Problem 1. [10] Referring to the Kirchhoff formula, explain the physical difference between the 2D and 3D cases of wave phenomena; namely, consider a disturbance propagating from a point source and comment on what happens behind the wave front $|x| = at$, i.e. for later times, $t > |x|/a$.

Problem 2. [20] Find the volume (“domain”) potential of a spherical layer, $a \leq r \leq b$ with a constant charge density $\rho_0$.

Problem 3. [20] Solve the boundary/initial value problem on a half-line:

\[
\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}, \quad x \in \mathbb{R}^+, \quad t > 0,
\]

\[
u(x, 0) = f(x); \quad x \in \mathbb{R}^+,
\]

\[
u_x(0, t) = 0, \quad t > 0.
\]