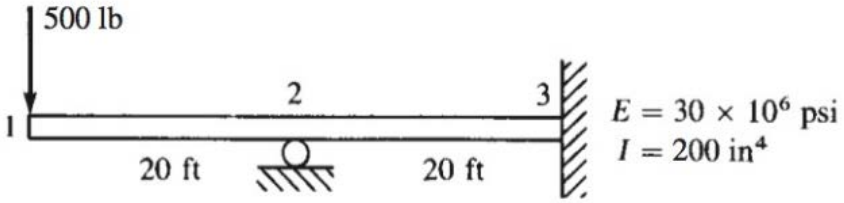
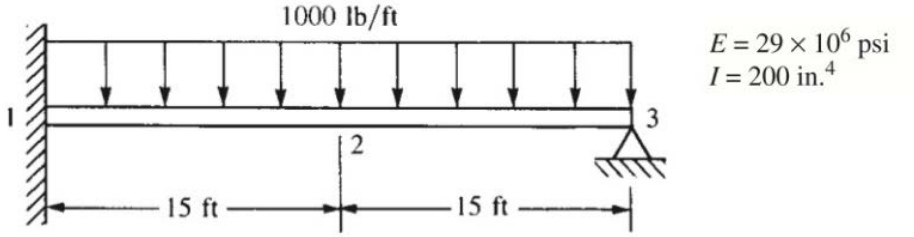
Homework Assignment #4

1. For the beam shown in Figure P4-7, determine the nodal displacements and rotations, the forces and moments in each element and the reactions at the supports:



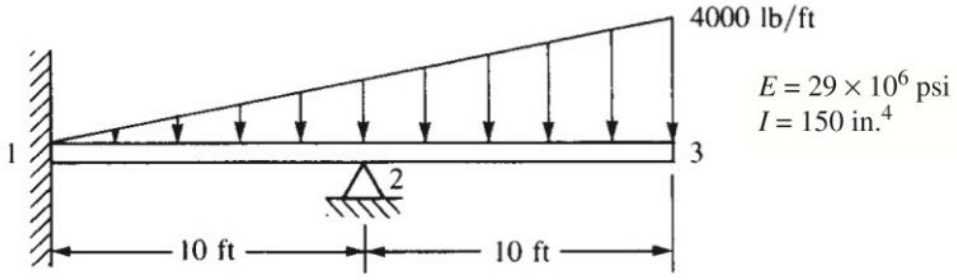
■ Figure P4–7

2. For the beam shown in Figure P4-23, determine the nodal displacements and rotations, the forces and moments in each element and the reactions at the supports:



■ Figure P4–23

3. For the beam shown in Figure P4-24, determine the nodal displacements and rotations, the forces and moments in each element and the reactions at the supports:



■ Figure P4–24

4a) For the beam shown in Figure P4-23, show that the function

$$v(x) = -\frac{w_0 \ell^4}{EI}\left\{\frac{1}{16}\left(\frac{x}{l}\right)^2 - \frac{5}{48}\left(\frac{x}{l}\right)^3 + \frac{1}{24}\left(\frac{x}{l}\right)^4\right\}$$

exactly satisfies the governing differential equation for the case

$$w(x) = -EI\,\frac{d^4v}{dx^4}$$

where $w(x) = w_0 =$ constant and boundary conditions given by $v(0) = v(\ell) = 0, \phi(0) = 0$. For Problem 4-23, $w_0 = 1000\,\frac{\text{lb}}{\text{ft}}$, $\ell = 30$ ft, $E = 29$ x 10^6psi and $I = 200$ in^4.

b) Using Matlab (or another computer plotting tool), plot the exact solution given in part (a) to the finite element solution derived in Problem 2 (similar to Fig 4-31a). In plotting the finite element solution, use the interpolation functions to show the variation of displacement within each element.