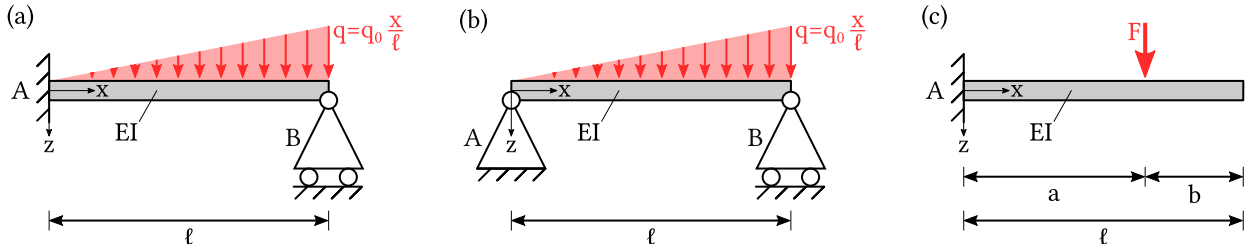
Exercise 10: Bending and buckling

Jan. 17, 2022 - Jan. 21, 2022

Question 1

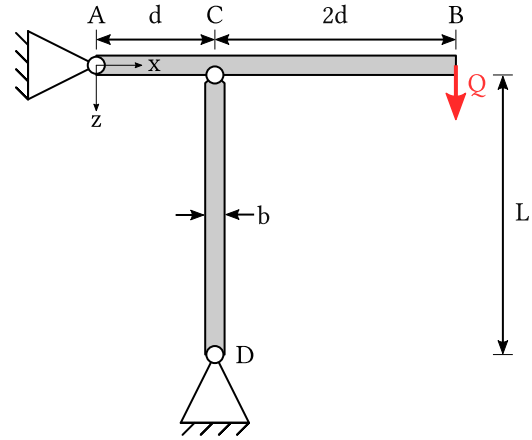
Determine if the following structures are statically determinate! Calculate the deflection and the reaction forces and moments at the supports!



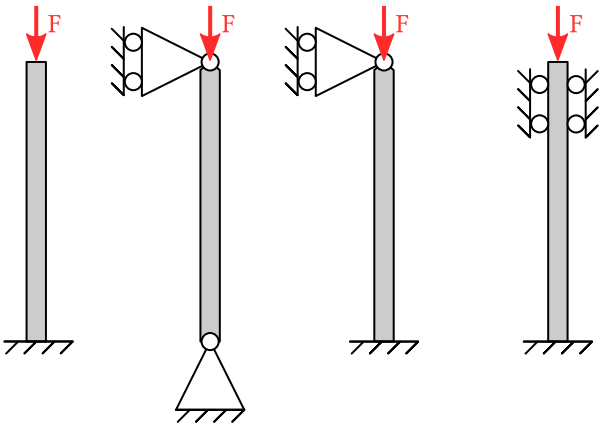
Question 2

Reference: Gere and Timoshenko, Mechanics of Materials, 4th ed., PWS Publishing Company (p. 789)

A horizontal beam AB is supported by a pinned-end column CD, as shown in the figure. The column is a solid steel bar (Young's modulus $E = 200\,\mathrm{GPa}$) of square cross-section having length $L = 1.8\,\mathrm{m}$ and side dimensions $b = 50\,\mathrm{mm}$. For safety reasons, the normal force in column CD should not exceed *half* the critical buckling force F_{crit}. Determine the maximum allowable force Q!



Reminder: Euler buckling cases



$$F_{\mathrm{crit}} = \frac{\pi^2 EI}{4L^2} \qquad \frac{\pi^2 EI}{L^2} \qquad \frac{2.046\pi^2 EI}{L^2} \qquad \frac{4\pi^2 EI}{L^2}$$

Question 3

Calculate the second moment of area I_y for a regular hexagon: