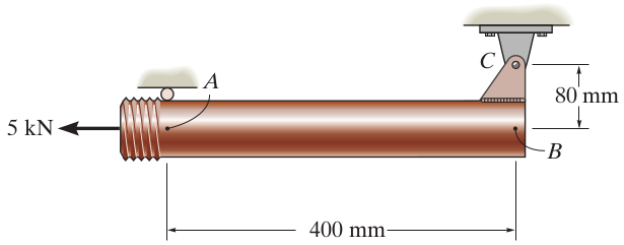
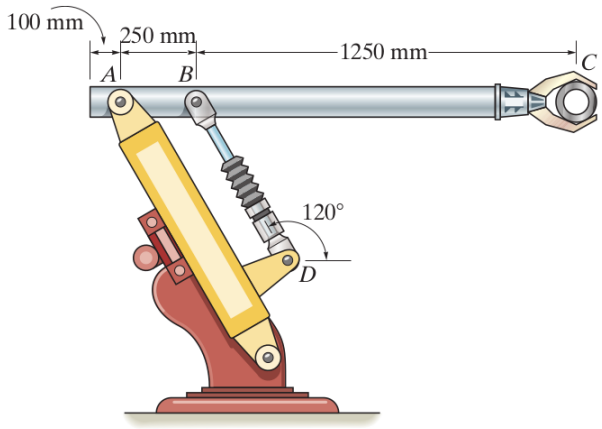
Tutorial Sheet 2A: Bending of Beams

Students are encouraged to plot the shear and moment diagrams using computer programs.

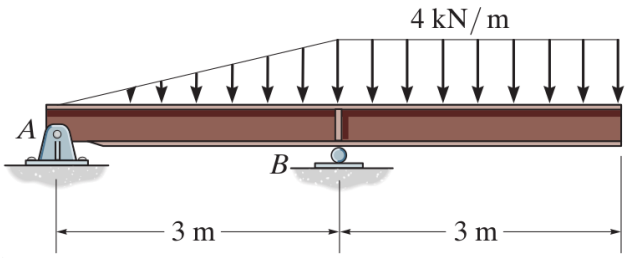
1. Draw the shear force and bending moment diagrams for the pipe. The end screw is subjected to a horizontal force of 5 kN.



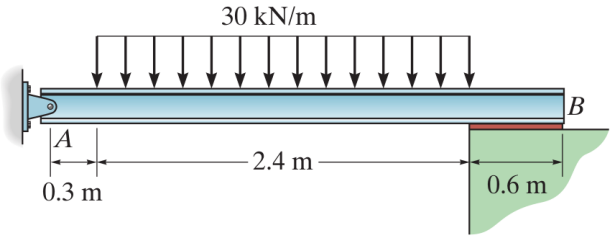
2. The industrial robot is held in the stationary position shown. Draw the shear force and bending moment diagrams of the arm ABC if it is pin connected at A and connected to a hydraulic cylinder (two-force member) BD. Assume the arm and grip have a uniform weight of 0.3 N/mm and support the load of 200 N at C.



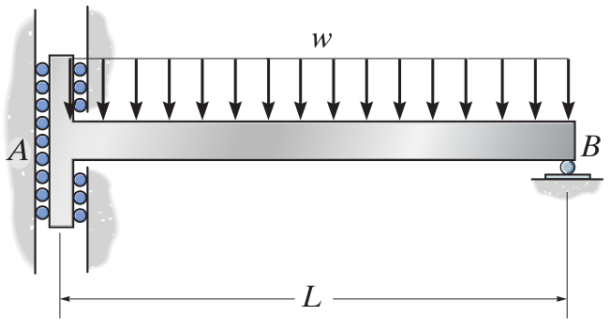
3. Draw the shear and moment diagrams for the overhanging beam.



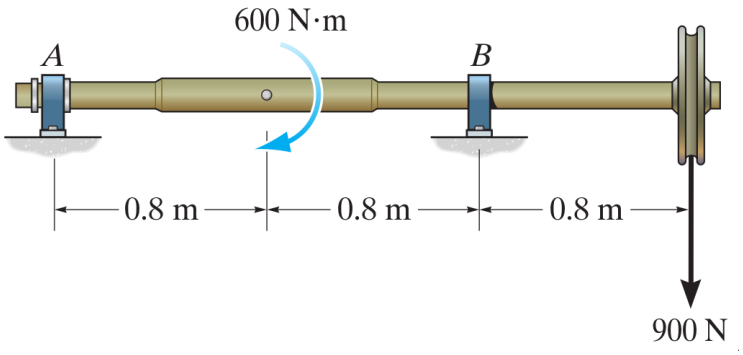
4. The beam is bolted or pinned at A and rests on a bearing pad at B that exerts a uniform distributed loading on the beam over its length of 0.6 m. If the beam supports a uniform loading of 30 kN/m, draw the shear and moment diagrams.



