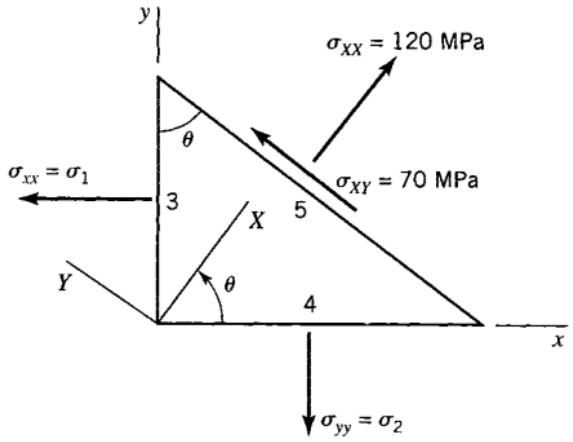
Problem Set #1 **Advanced Mechanics of Materials**

1. Determine the unknown stress components for the element in Figure.



2. The stress components are

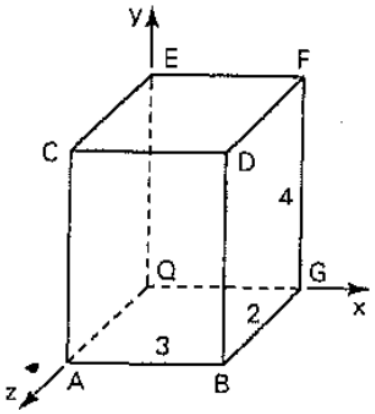
$$\begin{bmatrix} 150 & -45 & 0 \\ -45 & 70 & 0 \\ 0 & 0 & -80 \end{bmatrix} MPa$$

(a) Determine the principal and maximum shear stress.
(b) Determine the octahedral stresses.
(c) Determine the angle between the X axis and the x axis when the X axis is in the direction of the principal stress with largest absolute magnitude.

3. The stress at a point in a machine component relative to an x,y,z coordinate system is given by

$$\begin{bmatrix} 100 & 40 & 0 \\ 40 & 60 & 80 \\ 0 & 80 & 20 \end{bmatrix} MPa$$

According to Figure, calculate the normal and shear stresses at point Q for the surface parallel to the following planes: (a) ABEF, (b) CEBG, (c) AEG



4. Given zero body forces, determine whether the following stress distribution can exist for a body in equilibrium.

$$\sigma_x = -2c_1xy, \quad \sigma_y = c_2z^2, \quad \sigma_z = 0$$
$$\tau_{xy} = c_1(c_2 - y^2) + c_3xz, \quad \tau_{xz} = -c_3y, \quad \tau_{yz} = 0$$