

Winter 2023
Math 376: Differential Equations 1
12:00 - 12:50 MTTh, Samuelson 102,
(occasional Thursdays Samuelson 138 computer lab)

Instructor: Dr. Jim Bisgard

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Office Hours: M-Th 1:00-1:50, F 10:00 - 10:50 and by appointment, in-person (knock if the door is closed) or Zoom

Course Outcomes: Upon successful completion of this course, the student will be able to:

- Apply existence and uniqueness theorems to initial value problems.
- Formulate initial value problems.
- Solve differential equations using analytic methods.
- Analyze differential equations using numerical software.
- Describe both analytic and approximate solutions clearly using appropriate mathematical notation and language.

Course Goals: The goal of the course is to introduce you to the ideas of differential equations: how to use analytic, graphical and/or numerical methods to investigate the solutions of differential equations, as well as how to derive differential equations to describe phenomena in different sciences. More precisely, we will study first and second order equations. Topics for first order equations include slope fields, bifurcation diagrams and how they describe qualitative behavior. In addition, we will learn some analytic solution techniques including separation of variables and integrating factors. For second order equations, we shall look at the relation between the phase plane and qualitative behavior of solutions, as well as analytic techniques of solution such as the method of undetermined coefficients. In terms of our text, we will cover most of Chapters 1, 2, and 3.

Required Text: Noonburg, Virginia W.; Ordinary Differential Equations: From Calculus to Dynamical Systems 2nd edition; published by AMS

Software: Your homework assignments may have a few problems for which Mathematica will be very useful. CWU has a site license for Mathematica, and as a student you are entitled to your own license. You should make sure that you are able to access the COTS desktops and Mathematica. If you have any difficulty, please let me know.

1 Grades/Exams/Homework

- Grades

Grades will be calculated using the following weighting system:

Exams: 55% total, broken up as follows: 15% for each mid-term and 25% for the final;

Homework: 45%;

and the following scale:

	87 – 89.9 : B+	77 – 79.9 : C+	67 – 69.9 : D+	below 60 : F
93 – 100 : A	83 – 86.9 : B	73 – 76.9 : C	63 – 66.9 : D	
90 – 92.9 : A–	80 – 82.9 : B–	70 – 72.9 : C–	60 – 62.9 : D–	

I will use the following formula to calculate your overall score for the class:

$$(.45) * \frac{\text{HW points earned}}{\text{HW points possible}} + (.15) * \frac{\text{Exam 1 score}}{\text{points possible on Exam 1}} \\ + (.15) * \frac{\text{Exam 2 score}}{\text{points possible on Exam 2}} + (.25) * \frac{\text{Final Exam score}}{\text{points possible on Final Exam}}.$$

- Exams

There will be two exams during the course of the quarter, and a final exam. All exams must be taken in-person, in our regularly scheduled classroom. The exams during the quarter will be Thursday, February 2 and Thursday, February 23. The Final Exam is **FRIDAY, MARCH 17** and is cumulative. The Final exam **CANNOT** be taken early.

- Homework

We will have weekly homework assignments. They will be handed out on Thursday, and be due the following Thursday at 4 pm. There will be a homework due during the final week of class. To do some of the problems, you might need to use a computer. You may work with your classmates on homework (and in fact, I encourage you to do this!), but you should write your solutions using your own words. A really good way to make sure you are not copying is to only use scratch paper when working together, and then write your final solutions on the handout alone. Your homework must be neat and legible, and written using complete sentences where appropriate.

Note also that notation is important: good notation can help you solve a problem, while poor notation can confuse you. Notation includes using words to signpost and explain how you get your answer. As a result, to earn full credit you must correct notation as well as (at least) some words of explanation and/or signposting! Finally, you may not be able to do every problem when the homework is assigned, but you should immediately attempt to do every problem that you can — **DO NOT PROCRASTINATE!**

- **Submitting Work Electronically:** Homework for this course must be submitted electronically through Canvas.

1. Homework may only be submitted in .pdf format, and your submission must consist of a **SINGLE PDF FILE**. That is: you may **NOT submit a separate file for each page of your work! You must combine all parts of your submission into a single pdf prior to submission!**
2. If you choose to hand-write your homework, you have a couple of options for submission:
 - (a) You can scan it to a PDF document using a cell phone camera. Some apps that do this (there are many others if you don't like these): Adobe (free) or CamScanner (free version) for Android phones; the Notes App (built-in) or CamScanner (free version) for iPhone.
 - (b) You can take a well-lit, easy-to-read photograph, insert it into a Microsoft Word or OpenOffice Writer document, make sure that the photo is oriented correctly and easy to read, and then save the document as a .pdf file for upload to Canvas.

