

## Ordinary Differential Equations Course Information

**Course Webpage:** <http://www3.nd.edu/~kbarron/Math20750.html>

**Class Times:** MWF 9:25 AM–10:15 AM.

**Location:** DBRT 317

**Professor:** Katrina Barron    **Office:** 276C Hurley    **Email:** kbarron@nd.edu

**Textbook:** *Elementary Differential Equations & Boundary Value Problems, 11th ed.*, by Boyce, DiPrima & Meade.

### Course Description:

A differential equation is an equation that relates functions and their derivatives, i.e. rates of change, with respect to one or more variables. Almost all physical laws and physical processes are described in terms of differential equations, where by “physical processes” we include biological, chemical, environmental, and economic processes. Since differential equations are so ubiquitous across so many disciplines, learning some basic theory of differential equations is a basic part of mathematical training.

In this course, our focus will be in studying and finding solutions to “ordinary differential equations” or ODEs. This means we will focus on finding solutions to equations involving functions of one variable and their derivatives with respect to that variable, as opposed to functions of more than one variable and their partial derivatives with respect to those variables, which comprise “partial differential equations” or PDEs. Most physical laws and processes are actually described in terms of PDEs, but one must first understand the basics of the theory of ODEs before one can embark on understanding PDEs.

Of course you have already encountered and solved some ODEs in your Calculus II and III courses. For instance

$$y' = \frac{dy}{dt} = 2e^t$$

is an ODE describing the derivative of the function  $y(t)$  for  $t$  an independent variable, and in this case, this derivative  $y'$  is set equal to the function  $2e^t$ . Thus integrating both sides of the equation, we see that this ODE has the family of solutions  $y(t) = 2e^t + C$  for  $C$  any constant. Or more generally, the equation  $y' = f(t)$  has the solution  $y(t) = \int f(t)dt$ , and you would employ your knowledge of techniques of integration to solve this ODE. However, an equation such as

$$y'' + 2y' = \cos t$$

might be more challenging to solve without learning some of the new techniques we will soon introduce in this course.

One of the main tools that we will use in studying and solving ODEs is our knowledge of Linear Algebra! Since the derivative itself is a linear transformation on

the vector space of differentiable functions, it is not surprising that Linear Algebra might make an appearance in our study of differential equations, and so it does!

We will cover Chapters 1–4, & 7 of the text, and parts of Chapters 5 & 9, time permitting.

**Schedule:** On the course webpage listed above a schedule of the material to be covered in each class will be updated as we go along. You will need to read the material in the text before class. Then in class I will lecture on the main important points and subtle issues, will work through example problems, and have occasional worksheets and quizzes. I will typically not cover all the details of the section in the lecture, and so reading the text outside of class time is very important. Please come to class with questions that arise from your reading and from previous lectures.

**Homework:** On the webpage a list of the homework assignment for the material covered in each class will be posted. I have tentatively set the due date for homework as weekly on Wednesday. However, you should begin to attempt the problems for a given section after reading the text and attending class for that section so that you can bring questions to the next class and to office hours well in advance of the homework due date. You are encouraged to seek help early for those aspects of the material you are not understanding, those problems you are finding difficult or confusing, or for a more in depth understanding of the material. Prof. Barron will hold weekly office hours that you can drop in for without an appointment and will be available for meetings by appointment outside of those office hours. The math department will also have help available through the help rooms and the link to this information is on the course webpage under the heading “Resources”.

**Worksheets/Quizzes:** We will occasionally have in-class worksheets and short in-class quizzes to help you stay current with the material, get used to the types of questions that will be on exams, investigate interesting applications of the course material, and so that I can give you more personalized feedback.

**Exams:** There will be three Midterm Exams and a Final Exam. I will arrange to have the Midterm Exams out of class, as this allows for a less time constrained test taking experience. These will not be take home exams; they will be proctored. Tentatively the Midterm Exams will be on the dates listed below. The Final Exam date is set as the date listed.

Exam I	Monday	September 26,	
Exam II	Tuesday	November 1,	
Exam III	Monday	December 5,	
Final Exam	Friday	December 16,	8:00AM–10:00AM.

You need to notify Prof. Barron immediately if you anticipate any conflict with the exam dates and times once they are determined.

Calculators will not be allowed on exams and all exams and quizzes are closed book and closed notes.

**Attendance:** You are expected to attend all classes. Any reason for missing class should be brought to Prof. Barron’s attention **before** the absence if at all possible.

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

Homework	50 pts
Quizzes/Worksheets/Attendance	50 pts
Midterm Exam I	100 pts
Midterm Exam II	100 pts
Midterm Exam III	100 pts
Final Exam	150 pts

**Honor Code:** The Homework, Quizzes and Exams are conducted under the Honor Code. Exams and Quizzes are closed book, closed notes, and are to be done completely by yourself with no assistance from others.

Discussing the course material outside of class and collaborating on homework is highly encouraged, and in fact arguably necessary! However, directly copying the work of others without contributing to working out the solution and/or fully understanding the work constitutes an infringement of the Honor Code. On homework assignments, if you have collaborated with or gotten a lot of help from a fellow classmate, tutor, help center person, or others, in coming up with your solutions, please cite them in your homework. This is the collegial, ethical and obligatory thing to do! Citing the help of others will not result in a reduction of credit for you on the homework submitted.