1. Discretization

We define our approximate solution to be in the Soblev space $H^1(\Omega)$. The Soblev space is a space of continuous functions that are infinitily differentiable. The span of the Soblev space is infinite, so we will consider a finite subspace $V_h \subset H^1(\Omega)$, and we will construct our approximation in this subspace. We define a set of basis functions for the subspace V_h to be $\{\varphi_j\}$. We leave these basis functions as arbatrairy functions for now, and will show the process for the constructions of the basis functions in a later section.

The approximation of T we define as T_h. It is posible to express this apprximation as a linear combination of the basis functions φ_j for the finite subspace V_h that T_h is within. We write this expression as

$$T_h = \sum_{j=1}^{N} T_j \varphi_j(\vec{x}),$$

where T_j is a constant that we solve for later to achieve our final apprximation.