Whichever method you choose, please double-check that your images are oriented correctly. Images not oriented correctly or images that are not easy to read will lead to the assignment being returned without being graded.

- Late and Make-up Policy

Homework is due at 4 pm on its due date. Homework submitted after that time on its due date will have 5 points deducted from its score immediately, and 5 more points will be

deducted for every 24 hours after. That means: if you hand in homework at 4:25 pm on Thursday, you can earn at most 20 out of 25 on your homework. If you submit your homework on Friday at 4:25 pm, you can earn at most 15 out of 25, since over 24 hours will have passed. If you are unable to take an exam at its scheduled time, you may be eligible for a make-up. To get a make-up, you must notify me before the exam (if possible) or within 24 hours after the exam. In addition, a make-up is only allowed if you have proof of a compelling reason for having missed the exam. Make-ups will not be given for circumstances you know about ahead of time! When a make-up exam cannot be taken before I return the corrected exam, I reserve the right to instead replace that portion of your course grade with your final exam grade. These considerations also apply to the final: **IF YOU MISS THE FINAL BECAUSE YOU OVERSLEPT OR HAVE THE WRONG DATE, YOU DO NOT GET A MAKE-UP FINAL!**

2 Important Dates

January 10 — Last Day for Add/Drop
February 2 — Mid-term Exam #1
February 17 — uncontested withdrawal deadline
February 23 — Mid-term Exam #2
March 17 — Final Exam

3 General Class Policies

Come to class — attendance is considered necessary for success! You are responsible for all material covered in class, even from days that you are unable to attend! Do your own work. Work really hard; this class is likely to be quite difficult, but you will leave it with a useful set of skills that will be applicable in future courses and careers.

Face Coverings : I strongly encourage you to wear a mask — your mask protects me; my mask protects you. Masks with one-way valves for exhalation do not provide protective value for others — please don't use them as your face covering for any in-person interactions. Thank you for helping keep all of us safe!

Please note that if you wish to come to office hours or an appointment at my office, you **MUST** wear a face-covering. If this is not an option, we can instead meet virtually using Zoom.

Class Recordings: Attendance is considered mandatory, and you should plan to attend on an ongoing basis. Because of the ongoing pandemic, class will be recorded and posted on Canvas. It will not be edited, and I may point to portions of the board that aren't in the view of the camera. (Everybody in class is able to see the entire board, unlike the restricted viewing angle of the camera.) We all benefit from the conversations in-class, and they will be richer for having you there! One of the points of attending classes is to have an expert in the content area provide you with guidance in that content area, and be able to respond to any questions you may have. In addition, we may have some period of class where you will work with your neighbor to solve problems. If you do not attend, you miss out on the substantial benefit these small group interactions provide.

Academic Honesty: The integrity of students and their written and oral work is a critical component of the academic process. Consult university policies (CWUP 5-90-040(22), CWUR 2-90-040(22), and WAC 106-125-020) for student conduct, cheating, plagiarism, and other academic expectations. CWU's policies and recommendations for academic

misconduct will be followed, leading to disciplinary action up to and including failing the course.

Inclusivity Statement: As a member of a peer learning community, a high degree of professionalism is necessary. **CWU expects every member of the university community to contribute to an inclusive and respectful culture across its entire campus including within its classrooms, offices, and at all campus events.**

Classroom Conduct: Students in this class are expected to interact with students and the professor professionally. Instances of disruptive conduct, obstructive conduct, or harassment (see definitions below from the Washington Administrative Code: WAC 106-125-020) will be referred to the Dean of Student Success.

Disability Support Services: Central Washington University is committed to creating a learning environment that meets the needs of its diverse student body. Students with disabilities should contact Disability Services to discuss a range of options to removing barriers, including accommodations: Hogue Hall 126, 509.963.2214, DS@cwu.edu

Religious Obligations and Schedule Conflicts: In compliance with RCW 28B.137.010, Central Washington University makes every effort to deal reasonably and fairly with students who, because of religious obligations, have conflicts with scheduled exams, assignments or required attendance. Students must present written notice to their instructor *within the first two weeks of class* listing the specific dates on which accommodations are required. Contact the Dean of Student Success at (509) 963-1515 for further information or questions.

Switching to Online: If I need to quarantine during the quarter or if CWU decides that the safest way to conduct classes is completely online, class will be run as a synchronous online course, which will meet at its regularly scheduled day and time using Zoom. In this case, I will send all enrolled students a Zoom link and post it to Canvas.

I reserve the right to change the policies contained in this syllabus as dictated by developments during the quarter.