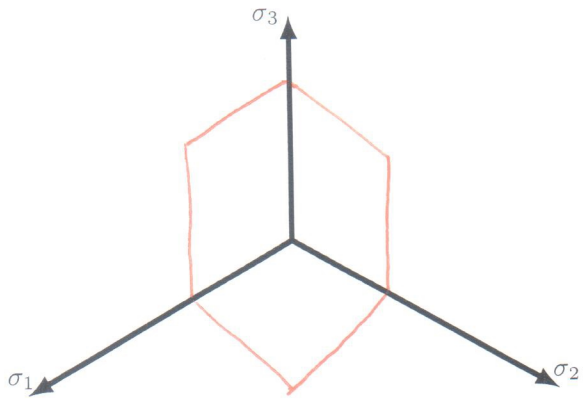
Problem 1

(5 points each) Short answer:

(i) Sketch a Mohr-Coulomb failure surface in the π-plane on the figure.



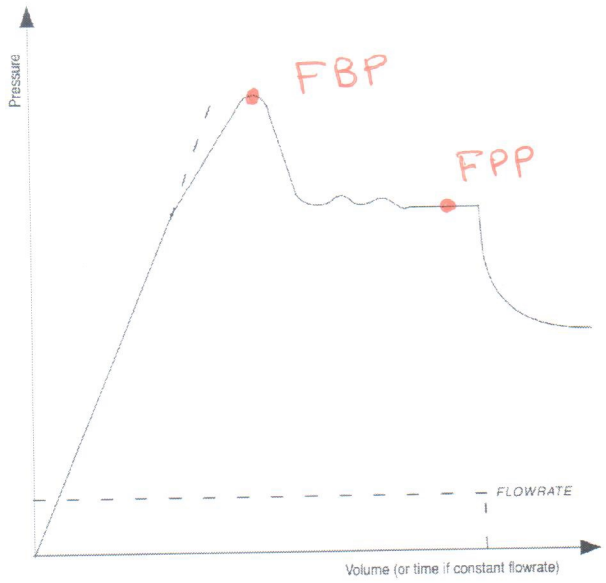
(ii) List two reasons why tensile strength is relatively unimportant in reservoir geomechanics.

1. Tensile strength of rocks is very low.

2. In situ stress at depth is always compressive.

Problem 1 continued on next page...

(iii) On the figure below that schematically represents an extended leakoff-test



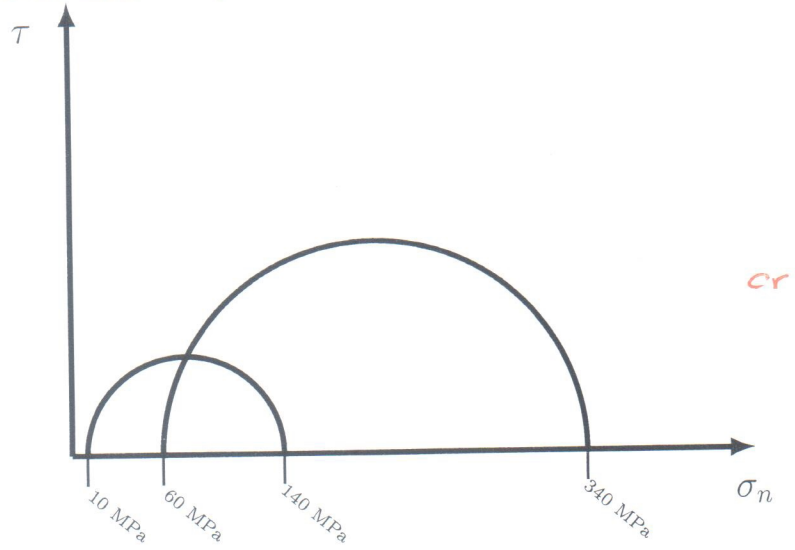
Label the **formation breakdown pressure** and the **fracture propagation pressure.**

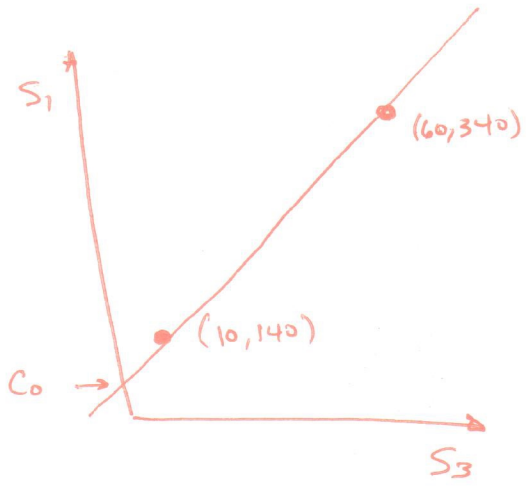
FBP FPP

Problem 2

(30 points)

Given the following two Mohr's circles created with triaxial tests on a rock material:





Give the unconfined compressive strength C_0 and internal friction angle μ_I for a Mohr-Coulomb failure model of the material.

$$n = \frac{340-140}{60-10} = \frac{200}{50} = 4$$

so

$$C_0 = S_1 - n S_3$$

$$= 140 - (4)(10)$$

$$= 100 \text{ MPa}$$

$$\mu_I = \frac{n-1}{2\sqrt{n}} = \frac{4-1}{2\sqrt{4}} = \frac{3}{4} = 0.75$$

Problem 3

(**30 points**) Given the geographical stress,

$$\mathbf{S}_G = \begin{bmatrix} 47.5 & -12.5 & 0 \\ -12.5 & 47.5 & 0 \\ 0 & 0 & 40 \end{bmatrix} \text{ MPa}$$

For a horizontal wellbore drilled along an azimuth oriented directly to the west, find the wellbore stress tensor, $\mathbf{S}_B$.

$\phi = 90°$ $\delta = 270°$

Using code :

$$S_B = \begin{bmatrix} 40 & 0 & 0 \\ 0 & 47.5 & +12.5 \\ 0 & +12.5 & 47.5 \end{bmatrix} \text{ MPa} \quad \text{///}$$