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## MATH 210 Introduction to Mathematical Computing

*Fall 2018*

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MATH 210 is an introduction to mathematical computing using the Python programming language. We start with basic Python programming (using Python 3 exclusively) including datatypes, logic, loops and functions and then focus on the scientific computing packages NumPy, SciPy, matplotlib and pandas. We use these packages to solve problems in calculus, linear algebra, differential equations and data visualization. Our main tool is Jupyter notebook (hosted on [ubc.syzygy.ca](http://ubc.syzygy.ca)) for writing Python,  $\text{\LaTeX}$  and markdown code.

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**Lectures:** MWF 2-3pm DMP 110. We will be writing Python code in Jupyter notebooks during lectures. Students are **strongly encouraged** to bring a laptop (or any device with a keyboard, browser and WiFi) to class.

**Labs:** Tuesday 3-4pm LSK 121 (L2A), Thursday 2-3pm LSK 121 (L2B) and Thursday 9-10am LSK 121 (L2C). Every student must be registered in one lab section.

**Canvas:** All course information is posted on Canvas (see [students.canvas.ubc.ca](http://students.canvas.ubc.ca))

**Syzygy:** All UBC students have an account on [ubc.syzygy.ca](http://ubc.syzygy.ca) which hosts Jupyter notebooks.

**Assessments:** Final grades are assigned according to the following outline:

- 5% Lab Activities
- 20% Assignments (5 assignments  $\times$  4%/assignment)
- 25% Midterm Exam (in class)
- 50% Final Exam

**Textbook:** *Mathematical Python* ([www.math.ubc.ca/~pwalls/math-python](http://www.math.ubc.ca/~pwalls/math-python))

### Python Resources:

- Official Python Webpage – [python.org](http://python.org)
- Official SciPy Webpage – [scipy.org](http://scipy.org)
- Python Documentation – [docs.python.org/3](http://docs.python.org/3)
- SciPy Lecture Notes – [scipy-lectures.org](http://scipy-lectures.org)
- Style Guide for Python Code – [python.org/dev/peps/pep-0008](http://python.org/dev/peps/pep-0008)

- SciPy 2018 Conference Videos – [youtube.com](https://www.youtube.com)
- Stack Overflow – [stackoverflow.com](https://stackoverflow.com)

#### **Other Resources:**

- L<sup>A</sup>T<sub>E</sub>X – [latex-project.org](https://www.latex-project.org)
- L<sup>A</sup>T<sub>E</sub>X WikiBook – [en.wikibooks.org/wiki/LaTeX](https://en.wikibooks.org/wiki/LaTeX)
- Jupyter Notebooks – [jupyter.org](https://jupyter.org)
- Markdown – [daringfireball.net/projects/markdown/basics](https://daringfireball.net/projects/markdown/basics)

#### **Schedule of Topics:**

- Week 1: Jupyter notebooks, markdown and LaTeX
- Week 2: Basic Python: numbers, variables, sequences and functions
- Week 3: Basic Python: functions, logic and loops
- Week 4: Roots and optimization
- Week 5: NumPy arrays and operations
- Week 6: Plotting with Matplotlib
- Week 7: Numerical integration: Riemann sums, trapezoid rule
- Week 8: Numerical integration: Simpson's rule, applications
- Week 9: Numerical differentiation
- Week 10: Linear systems of equations
- Week 11: Eigenvalues and eigenvectors
- Week 12: Euler's method, improved Euler
- Week 13: Numerical methods for systems of ODEs