

Math 20580

Fall 2024

Introduction to Linear Algebra and Differential Equations Course Information

Course Webpage: <http://www3.nd.edu/~kbarron/Math20580.html>

Textbooks: There are two required course text books which are available as ebooks through Cengage and WebAssign:

1. *Linear Algebra: A Modern Introduction, 4th edition*, by David Poole.
2. *A First Course in Differential Equations with Modeling Applications, 11th edition*, by Dennis Zill.

Course Description: *What is linear algebra?* Functions and equations that arise in the “real world” often involve many tens, hundreds, or thousands of variables, and one can only deal with such complexity by being much more organized than one typically is when treating equations and functions of a single variable. Linear algebra is, from one point of view, a “language for accounting” that has been developed just for this purpose, and is a fundamental tool used in large language models (ChatGPPT), search engines (Google), signal processing, etc. We will learn methods for solving equations and ways of understanding their solutions that are very effective when the equations are what is called (of course) “linear”. We will also learn that these linear systems can be viewed geometrically as maps from one multi-dimensional space to another, and thus are important for computer graphics, and in “visualizing” multi-dimensional settings. In addition, linear algebra is a key ingredient in solving multivariable and higher order differential equations.

What are differential equations? Many functions that arise in applications do so only in an indirect fashion. That is, rather than being told what the formula is for a function, one is given some (differential) equation relating the function to one or more of its derivatives. For instance, a bank does not advertise a formula for the amount of money in a hypothetical account. Instead it advertises an interest rate, which is a way of saying how the amount of money in an account will change with time. The main goal in studying a differential equation is to understand the function it applies to. In simple situations one can use the equation to determine a formula for the function. In more complicated ones, when exact formulas for the function are impractical or impossible to find, one can still try to answer specific questions, like “what happens to the function when the independent variable becomes large? does the function also become large? small?” etc. Luckily, for a certain class of differential equations called “linear” we can use the techniques of linear algebra to find solutions!

What will we cover? We will spend 2/3 of the semester on linear algebra, covering the main topics of Poole’s book. The remaining 1/3 of the semester (and the entirety of Math 30650, should you take it) will be spent on differential equations. In this semester, we will cover Chapters 1 through 4 of Zill. Time is short, and we will not have much time to discuss the many interesting applications of the math we are learning. So we highly encourage you to look at the chapter introductions and some of the “application” sections in both texts.

Schedule: A tentative schedule of the material to be covered in each class is available on the course webpage. You are expected to read the material before the class. We will

not necessarily cover all the details of the section. Please come to class with questions about the aspects you did not understand from your reading and for which you still need clarification after or during the in-class lecture.

Tutorial and Quizzes: Attendance at your Tutorial each Thursday is mandatory. You DO have tutorial the first week of class. Most weeks in Tutorial you will have a short Quiz and/or Worksheet to help you stay current with the material. The first tutorial, you will have a Worksheet on practicing row reduction which is a basic skill used throughout the course that it is important for you to become proficient with. You will not have a Quiz the weeks in which we have a Midterm Exam. There will be no makeups on Quizzes or Worksheets; if you have an excused absence for a missed tutorial, the work will not be counted in your tutorial grade, and your tutorial grade will be based on the remaining Worksheets and Quizzes.

Homework: The Homework is linked through Canvas to WebAssign. For details on accessing WebAssign go to the Course Syllabus tab on Canvas. You will have ample time to complete the Homework assignments and unlimited attempts. Importantly, you should attempt an assignment for a given section the day that that section is covered in class. Then you should seek help early on for those aspects of the material you are not understanding so as not to fall behind. Attempting the assignment the day before or the day it is due will not serve you well. Late Homework will not be accepted.

Exams: There will be three Midterm Exams and a Final Exam on the following dates:

Exam I	Tuesday,	September 24,	8:00 – 9:15 AM
Exam II	Thursday,	October 31,	8:00 – 9:15 AM
Exam III	Tuesday,	November 19,	8:00 – 9:15 AM
Final Exam	Wednesday,	December 18,	1:45 – 3:45 PM

Locations will be posted on the webpage. Calculators will not be allowed on exams.

Note that these exam times are official dates and times set by the University and may be made up only with an excused absence. If there is a conflict with another exam, these departmental exams take precedence and the conflict must be resolved with the other class. For departmental exams that conflict, the class with the larger total enrollment takes precedence. Please check your courses' exam schedules, and contact your dean's office as soon as you become aware of any such conflict, and make sure alternate arrangements have been made at least a week before the exam. Athletes should notify their athletic advisor of their exam schedule, so if an excused athletic absence falls on an exam day, your advisor can make arrangements to administer the exam to you while you are away. Students with disabilities wishing to take exams at the Sara Bea Center should make arrangements to do so well before the first exam.

Grades: Your course grade will be based on your total score out of 550 possible points, allocated as follows:

Homework	50 pts
Tutorial	50 pts
Exam I	100 pts
Exam II	100 pts
Exam III	100 pts
Final Exam	150 pts

Honor Code: The Homework, Quizzes and all Exams are conducted under the Honor Code. Exams and Quizzes are closed book, no calculators, and are to be done completely by yourself with NO assistance from others. Discussing Quizzes with other students on Thursday before the final tutorial ends at 4:20pm is a violation of the Honor Code. Although collaboration on Homework is encouraged, directly copying the work of others without contributing to working out the solution or fully understanding the work constitutes an infringement of the Honor Code. Any infringement of the Honor Code is taken very seriously and can result in severe consequences. If you have any questions regarding the Honor Code at Notre Dame, please visit <http://honorcode.nd.edu>, and if you have any questions about how the Honor Code is applied in this class, please feel free to discuss this with your instructor.