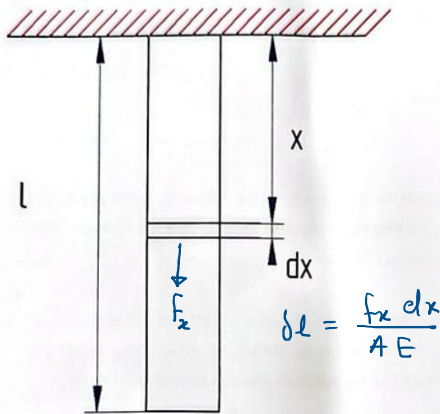


Calculate the total deformation due to gravity of a homogeneous rod with length l , made of material with density ρ and Young's modulus E

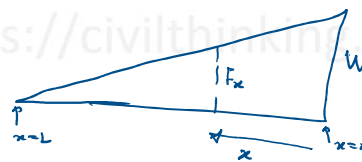


$$\int_0^L \delta l = \int_0^L \frac{w \cdot \frac{L-x}{L} \cdot dx}{AE}$$

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

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

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



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

This problem was solved by Civil Thinking (<https://civilthinking.com>)

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