

Exercise 6.2.1

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Given the Poisson's equation in one dimension:

$$-\frac{d^2u}{dx^2} = f(x)$$

With boundary conditions:

$$u(0) = 0, \frac{du}{dx}(1) = 0$$

Only homogeneous boundary conditions and operator $L = \frac{d^2}{dx^2}$, so the corresponding minimisation problem is given by:

$$J[u] = \int_0^1 \frac{1}{2} uLu - uf dx = \int_0^1 \frac{1}{2} \left(\frac{du}{dx}\right)^2 - uf dx$$