Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Student number\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

*L*

*x*

*y*

*g*

**Assignment 1**

The column of the figure is loaded by its own weight. Determine stress , strain  and displacement  as functions of . Cross-sectional area *A* and density  of the material are constants. Assume that stress and strain are related by Hooke’s law .

**Solution template**

Let us start with the axial force  by considering the equilibrium of the column part shown

*x*

**

**

Weight of the column part 

Equilibrium equation 

Axial force 

Stress at  follows from definition “force divided by the area” as directed area and force are aligned in the present problem.

Stress  . **🡸**

Strain at  follows from the stress-strain relationship .

Strain . **🡸**

Displacement of the column at *x* follows from the definition of strain (strain-displacement relationship)  to be considered as an ordinary first order differential equation to displacement . Let the integration constant be .

Generic solution to displacement 

Displacement is known to vanish at . Elimination the integration constant by using the boundary condition  gives the displacement for the problem.

Displacement . **🡸**