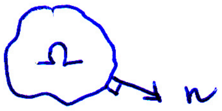
Multiply $-\Delta u = f$ by $v \in V$ and use Green's formula (partial integration in $\mathbb{R}^d$, $d>1$)

$$\int_\Omega f v\,dx = -\int_\Omega \Delta u\, v\,dx = -\int_\Gamma \partial_n u\, v\,ds + \int_\Omega \nabla u \cdot \nabla v\,dx = \int_\Omega \nabla u \cdot \nabla v\,dx$$

(since $v \in V \Rightarrow v = 0$ on Γ)

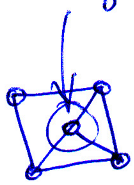


[Normal derivative $\partial_n u = \nabla u \cdot n = \dfrac{\partial u}{\partial x_1} n_1 + \dfrac{\partial u}{\partial x_2} n_2$
with $n = (n_1, n_2)$ outward unit normal]

$\Rightarrow$ (D) and (W) have the same solution
(if f continuous, see Ch. 21)

A triangular mesh of Ω (with a polygonal Γ) $\mathcal{T}_h = \{K\}$ is a sub-division of Ω into a non-overlapping set of triangles/elements/cells K, constructed such that no vertex of one triangle lies on the edge of another triangle:

no "hanging nodes"



$\mathcal{N}_h = \{N\}$ nodes/vertices of $\mathcal{T}_h$

$\mathcal{S}_h = \{S\}$ edges of $\mathcal{T}_h$