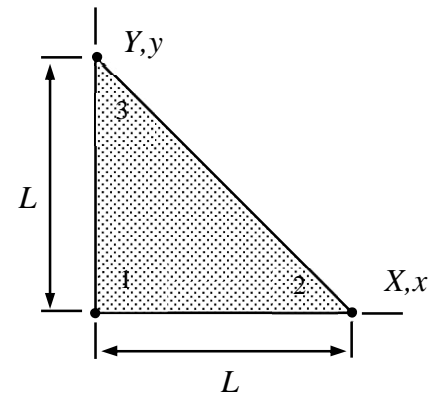


Name _____ Student number _____

Assignment 2

Consider the temperature distribution in the structure shown which is composed of one triangle element. Assuming that the thermal conductivity k and thickness t of the element are constants, derive the element contribution δP^{int} . Temperature at nodes 1 and 2 is known to be ϑ° and the unknown nodal temperature is ϑ_3 .



Solution template

In stationary thermo-elasticity, the variational densities of the thin slab mode of the plate model

$$\delta p_{\Omega}^{\text{int}} = - \left\{ \frac{\partial \delta \vartheta}{\partial x} \right\}^T kt \left\{ \frac{\partial \vartheta}{\partial x} \right\}, \quad \delta p_{\Omega}^{\text{ext}} = \delta \vartheta s$$

represent the energy balance. Linear shape functions of the temperature approximation can be deduced from the figure

$$N_2 = \underline{\hspace{2cm}}, \quad N_3 = \underline{\hspace{2cm}}, \quad N_1 = 1 - N_2 - N_3 = \underline{\hspace{2cm}}.$$

Approximation to $\vartheta(x, y)$ and its variation $\delta \vartheta(x, y)$ (notice that the variation of a given quantity vanishes)

$$\vartheta = \underline{\hspace{2cm}}, \quad \frac{\partial \vartheta}{\partial x} = \underline{\hspace{2cm}}, \quad \frac{\partial \vartheta}{\partial y} = \underline{\hspace{2cm}},$$

$$\delta \vartheta = \underline{\hspace{2cm}}, \quad \frac{\partial \delta \vartheta}{\partial x} = \underline{\hspace{2cm}}, \quad \frac{\partial \delta \vartheta}{\partial y} = \underline{\hspace{2cm}}.$$

When the approximation is substituted there, the variational density simplifies to

$$\delta p_{\Omega}^{\text{int}} = \underline{\hspace{4cm}}.$$

Integration over the element gives

$$\delta P^{\text{int}} = \int_{\Omega} \delta p_{\Omega}^{\text{int}} dA = \underline{\hspace{4cm}}. \quad \leftarrow$$