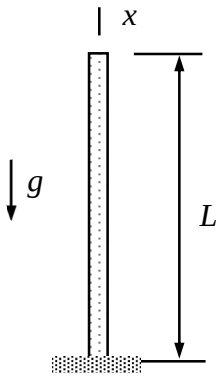
Name_____ Student number_____

Assignment 2

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



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

Assume that the cross-sectional area A, Young's modulus E of the material, density ρ 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:

$$\frac{d^2u}{dx^2} = \frac{\rho g}{E} \quad \Rightarrow \quad \frac{du}{dx} = \_\_\_\_\_ \quad \Rightarrow \quad u(x) = \_\_\_\_\_\,.$$

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

$$u(0) = \_\_\_\_\_ = 0 \text{ and } EA\frac{du}{dx}(L) = \_\_\_\_\_ = 0 \quad \Rightarrow \quad b = \_\_\_\_ \text{ and } a = \_\_\_\_\,.$$

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

$u(x) =$ _____ .