

MATH 210 Section 201

Introduction to Mathematical Computing

Course Outline 2023W2

Introduction to mathematical software and numerical methods. Basic Python programming including numbers, arrays, functions, vectorization and iteration. Sequences and series, root finding, numerical integration, numerical methods for differential equations, systems of linear equations, eigenvalues and mathematical graphics.

Learning Goals

- Create scientific documents with [Jupyter notebook](#) using [markdown](#), [LaTeX](#) and [Python](#)
- Solve problems using mathematical software [NumPy](#), [SciPy](#) and [Matplotlib](#)
- Approximate solutions of nonlinear equations
- Approximate definite integrals and estimate error
- Approximate solutions of ordinary differential equations
- Compute solutions of linear systems of equations

Instructors

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|------------|---------------|--|
| Instructor | Patrick Walls | pwalls@math.ubc.ca |
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Lectures

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|-------------|-------------------------------|-------------------------|
| Section 201 | Monday/Wednesday/Friday 4–5pm | LSK 200 |
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Learning Resources

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| Mathematical Python | Online textbook on mathematical computing with Python |
| Syzygy | Jupyter notebooks for UBC students |
| Canvas | All course information posted on Canvas |

Assessments

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|---------------|----------------------------|---------------------------------------|
| Assignments | $5 \times 2\%$ each = 10% | Jupyter notebooks submitted to Canvas |
| Midterm Exams | $2 \times 20\%$ each = 40% | In class February 14 and March 27 |
| Final Exam | 50% | Exam period April 16–27 |

Lecture Schedule

| Week | Description |
|------|---|
| 1 | Jupyter notebooks, markdown and LaTeX |
| 2 | Basic Python: numbers, variables and sequences |
| 3 | Basic Python: functions, logic and loops |
| 4 | Sequences and series, fixed point iteration |
| 5 | Root finding: bisection, secant and Newton's method |
| 6 | Vectorization, NumPy arrays and functions, plotting with Matplotlib |
| 7 | Numerical integration: Riemann sums, trapezoid rule, Simpson's rule, error formulas |
| 8 | Numerical methods for differential equations, accuracy and stability |
| 9 | Numerical methods for systems of differential equations |
| 10 | Solutions of linear systems of equations, eigenvalues and eigenvectors |
| 11 | Numerical methods for nonlinear equations, Newton's method, gradient descent |
| 12 | Advanced topics and review |

Prerequisites/Corequisites

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|------------------------|---|
| Integral Calculus | One of MATH 101, MATH 103, MATH 105, MATH 121, SCIE 001 |
| Differential Equations | One of MATH 215, MATH 255, MATH 256, MATH 258 |
| Linear Algebra | One of MATH 152, MATH 221, MATH 223 |
| Multivariable Calculus | One of MATH 200, MATH 217, MATH 226, MATH 253, MATH 254 |

- See the [UBC Course Schedule](#)

Important Dates

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|----------------|---|
| January 8 | First lecture |
| February 14 | Midterm Exam 1 |
| February 19–23 | Reading break (no lectures) |
| March 27 | Midterm Exam 2 |
| March 29 | Good Friday (University closed, no lecture) |
| April 1 | Easter Monday (University closed, no lecture) |
| April 12 | Last lecture |
| April 16–27 | Final exam period |

- See the [UBC Academic Calendar 2023/2024](#)

Student Resources

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| Science Advising | Health and Wellbeing | Centre for Accessibility |
| Academic Concession | Academic Integrity | Counselling Services |

University Policies

UBC provides resources to support student learning and to maintain healthy lifestyles but recognizes that sometimes crises arise and so there are additional resources to access including those for survivors of sexual violence. UBC values respect for the person and ideas of all members of the academic community. Harassment and discrimination are not tolerated nor is suppression of academic freedom. UBC provides appropriate accommodation for students with disabilities and for religious observances. UBC values academic honesty and students are expected to acknowledge the ideas generated by others and to uphold the highest academic standards in all of their actions. Details of the policies and how to access support are available on the [UBC Senate website](#).