3. A rigid beam AC is supported by three columns, as shown in Figure 3. The cross sectional area of side columns is 3500 mm^2, and the central column is 2000 mm^2. The Young's modulus E = 200 GPa for each column.
   (a) Use the principle of virtual displacements to determine the vertical displacement v of the rigid beam when a vertical load P = 540 kN is applied.
   (b) Determine the axial forces carried in each column. (20%)

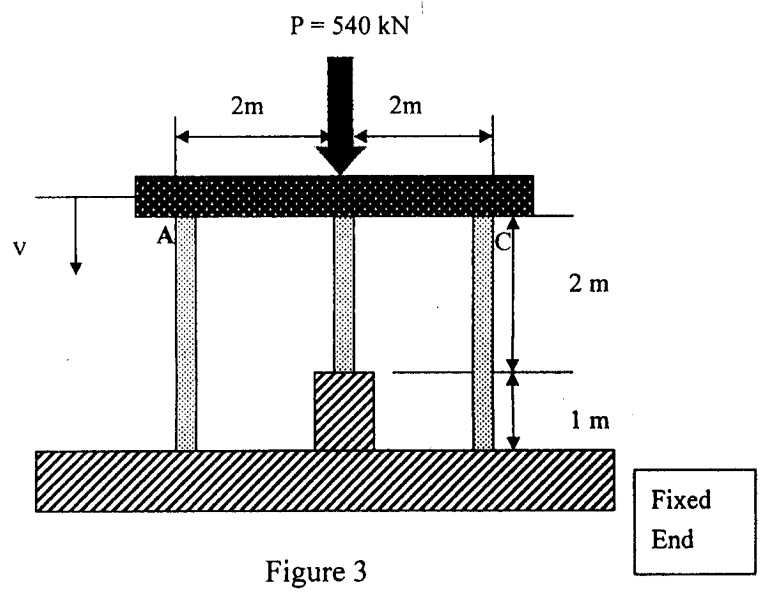

Figure 3

4. Construct the shear-force and bending-moment diagrams for the beam shown in Figure 4. (20%)

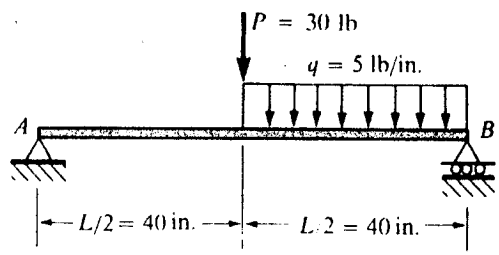

Figure 4