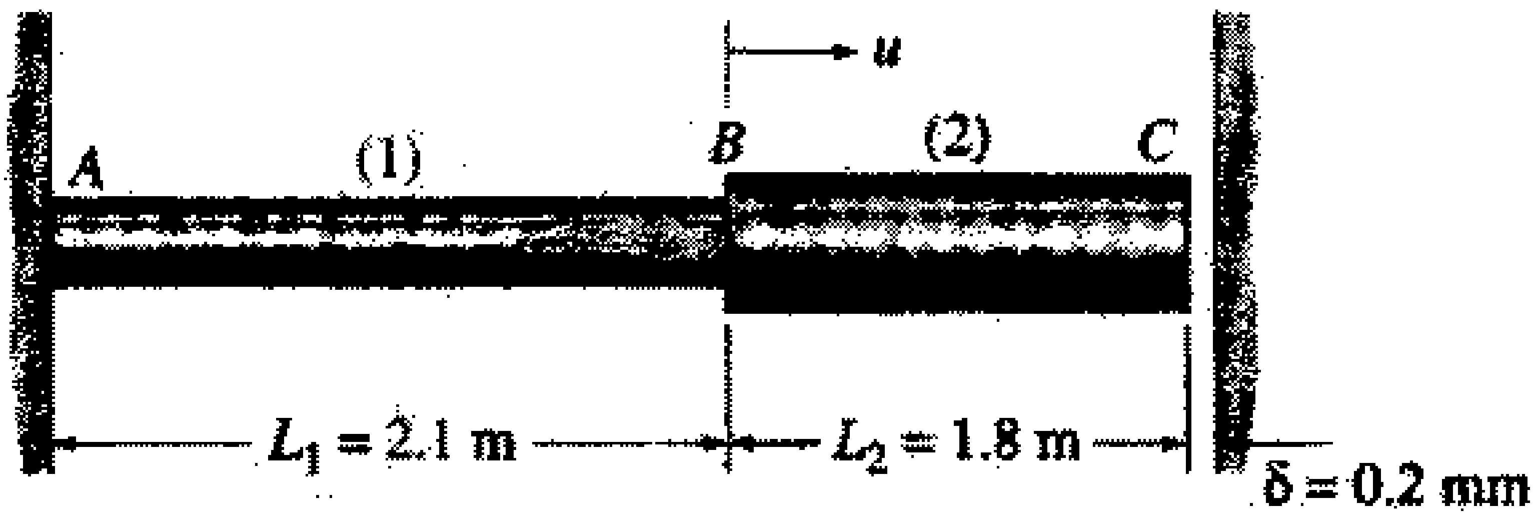
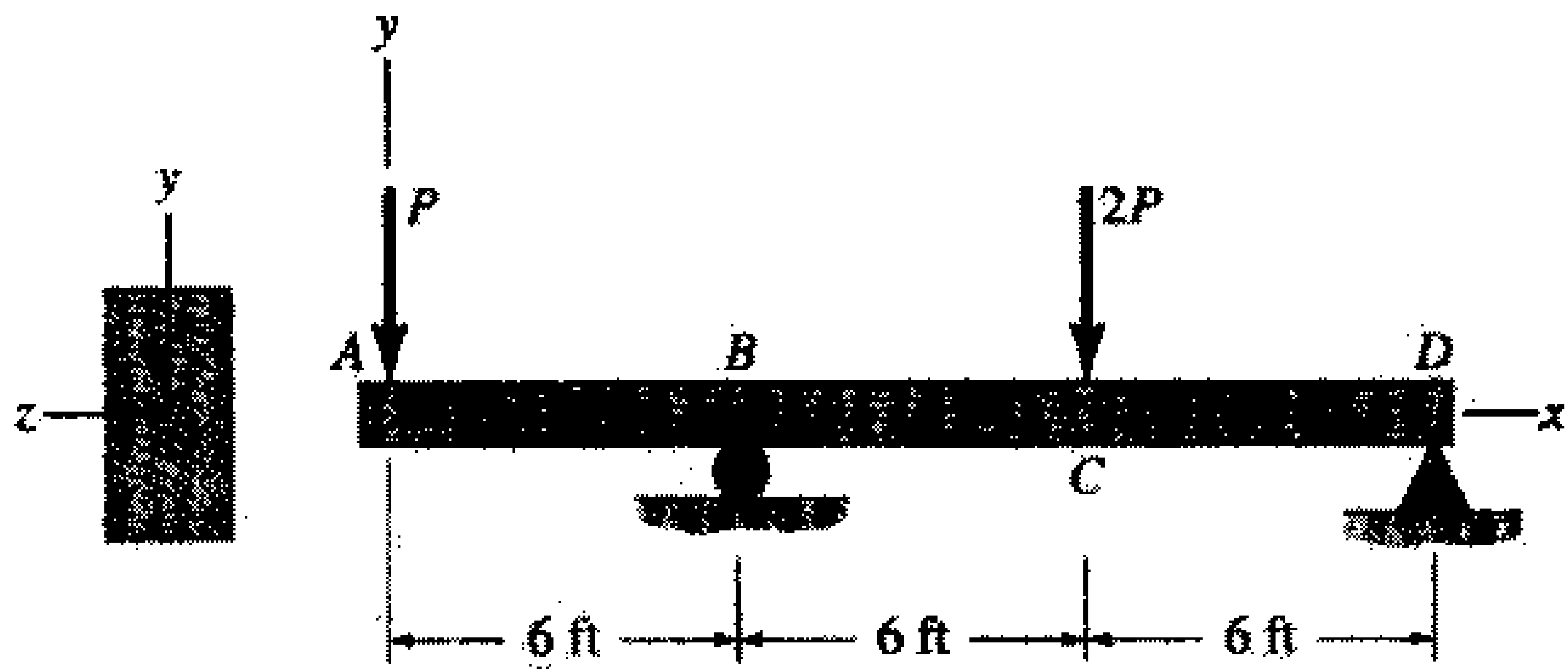
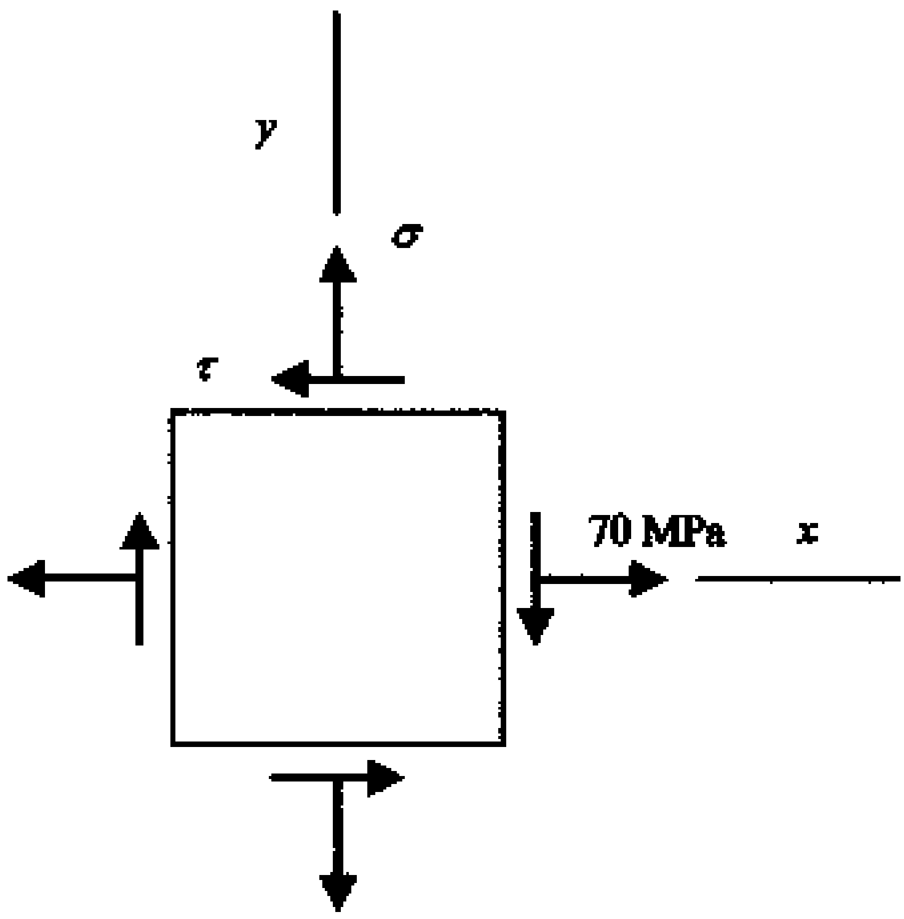
1. Two uniform, linearly elastic members are joined together at B, and the resulting two-segment rod is attached to a rigid support at end A. When the rod is at room temperature, there is a gap of 0.2 mm between the end of element (2) and the rigid wall at C. Element (1) is steel with modulus $E_1 = 210$ GPa, coefficient of thermal expansion $\alpha_1 = 12\times10^{-6}/^\circ C$, cross-sectional area $A_1 = 1000\ mm^2$, and length $L_1 = 2.1$ m; element (2) is titanium alloy with $E_2 = 120$ GPa, $\alpha_2 = 10\times10^{-6}/^\circ C$, $A_2 = 1000\ mm^2$, and $L_2 = 1.8$ m. Temperature of the entire rod is then raised by $20^\circ C$. (a) Calculate the horizontal displacement, u, of joint B. (b) Determine the axial stresses, σ_1 and σ_2, in the two elements. (25%)



2. A timber beam has the following cross-sectional data, width b = 3.5 in., height h = 7.25 in., moment of inertia I = 111.15 in^4, and A = 25.38 in^2. It is supported and loaded as shown. If the allowable shear stress for the wood is $(\tau_{allow})_w = 120$ psi, and if the load at C is always twice the load at A, that is , 2P and P, respectively, calculate the maximum load P that may be applied to this beam. Include the weight of the beam in your calculations, using $\gamma = 36$ lb/ft^3 for the specific weight of the wood. (25%)



3. The state of plane stress at a point can be described by a known tensile stress $\sigma_x = 70$ MPa, an unknown tensile stress σ, and an unknown shear stress τ, as shown. At this point the maximum in-plane shear stress is 78 MPa, and one of the two in-plane principal stresses is 22 MPa (T). Determine the values of the two unknown stresses, labeled σ and τ on the figure, and determine the second in-plane principal stress. (25%)



4. For the uniformly loaded propped cantilever beam shown, (a) solve for the reactions at A and B, and (b) determine an expression for the deflection curve v(x). (25%)