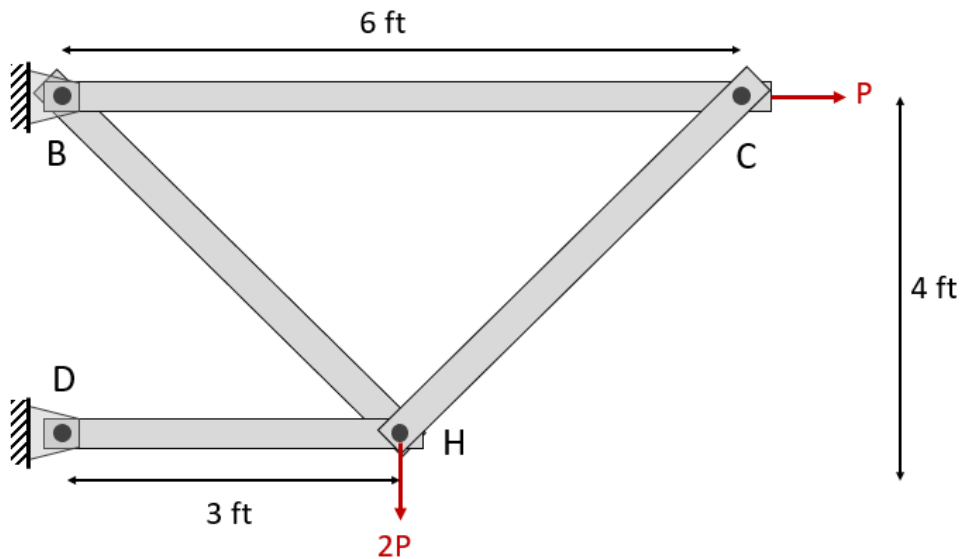


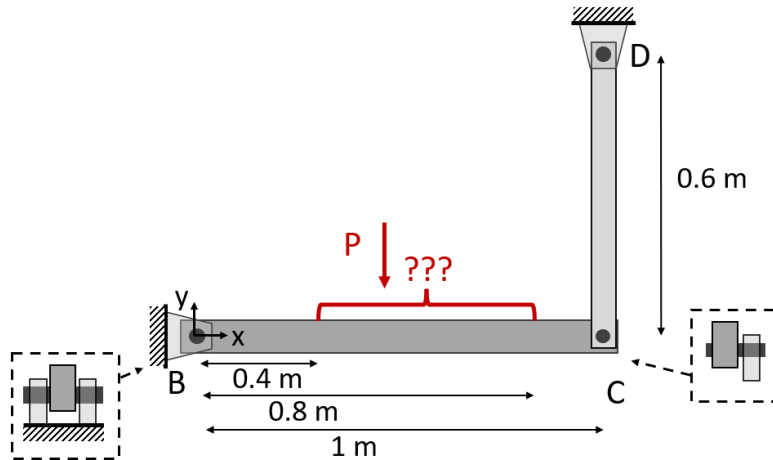
Problem 2.1 (10 points)



Each of the bars of truss have a cross-sectional area of 1.5 in^2 and an axial failure stress $\sigma_f = 30 \text{ ksi}$.

- (a) Draw the free body diagrams.
- (b) Determine the forces in each member as a function of the applied force of P .
- (c) Determine the maximum magnitude P of the loads that can be applied to the truss that meets factor of safety $FS = 2$.

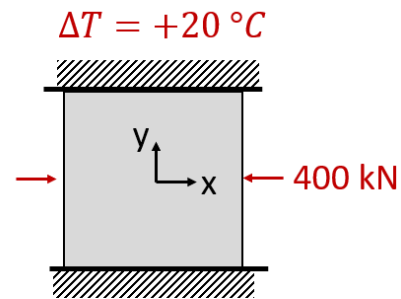
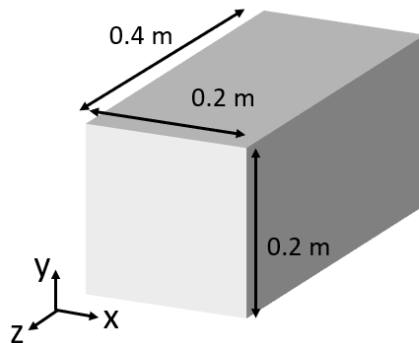
Problem 2.2 (10 points)



BCD is a shelf that has a double-sided pin at B and a single-sided pin at C. The ultimate stresses of the pins are both 60 MPa. A load of $P = 1 \text{ kN}$ will be placed on the BC section of the shelf somewhere between 0.4 m and 0.8 m from B.

- Determine the minimum diameter of the pin at B to achieve a factor of safety of at least 3.0 for all possible loading conditions.
- Determine the minimum diameter of the pin at C to achieve a factor of safety of at least 3.0 for all possible loading conditions.

Problem 2.3 (10 points)

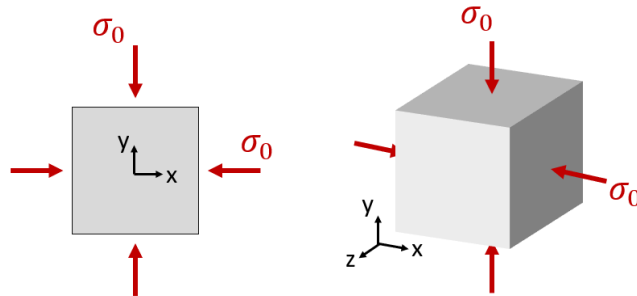


A block of materials has initial dimensions of 0.2, 0.2, and 0.4 m in the x, y, and z directions when no stress is applied. The block is constrained in the y-direction and has a force of 400 kN applied in the x-direction and has no constraint in the z-direction. The temperature of the block is increased by 20 °C ($\Delta T = 20\text{ }^{\circ}\text{C}$). The block is made of epoxy with a Young's modulus of 4 GPa, a Poisson's ratio of 0.45, and a thermal expansion coefficient of $40 \times 10^{-6}\text{ }^{\circ}\text{C}^{-1}$.

- (a) Determine the stress applied on the fixed surfaces in the y-direction when the load is applied and the temperature is increased.
- (b) Determine the length of the block in the z direction when the load is applied and the temperature is increased.

Problem 2.4 (5 points)

A cube of material is subjected to compressive stresses of σ_0 in the x and y directions and is free to deform in the z direction (no stresses or constraints in the z direction).



Assume small strains and linear materials properties. For different values of the Poisson's ratio, indicate whether the change in volume (ΔV) and the strain in the z direction (ϵ_z) are >0 , $=0$, or <0 .

ν	ΔV	ϵ_z
0.5		
0.2		
0		
-0.2		