numerical grade	**[90,100]**	**[80,90)**	**[70,80)**	**[60,70)**	**[0,60)**
Letter grade	A	B	C	D	F

2.1. Attendance (5%). *Regular and engaged attendance is essential for your learning;*

failures in my classes are strongly correlated with low attendance or attendance with weak engagement. I will take attendance on each of the days that we meet and do not have an exam, either by checking the course roster or by reviewing in-class work that you will submit. (This work will not be graded for correctness.) Each day that you are present will add a point to your final attendance score. At the end of the term, your attendance grade will be determined by

$$\max\left\{100 \times \frac{\text{Total number of attendance points}}{\text{Total number of meetings} - 6}, 100\right\}.$$

This allows you to miss several classes without penalty, including the first week if you join the course after the term begins.

An absence may or may not be "excused." Important family commitments, religious obligations, feeling ill, COVID exposure/infection, emergency car trouble, legal issues, an essential work commitment, and university-sponsored athletics, trips, or programs are all sufficient reasons for an excused absence. Making up work in another class, oversleeping, traffic, and vacations (...early Thanksgiving break...) are not.

If you feel that your absence merits an excuse, please read the posted lecture notes from that day and then email me (1) the reason for your absence and (2) a question about something that you don't understand from that day's discussion or, if you feel that you understand everything, a comment about something that seems interesting, or frustrating, or weird, or anything that evokes an emotional reaction in you. An excused absence will not receive attendance credit without the component (2).

2.2. Projects (15%). *The two projects will help you explore in more intense and personal focus particular aspects of our course, subject in part to your own interests, with a special focus on formal writing skills.* Each project will count for 7.5% of your final grade. The first project requires independent work, while the second project allows (but does not require) group work. Instructions are available on the course website, and due dates are on the calendar (Section 4).

2.3. WeBWorK problem sets (25%). *Regular work on problem sets will strengthen and reinforce your understanding of course concepts and techniques.* There will be 11 WeBWorK problem sets due throughout the term, mostly on Fridays. See the calendar (Section 4) for the exact dates on which WeBWorK is due. Instructions for accessing WeBWorK and strategies for WeBWorK success are on the website. In general, I will not accept late WeBWorK assignments, but I will drop your lowest two WeBWorK scores. Incorporated into the WeBWorK grade will be a syllabus quiz that is available on D2L and due by the Wednesday of the second week of the term. Your final problem set score will be given by

$$\frac{\text{Syllabus quiz score } + \text{ the sum of the 9 highest WeBWorK scores}}{10}.$$

2.4. Exams (55%). *Exam preparation will help you connect discrete course topics; completing an exam under time constraints is one way of evaluating your fluency with course material and your intellectual independence.* There will be three in-class exams (Exams 1,

2, and 3) during the term and a cumulative final exam. The final exam will only be given at the university-specified time, which cannot be changed. See the calendar (Section 4) for the exam dates. I will provide a detailed study guide at least a week in advance of each exam. You will earn 5 points on each exam from a reflection activity that you will do based on the study guide; you can earn the other 95 points on the actual exam.

In order to be excused from an exam, you must (1) notify me before the start of the exam (or as soon after as the circumstances allow) and (2) provide official documentation (a doctor's note, a quarantine notice or proof of COVID test, a note from your employer, etc.) excusing your absence in a timely manner. If your absence from an exam is excused, then you will take a make-up exam during finals week; if your absence is not excused, you will score a 0 on that exam. Dates and times for the make-up exam are also on the calendar. Valid (and invalid) reasons for missing an exam are, in general, the same as for missing class.

In the unlikely event that you first have an excused absence from Exam m and later have an excused absence from Exam n, where $1 \leq m < n \leq 3$, then you will take a make-up for Exam n within one week of returning to class. Failure to do so will result in a score of 0 on Exam n. This is to prevent you from having too much work at the end of the term.

To encourage and reward improvement throughout the term, your final exam grade can replace the lowest of your Exams 1, 2, and 3 grades. The final exam grade will not replace a score of 0 on Exams 1, 2, or 3 that results from an unexcused absence from the exam or from not taking the make-up exam in the event of an excused absence from the original exam.

2.5. Incomplete grades. The catalogue specifies that an "incomplete grade may be awarded only when the student was doing satisfactory work prior to the last two weeks of the semester but for nonacademic reasons beyond the student's control, was unable to meet the full requirements of the course." I define "satisfactory work" to mean the existence of a score (scores) on your remaining work that will allow you to pass the class.

The catalog subsequently states that a "grade of 'I' must be removed by completing the course requirements within one calendar year from the end of the semester in which the 'I' was originally assigned. In addition, should the student enroll in classes at KSU during the calendar year, the grade of 'I' must be removed by the end of the first semester of enrollment during that calendar year."

If you are awarded an incomplete for this course, it will be to your advantage to complete all remaining work as soon as possible. Based on your circumstances, we will agree on a mutually convenient and appropriate timeline for completing your work. Failure to follow this timeline without a justifiable excuse may result in failing grades for the missed work and possibly the course. Ideally, you would complete all work by the end of January 2023.

3. Strategies for Success and/or Failure

3.1. Class attendance and participation. Failures in my classes are strongly correlated with low attendance or attendance with minimal engagement; students who both attend class regularly and engage with me in and/or outside class tend to succeed. (This should be utterly unsurprising.) This is *your* education — seize every opportunity that you can to learn, and don't be content with mediocrity!

3.2. Office hours. During office hours, we can discuss specific examples, problems, or techniques from class, the lecture notes, or the textbook. More broadly, we can talk about your study habits, time management, and mathematical reading skills. Before coming to office hours, think carefully about what you want to discuss so that we use our time well.

