# Mathematics 226
# Elementary Differential Equations
## Winter, 2025


**Instructor:** George Ballinger
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**Website:** georgeballinger.ca (follow the MATH 226 link for course information)
**Telephone:** 250-370-3116

**Timetable:**

| Time | Monday | Tuesday | Wednesday | Thursday | Friday |
|---|---|---|---|---|---|
| 8:30 am – 9:20 am | MATH 101-002 Room Y219 | MATH 101-002 Room Y219 | MATH 101-002 Room Y219 | MATH 101-002 Room Y219 | MATH 101-002 Room Y219 |
| 9:30 am – 10:20 am | MATH 226-001 Room Y219 | MATH 226-001 Room Y219 | MATH 226-001 Room Y219 | MATH 226-001 Room Y219 | MATH 226-001 Room Y219 |
| 10:30 am – 11:20 am | Office Hour E260 | Office Hour E260 | Office Hour E260 | Office Hour E260 | Office Hour E260 |
| 11:30 am – 12:20 pm | | | MATH 251-X03 Room Y219 | MATH 251-X03 Room Y219 | MATH 251-X03 Room Y219 |
| 12:30 pm – 1:20 pm | | | | | |
| 1:30 pm – 2:20 pm | | MATH 251-X03 Room Y219 | | | |
| 2:30 pm – 3:20 pm | | | | | |
| 3:30 pm – 4:20 pm | | | | | |

**Important Dates:**

| | |
|---|---|
| January 6 | First day of class |
| January 12 | Add Course deadline |
| January 12 | Drop Course with 80% Tuition Refund deadline |
| January 20 | Deferred Tuition & Fee Payment deadline |
| February 17 | Family Day (no class) |
| February 18-21 | Reading Break (no class) |
| April 11 | Last day of class |
| April 12 | Withdrawal deadline |
| April 14-25 | Final exam period |

**Calendar Description:** This course is an introduction to differential equations for students in mathematics, financial mathematics and economics, computer science, physics, and engineering. Topics include: first order differential equations, applications of first order equations, second order differential equations, applications of second order equations, power series solutions, Laplace transforms, first order linear systems, the phase plane, and an introduction to Fourier series. [3 Credits]

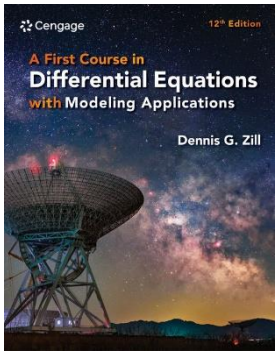
*(Source: Camosun College Calendar calendar.camosun.ca/preview_course_nopop.php?catoid=24&coid=43602)*

**Prerequisites:** C in MATH 101.

**Transfer Credit:** In order to receive transfer credit for UVic MATH 204 (Calculus IV), students must complete *both* MATH 226 *and* MATH 220.

**Textbook:** Dennis Zill, *A First Course in Differential Equations with Modeling Applications,* 12th Edition, Cengage Learning, 2024.

**Course Content:**




**Chapters and Sections**

1. Introduction to Differential Equations
   - 1.1 Definitions and Terminology
   - 1.2 Initial-Value Problems
2. First-Order Differential Equations
   - 2.2 Separable Equations
   - 2.3 Linear Equations
   - 2.4 Exact Equations
   - 2.5 Solutions by Substitutions
3. Modeling with First-Order Differential Equations
   - 3.1 Linear Models
   - 3.2 Nonlinear Models
4. Higher-Order Differential Equations
   - 4.1 Theory of Linear Equations
   - 4.2 Reduction of Order
   - 4.3 Homogeneous Linear Equations with Constant Coefficients
   - 4.4 Undetermined Coefficients - Superposition Approach
   - 4.5 Undetermined Coefficients - Annihilator Approach
   - 4.6 Variation of Parameters
   - 4.7 Cauchy-Euler Equations
   - 4.9 Solving Systems of Linear DEs by Elimination
   - 4.10 Nonlinear Differential Equations
5. Modeling with Higher-Order Differential Equations
   - 5.1 Linear Models: Initial-Value Problems
6. Series Solutions of Linear Equations
   - 6.1 Review of Power Series
   - 6.2 Solutions about Ordinary Points
   - 6.3 Solutions about Singular Points
7. The Laplace Transform
   - 7.1 Definition of the Laplace Transform
   - 7.2 Inverse Transforms and Transforms of Derivatives
   - 7.3 Operational Properties I
   - 7.4 Operational Properties II
   - 7.5 The Dirac Delta Function
8. Systems of Linear Differential Equations
   - 8.1 Theory of Linear Systems
   - 8.2 Homogeneous Linear Systems
   - 8.3 Nonhomogeneous Linear Systems

