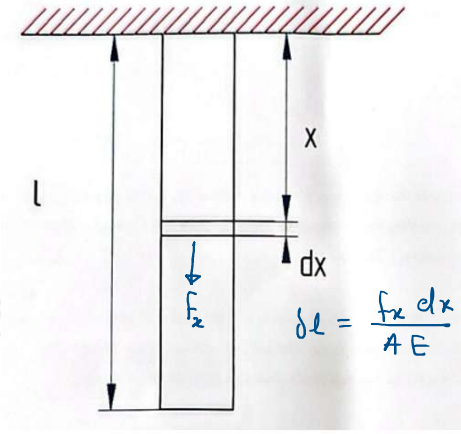
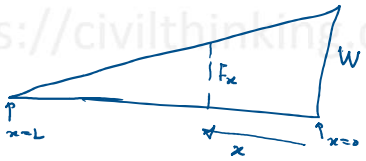
Calculate the total deformation due to gravity of a homogeneous rod with length l, made of material with density ρ and Young's modulus E



$$\int_0^{\Delta L} \delta l = \int_0^L \frac{w \cdot \frac{L-x}{L} \cdot dx}{AE}$$



$$\frac{w}{L} = \frac{f_x}{L-x} \Rightarrow F_x = w \times \frac{L-x}{L}$$

$$\Delta L = \frac{w}{AEL} \int_0^L (L-x) \cdot dx$$

$$\Delta L = \frac{w}{AEL} \left[Lx - \frac{x^2}{2} \right]_0^L$$

$$= \frac{w}{AEL} \left[L^2 - \frac{L^2}{2} \right] = \frac{w}{AEL} \frac{L^2}{2} = \frac{wL}{2AE} = \frac{mgL}{2AE} = \frac{\rho \times A \times L \, g L}{2AE} = \frac{\rho g L^2}{2E}$$

☑ Engineering Software (ANSYS, ETABS, MATLAB, Revit, etc.) Let us help you solve your engineering challenges! 🚀