# MATH 231: Differential Equations with Linear Algebra
Syllabus, Fall 2024

**Course Information**.

- 4 semester hours
- Professor: Thomas Scofield
- Prerequisites: C- or better in MATH 172
- Text: Differential Equations and Linear Algebra, 2nd Edition, by Todd Kapitula
- Class meetings: MWF, 11:00–12:05 pm, NH 251

**Catalog Description**.
An introduction to solutions and applications of first and second-order differential equations including Laplace transforms, elementary linear algebra, systems of linear differential equations, numerical methods and nonlinear equations.

**Student Learning Outcomes**. Upon completion of this course, students will be able to

- Perform Gaussian elimination.
- Compute the dimension of subspaces.
- Find eigenvalues and eigenvectors.
- Explicitly solve many scalar first-order ODEs.
- Derive rudimentary ODE models based on physical descriptions of first-order problems.
- Solve systems of ODEs using eigenvalues and eigenvectors.
- Solve scalar linear ODEs of order $n$.
- Use the Laplace transform to solve ODEs with discontinuous forcing.

**Topics**.

1. Solving linear systems of equations
2. Matrix algebra
3. Subspaces, basis, and dimension
4. Eigenvalues and eigenvectors
5. Applications of linear algebra
6. Solving scalar first-order ODEs
7. Numerical methods for solving first-order ODEs
8. Solving systems of first-order ODEs
9. Applications of first-order ODEs
10. Solving scalar $n^{\text{th}}$-order ODEs
11. Applications of $n^{\text{th}}$-order ODEs
12. Heaviside function, delta function, and the Laplace transform
13. Applications of the Laplace transform

**Methods of Evaluation**.

| Assessment | Pct |
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| Assignments | 17% |
| Midterms (Sept. 30, Nov. 4, and Dec. 9) | 57% |
| Final (Dec. 17, at 9 am) | 26% |

**Policies**.

- You are expected to attend class faithfully, in person, ready to go as class begins. When you cannot, regardless of reason, you are responsible for catching yourself up.
- Written work should be neat and well-organized, legibly written in complete sentences, and providing justification in the form of reasoning and mathematical or computational work/plots with shared code. You are expected to be aware of assignments and their due dates. If you are unable to submit work by the due date, you may use one of your allotted late passes in MyOpenMath, adhering to the extra time it provides. Manage the 10 late passes you have well, **saving ones for unforeseen circumstances**.
- Unless directed otherwise on specific assignments, you may freely collaborate with classmates as you explore problems. Your write-ups are to be your own, however. Sections grafted from another student's work, whether in homework or on a test, shall be considered *cheating*, and shall result in an "F" on that assignment or test. The same goes for unauthorized use of aids, and "work" that you cannot explain (answers produced by Wolfram Alpha or some AI engine, for instance). A second instance shall result in a course grade of "F".
- You are expected to take exams on the dates specified, or provide sufficient cause why you cannot. Family trips, pre-arranged flights, etc. are *not* sufficient.
- You are allowed the use of a calculator (not any "smart" devices) while taking exams, though specific instructions may limit the features allowed. At all times, complete transparency that you used a calculator, and for what specific tasks, is expected, with points deducted when this practice is not followed.

**Accommodations**. Calvin University is commited to providing reasonable accommodations for students with disabilities. Students with a documented disability should notify a Disability Coordinator in the Student Success Office (HH 227) to discuss appropriate accommodations. If you have an accommodation memo, talk with me early about arrangements, preferably within the first 2 weeks of the semester.

**Exceptions**. I reserve the right to make changes or exceptions to course policies, including those described in this document, either for the entire class or for individuals. The ultimate goal in this course is **learning**, and formal requirements should not unnecessarily stand in the way of that. Thus, if you think that any of the conditions of the course are interfering with learning, please speak with me about this, and we will consider what can be done.