If my office hours conflict with your other classes, we can make an appointment for a different time. If the currently scheduled office hours conflict with the availability of students who most frequently want to see me, I may change the weekly hours to accommodate the preferences of the majority.

An online option via Teams will always be available for office hours. The Teams link will be on D2L. I will attempt to hold office hours in person (please wear a mask).

3.3. Email communication. You are welcome to email me questions about any aspect of the course at any time. A short hint from me can make a big difference for you.

Please include the words "Math 2306" in the subject of your email. I filter emails and may not respond to your message promptly, or may miss it entirely, without these key words. Please use your "students" email, not D2L email.

Please begin your email with a salutation (e.g., "Hi, Dr. Faver") before the body of text; this is simply good manners (and will put me in a good mood, which will be helpful for you).

3.4. WeBWorK. The WeBWorK introduction on the course website discusses some common challenges with the program, working strategies, and time management.

3.5. Reading assignments and recommended problems. It is quite likely, and wholly natural, that you will not fully understand the material that we cover in class. Readings from the textbook(s) will offer different perspectives that may be more conducive to your personal engagement with Math 2306. Part of your mathematical education is developing your reading comprehension; be prepared to invest time, and struggle, with the course's *written* materials (lecture notes, the textbooks) before seeking outside help or alternate media.

Doing the WeBWorK problems *alone* probably will not provide you with enough exposure to course material outside of class. Instead, you should attempt a variety of problems from the "Recommended Problems" lists that I provide each week; challenge yourself to do a certain number of these each week along with WeBWorK. Recommended problems will also serve as additional, essential practice and review for exams. You are welcome to request particular kinds of recommended problems if there is a topic on which you want more practice.

3.6. How to fail. The following strategies have helped prior students fail my classes.

1. Don't come to class regularly; in particular, show up only for exams.

2. Be physically present but intellectually disengaged in class. Avoid talking with me.

3. Don't do the WeBWorK problem sets or any recommended practice problems.

4. Save all your Math 2306 work for only one day each week.

5. Ask for, but then completely ignore, my advice on improving your course performance.

4. Calendar

You are responsible for knowing all of the due dates for assignments and scheduled dates for exams listed below. WeBWorK and D2L submissions are due at 11:59 pm on the stated day.

F August 19:	Problem Set 1 due on WeBWorK
W August 24:	Syllabus quiz due on D2L
F August 26:	Problem Set 2 due on WeBWorK
F September 2:	Problem Set 3 due on WeBWorK
M September 5:	No class — Labor Day
F September 9:	Problem Set 4 due on WeBWorK
M September 12:	Exam 1 reflection due on D2L
F September 16:	Exam 1
F September 23:	Problem Set 5 due on WeBWorK
F September 30:	Project 1 due on D2L
F October 7:	Problem Set 6 due on WeBWorK
T October 11:	Last day to withdraw without academic penalty
F October 14:	Problem Set 7 due on WeBWorK
M October 17:	Exam 2 reflection due on D2L
F October 21:	Exam 2
F October 28:	Problem Set 8 due on WeBWorK
F November 4:	Problem Set 9 due on WeBWorK
F November 11:	Problem Set 10 due on WeBWorK
M November 14:	Exam 3 reflection due on D2L
F November 18:	Exam 3
M November 21:	No class — Thanksgiving Break
W November 23:	No class — Thanksgiving Break
F November 25:	No class — Thanksgiving Break
T November 29:	Last day to withdraw without a WF
W November 30:	Final exam reflection due on D2L
F December 2:	Project 2 due on D2L
M December 5:	Problem Set 11 due on WeBWorK/Last day of class
T December 6:	Make-up exams, 3:30 pm – 4:30 pm
W December 7:	Make-up exams, 3:30 pm – 4:30 pm
F December 9:	Final exam, 1:00 pm – 3:00 pm

If something within or beyond Math 2306 is negatively affecting your Math 2306 experience, please come talk to me (in person, via email, during office hours — whatever you prefer). It is very likely that we can find a way to make your Math 2306 experience better. Waiting to discuss a Math 2306-related problem usually will not make that problem go away.

5. University Policies and Formal Matters

5.1. Federal, BOR and KSU Student Policies. You should be familiar with the policies detailed via the link below.

`https://cia.kennesaw.edu/instructional-resources/syllabus-policy.php`

5.2. KSU student resources. You should be familiar with the resources and rights available to you as detailed in the link below.

`https://cia.kennesaw.edu/instructional-resources/syllabus-resources.php`

5.3. Academic integrity statement. Every KSU student is responsible for upholding the provisions of the Student Code of Conduct, as published in the Undergraduate and Graduate Catalogs. Section 5c of the Student Code of Conduct addresses the university's policy on academic honesty, including provisions regarding plagiarism and cheating, unauthorized access to university materials, misrepresentation/falsification of university records or academic work, malicious removal, retention, or destruction of library materials, malicious/intentional misuse of computer facilities and/or services, and misuse of student identification cards. Incidents of alleged academic misconduct will be handled through the established procedures of the Department of Student Conduct and Academic Integrity (SCAI), which includes either an "informal" resolution by a faculty member, resulting in a grade adjustment, or a formal hearing procedure, which may subject a student to the Code of Conduct's minimum one semester suspension requirement.

5.4. Course catalogue description.
3 Class Hours 0 Laboratory Hours 3 Credit Hours
Prerequisite: A grade of "C" or better in MATH 2202
An introduction to the theory of ordinary differential equations (ODEs), methods of solving first and higher order linear differential equations and linear systems, some applications in the sciences and engineering, the Laplace transform and its application in solving differential equations and linear systems, stability analysis and Euler's numerical algorithm.

5.5. COVID-19 statements. You should be familiar with the most recent university policies and resources regarding COVID-19 as detailed in the link below.

`https://www.kennesaw.edu/coronavirus`