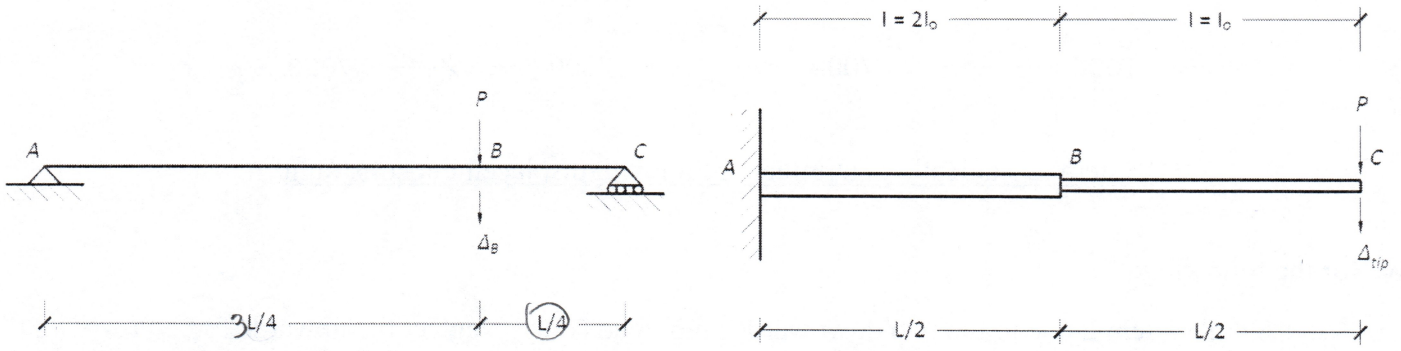
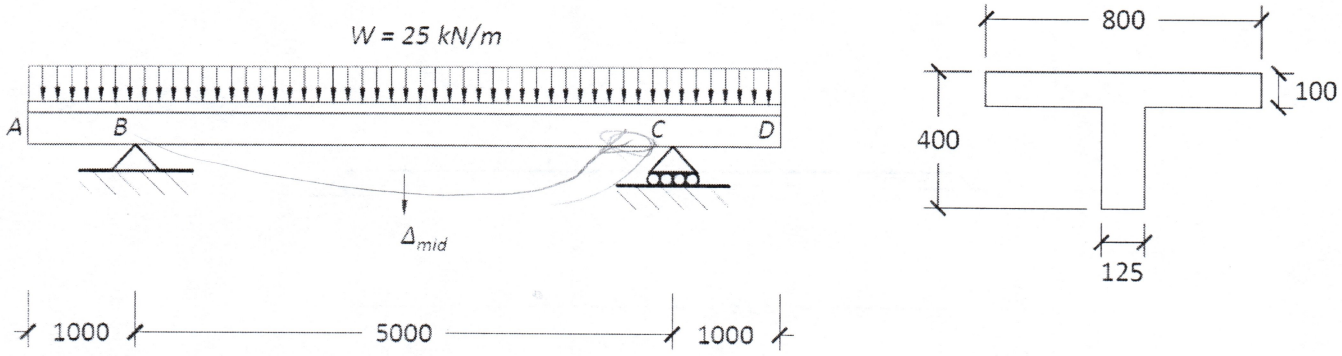
A/h

CIV 102F Problem Set # 7 - November 7 and 8, 2019
Due in Lecture on November 18, 2019

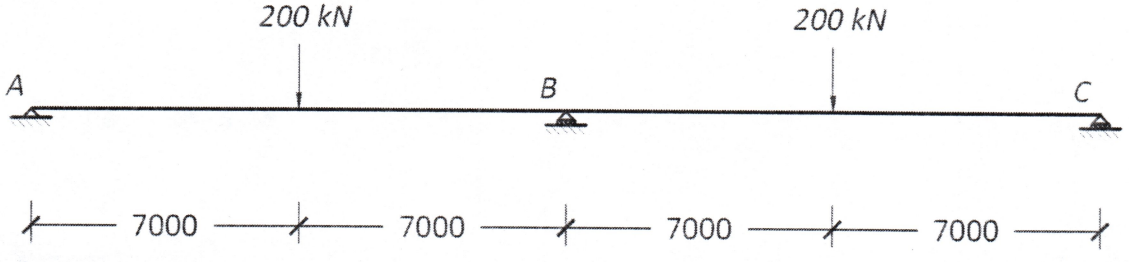
1. For the two beams shown below, draw the shear force diagrams, bending moment diagrams and curvature diagrams. Calculate the unknown displacements shown on each figure. Express your results in terms of P, L, E and I (I_o for the cantilever on the right).



2. For the following beam, draw the shear force diagram, bending moment diagram and curvature diagram. Calculate the midspan displacement and the slope of the beam at points B and C. Sketch out the displaced shape and indicate the points of inflection. Assume E = 30,000 MPa when performing your calculations. All dimensions are in mm.

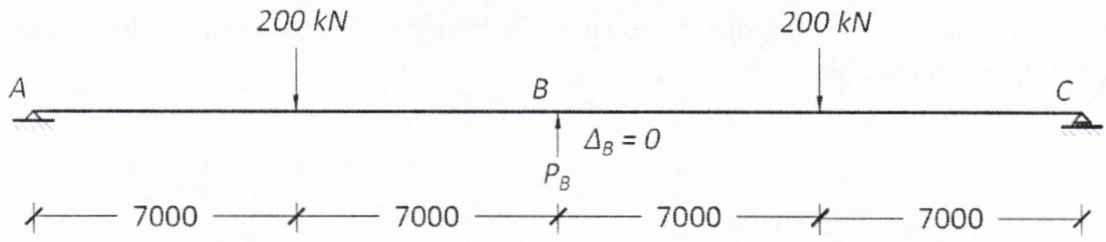


3. Shown below in System 1 is a statically indeterminate beam – there are four unknown reaction forces, which cannot be solved by the three equilibrium equations alone. All dimensions are in mm.



System 1: Statically indeterminate beam

The statically indeterminate beam in System 1 is equivalent to System 2 shown below, which is a simply supported beam where the upwards force P_B causes the downwards displacement at point B to be zero.



System 2: Statically determinate beam with displacement constraint

Solve for the following:

a. Find Δ_B in System 2 due to the two downwards point loads only. Neglect the upwards force P_B.
b. In System 2, remove the two 200 kN point loads and solve for P_B which would cause an upwards displacement Δ_B equal to the downwards displacement found in part (a).
c. From your results in parts (a) and (b), draw the shear force and bending moment diagrams for system 1.

Perform your calculations assuming the E = 200,000 MPa and I = 1.00×10^9 mm^4.

4. Determine the location of maximum displacement in the following beam and calculate it. Calculate the slopes at points A and B. Express your answer in terms of P, E, I and L.