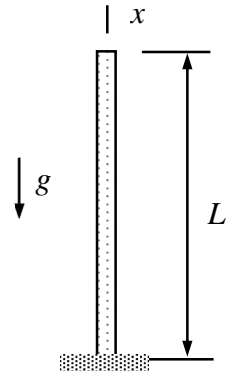


Name \_\_\_\_\_ Student number \_\_\_\_\_

## Assignment 2

Find the displacement  $u(x)$  of the column shown by using the boundary value problem

$$EA \frac{d^2 u}{dx^2} - \rho A g = 0 \quad x \in ]0, L[, \quad u = 0 \text{ when } x = 0, \quad EA \frac{du}{dx} = 0 \text{ when } x = L.$$



Assume that the cross-sectional area  $A$ , Young's modulus  $E$  of the material, density  $\rho$  of the material, and acceleration by gravity  $g$  are constants.

### Solution template

First, repeated integrations with the differential equation are used to find the generic solution. Let the integration constants be  $a$  and  $b$  :

$$\frac{d^2 u}{dx^2} = \frac{\rho g}{E} \Rightarrow \frac{du}{dx} = \underline{\hspace{2cm}} \Rightarrow u(x) = \underline{\hspace{2cm}}.$$

Second, boundary conditions are used to find the values of the integration constants  $a$  and  $b$  :

$$u(0) = \underline{\hspace{2cm}} = 0 \quad \text{and} \quad EA \frac{du}{dx}(L) = \underline{\hspace{2cm}} = 0 \Rightarrow b = \underline{\hspace{2cm}} \quad \text{and} \quad a = \underline{\hspace{2cm}}.$$

Finally, the values of the integration constants are substituted into the generic solution to get the displacement solution:

$$u(x) = \underline{\hspace{2cm}}. \quad \leftarrow$$