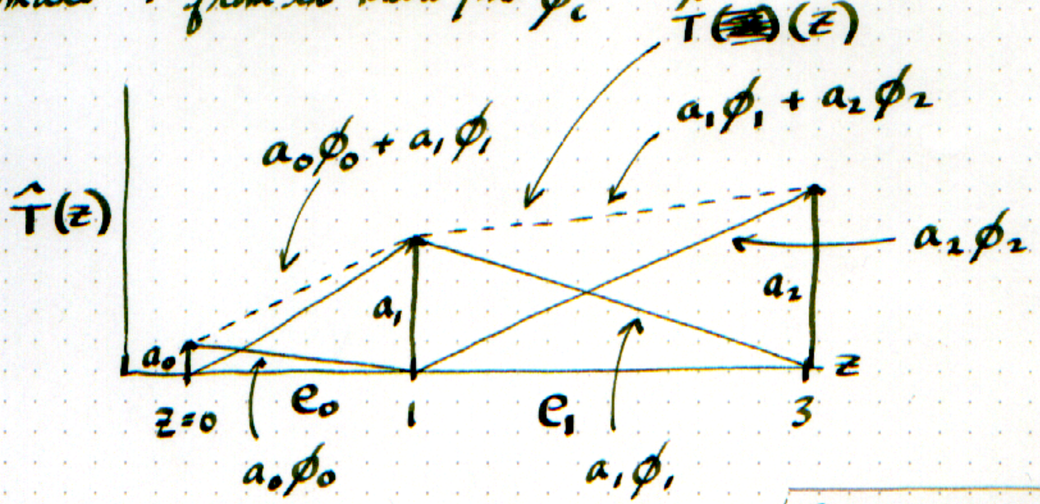
To make $\hat{T}$ from the Basis fns ϕ_i



so we approx the soln $T(z) \cong \hat{T}(z) = \boxed{\sum_{i=0}^{2} a_i \phi_i(z)}$

Our problem is to find the a_i that best fit:

$$\frac{\partial^2 \hat{T}}{\partial z^2} + \frac{g}{K} = 0 \quad \text{with BC's} \quad T(0) = 0$$

$$\frac{dT}{dz}(3\,km) = 0$$

in the Galerkin F.E. formulation:

we solve $\displaystyle\int_0^3 \underbrace{\left(\frac{\partial^2 \hat{T}}{\partial z^2} + 3\right)}_{R(\hat{T})} \cdot \frac{\partial \hat{T}}{\partial a_i}\, dz = 0$ ← this is the minimization of the Residual $\left(\int_\Omega R \frac{\partial \hat{u}}{\partial a_i}\, d\Omega = 0\right)$

using the notation $\langle a, b \rangle^\Omega = \int_\Omega a \cdot b \, dx$ and $\frac{\partial^2 \hat{T}}{\partial z^2} \equiv \hat{T}''$ this is:

$$\left\langle \hat{T}'' + 3, \phi_i(z) \right\rangle = 0 \qquad i = 0,1,2$$

note that $\displaystyle\frac{\partial}{\partial a_i}\left(\sum_{i=0}^{2} a_i \phi_i(z)\right)$

$$\frac{\partial \hat{T}}{\partial a_i} = \phi_i \qquad i = 0,1,2$$

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the result $\left\langle \hat{T}''(z) + 3, \phi_i(z) \right\rangle = 0 \quad i = 0,1,2$ is 3 eqns in the 3 unknowns a_i

But $\hat{T} = a_0\phi_0 + a_1\phi_1 + a_2\phi_2$

PROBLEM → and $\hat{T}''$ in this form $= 0$! since ϕ_i is linear in z and the 2nd derivative $= 0$!