Eq. 1.1 \[ \nabla^2 u = 0 \] Laplace \[ u = u(x, y, z, t) \]

1.2 \[ \nabla^2 u = f(x, y, z) \] Poisson's

1.3 \[ \nabla^2 u = \frac{1}{\kappa^2} \frac{\partial u}{\partial t} \] Heat Flow / Diffusion

1.4 Wave \[ \nabla^2 u = \frac{1}{v^2} \frac{\partial^2 u}{\partial t^2} \]

1.5 \[ \nabla^2 F(x, y, z) + k^2 F(x, y, z) = 0 \] Helmholtz wave Eq.

1.6 \[ \frac{-\hbar^2}{2m} \nabla^2 \psi + V \psi = i \hbar \frac{\partial \psi}{\partial t} \] Schrödinger

Note \[ \nabla^2 = \frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2} + \frac{\partial^2}{\partial z^2} \]

is an example of a separable differential operator and

\[ \nabla^2 = \frac{\partial^2}{\partial x \partial y} + \frac{\partial^2}{\partial y \partial z} + \frac{\partial^2}{\partial z \partial x} \]

is non-separable. The Laplacian \( \nabla^2 \) separates only in a finite # of coordinates.