

# Partial Differential Equations

## Fall 2022, MATH-UA 263.001

Instructor: Prof. Oliver Bühler, room 1129, Warren Weaver Hall,  
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office hours: tba

Lectures: Tu & Th, 2-3:15pm, room 1302, Warren Weaver Hall  
Recitations: Fri 2-3:15pm, room 304, 194 Mercer.

Teaching Assistant: Ildebrando Magnani [im975@nyu.edu](mailto:im975@nyu.edu)

Homework out Thursdays, due back the following Thursday.

Textbook: Peter J. Olver, “Introduction to Partial Differential Equations”,  
Springer Undergraduate Texts in Mathematics, 2014.  
Corrected publication 2020  
Free online access for NYU students:  
<http://link.springer.com/book/10.1007/978-3-319-02099-0>

Assessment: homework, mid-term and final exam.

### Syllabus

Hyperbolic equations: first-order PDEs, method of characteristics, wave equation in one dimension, initial value problem, energy conservation, spherical waves, characteristic formulation, method of images. Fourier series solution, normal modes.

Traffic waves, conservation laws, shocks, weak solutions.

Parabolic equations: heat equation in one dimension, fundamental solution, maximum principle, boundary conditions, well-posedness.

Linear dispersive waves, Fourier transform method, group velocity.

Elliptic equations: Laplace and Poisson equation, averaging property, well-posedness, Green’s function approach. Classification of second-order equations.