Introduction to Fourier Series *(notes)*
Plane Autonomous Systems *(notes)*

**Learning Outcomes:** The Intended Learning Outcomes for this course, as approved by the Education Council, are as follows. Upon completion of this course a student will be able to:

1. Use integration to solve 1st and 2nd order differential equations and applied initial value problems.
2. Use power series to solve differential equations.
3. Use Laplace transforms to solve differential equations and applied problems.
4. Sketch trajectories in the phase plane of simple dynamical systems.
5. Compute Fourier coefficients of simple functions.

**A&S Math Lab:** Ewing 224: This drop-in centre is freely available for your use to work on math homework and to seek help from the instructional assistant. Hours are posted on the door or online at camosun.ca/services/academic-supports/help-centres/math-help.

**Academic Integrity:** The Department of Mathematics and Statistics has prepared a handout called *Student Guidelines for Academic Integrity* to help you interpret college policies involving student conduct, academic dishonesty, plagiarism, etc. It is your responsibility to become familiar with the contents of the document and the college policies it references.

**Calculator Policy:** As per department policy, the only calculator permitted for use on tests and the final exam is the Sharp EL-531 (or EL-510R) scientific calculator. No other calculator or any other electronic device including cell phones, smartwatches, etc. is allowed.

**Homework:** There will be periodic assignments (10 all together) to be completed and handed in for marking. They must be completed on the worksheets provided (not on blank paper), copies of which will be handed out in class. While collaboration with your classmates is permitted, you must submit your *own* work and ensure you don't let collaboration turn into plagiarism. You may not post assignment questions to, or copy solutions from, "cheat" websites such as Chegg and ChatGPT.

Due dates for assignments will be posted on the course webpage, and assignments are due by the end of class on the due dates. If you are unable to hand in a hardcopy of your assignment solutions, you may scan and email me a single PDF file (not JPG images) of your assignment so long as it prints legibly and arrives by the deadline. Solutions will be posted soon after assignments are collected. As such*, late assignments will not be accepted under any circumstances*. To further accommodate situations where a student is unable to submit his or her assignment on time (e.g. due to illness), the lowest assignment mark will be dropped when computing the assignment average.

**Tests:** Two term tests are tentatively scheduled for the following dates:

- Test 1 on Wednesday, February 12
  Sec 1.1-4.3
- Test 2 on Wednesday, March 26
  Sec 4.4-7.5

If you miss a test for a legitimate reason such as illness, accident or family affliction, you should notify me (by email, phone/voicemail, or in person) *as soon as possible* and *before* the test, and be prepared to provide supporting documentation upon your return. There will be no "make-up" tests, but instead, in the event of an excused absence, the mark from your final exam, or relevant subset thereof, will replace your test mark.

**Final Exam:**

A comprehensive, 3-hour final exam will take place during the final exam period of April 14-25. The specific date, time, and location will be announced on or about February 14. You must write the final exam at the scheduled time as per Camosun College's policy on final examinations. See camosun.ca/registration-records/policies-and-procedures-students/academic-policies-and-procedures-students#examinations-evaluation.

**Grade Calculation:**

The final grade will be calculated according to the following breakdown:

| | |
|---|---|
| 10 Assignments: | 20%* |
| Test 1: | 20% |
| Test 2: | 20% |
| Final Exam: | 40% |

* The lowest assignment mark will be dropped when calculating the assignment average. This allows you to miss one assignment for any reason, including illness, without penalty. *Late assignments will not be accepted.*

**Grade Scale:**

Final letter grades are assigned as follows:

| 0-49 | 50-59 | 60-64 | 65-69 | 70-72 | 73-76 | 77-79 | 80-84 | 85-89 | 90-100 |
|---|---|---|---|---|---|---|---|---|---|
| **F** | **D** | **C** | **C+** | **B–** | **B** | **B+** | **A–** | **A** | **A+** |

For information on Camosun College's grading policy, see policy E-1.5 online at camosun.ca/about/policies/education-academic/e-1-programming-and-instruction/e-1.5.pdf.