1. For the pin-connected structure shown, determine the minimum diameter for the pin at joint D if the average shear stress in the pin is limited to 7,500 psi. Note: The pin is in single shear.
2. The stresses shown act at a point on the free surface of a stressed body.
   (a) Determine the principal stresses and the maximum in-plane shearing stress and show these stresses on a properly labeled and oriented sketch (i.e., a single wedge element or two square elements).
   (b) Determine the absolute maximum shear stress. (No sketch required...just the magnitude.)
3. A 60° strain rosette is mounted on the outside of a cylindrical pressure vessel as shown in the figure. The recorded strains are $\varepsilon_a = 80\mu\varepsilon$ and $\varepsilon_b = \varepsilon_c = 275\mu\varepsilon$. If the vessel has an $r/t$ ratio (i.e., inside radius to wall thickness ratio) of 25, find the pressure $p$ in the tank. Assume that the modulus of elasticity is $E = 200$ GPa and Poisson’s ratio is $\nu = 0.30$. 

![Delta rosette diagram]
4. The rigid plate shown in the figure pivots at point C and is held by two horizontal rods at points A and B. Each rod has a cross sectional area of 474 mm$^2$ and a modulus of elasticity of $E = 1,140$ MPa. The horizontal rods are both the same length. If a vertical load of $P = 2.2$ kN is applied at point D as shown, find the tension force in Rod A.
5. The 100-mm diameter segment ABC of the shaft is securely connected to the 60-mm diameter segment CD, and the ends of the shaft are fixed to rigid walls. The moduli of rigidity are $G = 40$ GPa for ABC and $G = 80$ GPa for CD. When torque $T_B = 15$ kN-m is applied as shown, determine the maximum shearing stresses $\tau_{AB}$, $\tau_{BC}$ and $\tau_{CD}$ for the three regions of the shaft.
6. A simply supported beam is loaded as shown.
   (a) Determine the shear force \( V \) and bending moment \( M \) acting at section a-a, which is located 4 ft from pin support A.
   (b) At section a-a, determine the bending stress \( \sigma_x \) and the transverse shear stress \( \tau_{xy} \) at point H, which is located 2 in. above the z centroidal axis.
   (c) Show \( \sigma_x \) and \( \tau_{xy} \) on a stress element for point H.
7. The vertical structural member consists of a steel pipe with an outside diameter of 10 in. and an inside diameter of 9 in. For the loads shown, determine the normal and shear stresses acting at point \( H \), which is located on the \( x \) axis at the lower end of the vertical member. Show the stresses at \( H \) on a stress element.
8. A steel \((E = 29 \times 10^6 \text{ psi} \text{ and } I = 120 \text{ in}^4)\) beam is loaded and supported as shown. Additional support is provided at \(B\) by a \(6 \times 6\)-in. timber \((E = 1.5 \times 10^6 \text{ psi})\) post BD. Determine the load carried by the post if it is unstressed before the 530 lb/ft uniform load is applied to the beam.