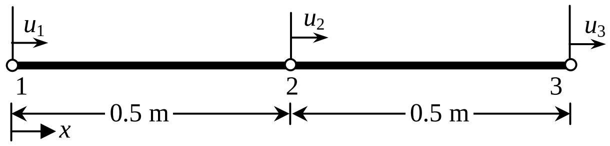
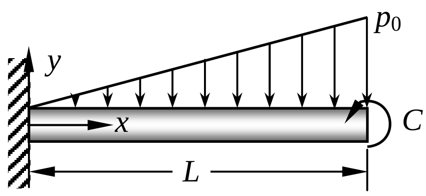
1. Solve Problem 2.5-3 using two beam elements. Write matrix equation after applying boundary conditions

2. Consider a bar element with three nodes, as shown in the figure. When the solution is approximated by $u(x) = N_1(x)u_1 + N_2(x)u_2 + N_3(x)u_3$, calculate interpolation functions $N_1(x), N_2(x), N_3(x)$. When a distributed load q_0 is uniformly distributed on the element, calculate work-equivalent nodal forces.



3. Use the Rayleigh-Ritz method to determine the deflection $v(x)$, bending moment $M(x)$, and shear force $V_y(x)$ for the beam shown in the figure. Assume EI = 1,000 N-m^2, L = 1 m, and p_0 = 100 N/m, and C = 100 N-m. The displacement is expressed as $v(x) = c_0 + c_1 x + c_2 x^2 + c_3 x^3$. Make sure the displacement boundary conditions are satisfied a priori. **Hint:** Potential energy of a couple is calculated as $V = -Cdv / dx$, where the rotation is calculated at the point of application of the couple.



4. Solve problem 4.5-8.

5. A space frame structure as shown in the figure consists of 25 truss members. All members have the same circular cross-sections with diameter d = 0.5 in. At nodes 1 and 2, a constant force F = 60,000 lb is applied in the y–direction. Four nodes (7, 8, 9, and 10) are fixed on the ground. The frame structure is made of a steel material whose properties are Young's modulus E = 3×10^7 psi, Poisson's ratio ν = 0.3. Calculate displacements of all nodes and stress of all members using finite element software. Provide a plot that shows labels for elements and nodes along with boundary conditions. Provide deformed geometry of the structure and a table of stress in each element.