Two-dimensional stress and strain – supplementary questions

1. For the elements illustrated in Figure Q1, construct Mohr's circle of stress to find the stress components on the inclined planes shown.

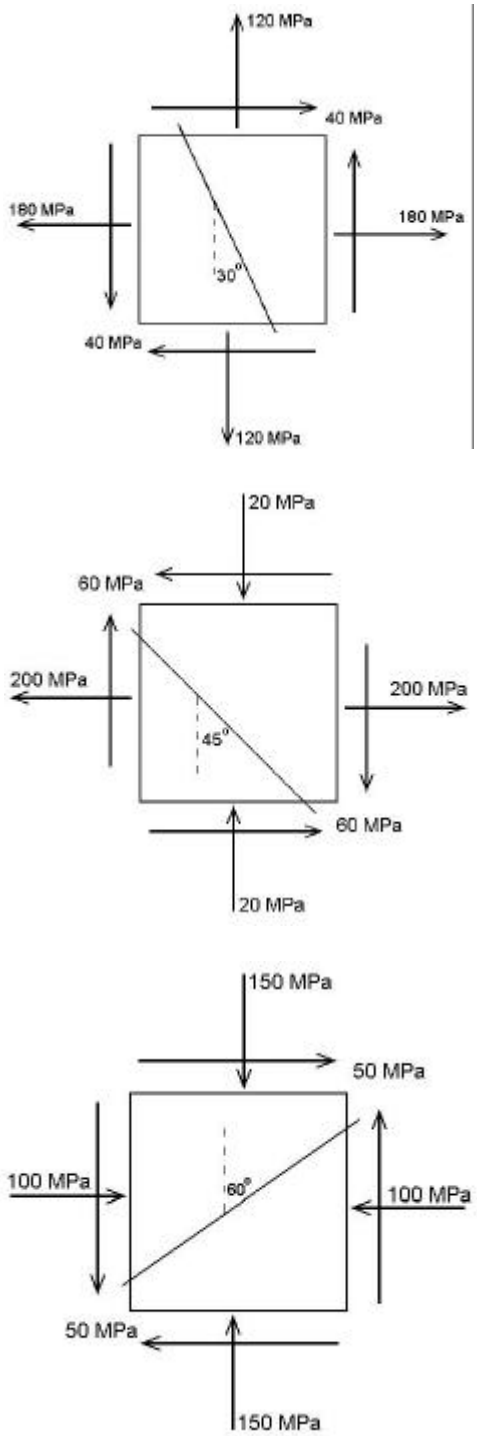

Figure Q1.

Ans:

(a) σ_n = 199.6 MPa, τ_s = -5.98 MPa

(b) σ_n = 30 MPa, τ_s = -110 MPa

(c) σ_n = -180.8 MPa, τ_s = -3.35 MPa

2. Figure Q2 illustrates a bar having a cross sectional area of 0.0025m^2. Estimate the stresses on an element at P and aligned with the xy directions. Draw Mohr's circle and use it to determine the stresses on elements at inclinations of (a) 15^o and (b) 75^o to the x direction.

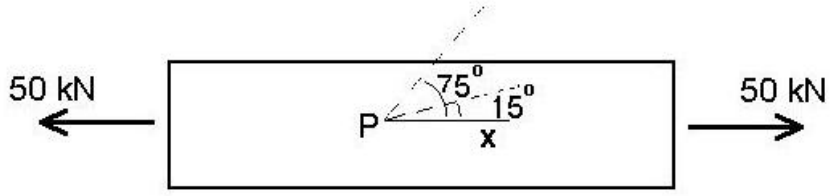

Figure Q2.

Ans:
(a) σ_{n1} = 18.5 MPa, σ_{n2} = 1.5 MPa
(b) σ_{n1} = 1.5 MPa, σ_{n2} = 18.5 MPa τ_s = 5 MPa

3. A column rests on a horizontal foundation block. The column transmits to the block a compressive stress of 174 MPa, together with a shear stress of 46.6 MPa. Find the magnitude and direction of the principal stresses at a point just below the top face of the block.

Ans:
σ_1 = -185 MPa and σ_2 = 11.7 MPa at 14^o and 104^o respectively to the vertical.