Wave Equation

- Be able to use d'Alembert's formula to solve the wave equation in $\mathbb{R}$.

- Know Kirchoff's and Poisson's formulas for the wave equation in $\mathbb{R}^2$ and $\mathbb{R}^3$.

- Understand the property of finite propagation speed.

- Be able to describe the domains of dependence and influence of a point.

- Be able to use an energy method to prove uniqueness for the wave equation.

Separation of Variables

- Be able to apply the method of separation of variables to find solutions of linear PDEs in simple geometries.

Method of Characteristics

- Understand how to derive the method of characteristics for quasilinear first-order PDEs.

- Be able to use the method of characteristics to solve quasilinear and fully nonlinear first-order Cauchy problems.

- Know how to determine when a classical solution to a first-order Cauchy problem will fail to exist.

Fourier Transform

- Know how to apply the Fourier transform and inverse Fourier transform to a function.

- Understand the properties of the Fourier transform, such as its effect on derivatives and products.

- Be able to use the Fourier transform to find a solution to a linear initial value problem.

Integral Solutions

- Understand how to use the Rankine-Hugoniot condition to determine the motion of a shock for a given conservation law.

- Be able to determine the shape of a rarefaction wave for a given conservation law.

- Know how to use the entropy condition to eliminate the possibility of solutions such as rarefaction shocks.