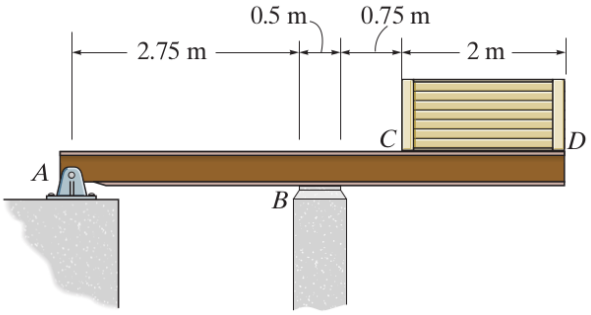
5. Draw the shear and moment diagrams for the beam when the support at A allows it to slide freely along the vertical guide and hence it cannot support a vertical force.



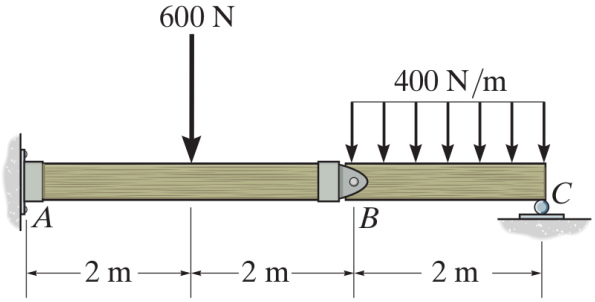
6. The shaft is supported by a smooth thrust bearing at A and a smooth journal bearing at B. Draw the shear and moment diagrams for the shaft.



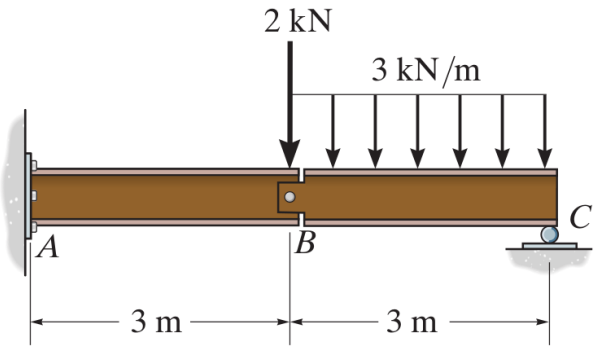
7. The beam is used to support a uniform load along CD due to the 6-kN weight of the crate. If the reaction at bearing support B can be assumed to be uniformly distributed along its width, draw the shear and moment diagrams for the beam.



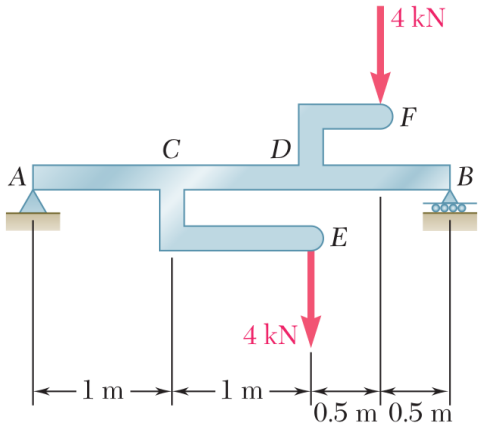
8. The compound beam is fixed at A, pin connected at B, and supported by a roller at C. Draw the shear and moment diagrams for the beam.



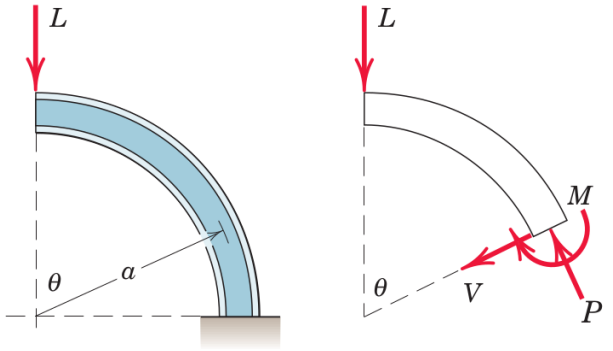
9. The compound beam is fixed at A, pin connected at B, and supported by a roller at C. Draw the shear and moment diagrams for the beam.



10. Draw the shear and bending moment diagrams for the beam and loading shown.



11. A curved cantilever beam has the form of a quarter circular arc. Determine the expressions of the shear force V and the bending moment M as functions of θ. The depth of the beam is much smaller than the arc radius.



12. Construct the shear and moment diagrams for the loaded beam shown. Determine the maximum bending moment and its location. [$M_{\max} = 6.23$ kN·m at $x = 2.13$ m]