<u>Variational formulation</u> : find $u \in V$:

(V) $\quad (\nabla u, \nabla v) = (f, v) \qquad \forall v \in V$

$V = \{ v : \int_\Omega (|\nabla v|^2 + v^2)\, dx < \infty \ \& \ v = 0 \text{ on } \Gamma \}$

$V_h = \{ v \in V : v \text{ p.w. const. on } \mathcal{T}_h \}$

Degrees of freedom of $v \in V_h$: $\mathcal{N}_h = \{N\}$
set of ~~internal~~ <u>nodes</u> of $\mathcal{T}_h$
(homogeneous Dirichlet b.c.)

Let $\{N_1, \dots, N_M\}$ be an enumeration of $\mathcal{N}_h$
Let $\{\varphi_1, \dots, \varphi_M\}$ be corresponding nodal basis for V_h

<u>Galerkin FEM</u> : Find $U \in V_h$ such that

(G) $\quad (\nabla U, \nabla v) = (f, v) \qquad \forall v \in V_h$

$V_h \subset V \Rightarrow$ Galerkin orthogonality: (V)−(G)

$$(\nabla u - \nabla U, \nabla v) = 0 \qquad \forall v \in V_h$$