1. Set up least squares problems.

2. Use the pseudo-inverse to solve least squares problems.

3. Set up Newton’s method for systems of equations in several variables. Learn the algorithm to implement Newton’s method on a computer from scratch.

4. Learn how to write and solve compartmental models using rate of change = rate in - rate out.

5. Learn how to derive reaction-diffusion equations from first principles and constitutive laws. Set up simple models involving heat conduction including initial and boundary conditions.

6. Learn the method of separation of variables and the basics of Fourier series representations, for example know how to compute the sine and cosine Fourier coefficients of a function defined on a finite interval \((0, L)\). Would you be clueless if the function were defined on \((a, b)\) instead of \((0, L)\)?

7. Be able to define and use Euler’s method, the explicit and implicit improved Euler methods for ODEs.

8. Be able to explain how to solve a heat equation model on a computer using Euler’s method.