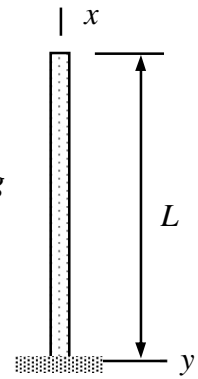


Name \_\_\_\_\_ Student number \_\_\_\_\_

## Assignment 1 (2p)

The column of the figure is loaded by its own weight. Determine stress  $\sigma_{xx}$ , strain  $\varepsilon_{xx}$  and displacement  $u_x$  as functions of  $x$ . Cross-sectional area  $A$  and density  $\rho$  of the material are constants. Assume that stress and strain are related by Hooke's law  $\sigma_{xx} = E\varepsilon_{xx}$ .



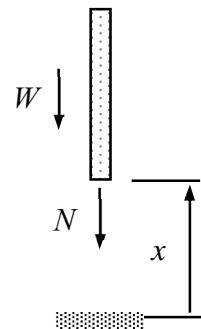
### Solution template

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

Weight of the column part  $W =$  \_\_\_\_\_

Equilibrium equation \_\_\_\_\_ = 0

Axial force  $N =$  \_\_\_\_\_



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

Stress  $\sigma_{xx} =$  \_\_\_\_\_ . ←

Strain at  $x$  follows from the stress-strain relationship  $\sigma_{xx} = E\varepsilon_{xx}$ .

Strain  $\varepsilon_{xx} =$  \_\_\_\_\_ . ←

Displacement of the column at  $x$  follows from the definition of strain (strain-displacement relationship)  $\varepsilon_{xx} = du_x / dx$  to be considered as an ordinary first order differential equation to displacement  $u_x$ . Let the integration constant be  $C$ .

Generic solution to displacement  $u_x =$  \_\_\_\_\_

Displacement is known to vanish at  $x = 0$ . Elimination the integration constant by using the boundary condition  $u_x(0) = 0$  gives the displacement for the problem.

Displacement  $u_x =$  \_\_\_\_\_ . ←