SOLVE THIS PROBLEM USING THE EXCEL FILE PROVIDED

PROBLEM 5 (25 POINTS).

A pressure survey has been performed in a producing oil well (production rate of 1394 Sm3/d and GOR = 155.1), and pressure and temperature at several depths have been recorded. The values are provided in the Excel file attached.

Task (25 POINTS). Calculate the following variables along the well:

- Non-slip gas volume fraction
- Gas void fraction
- Oil and gas real velocities
- The slip ratio
- The hydrostatic pressure gradient

Useful information:

• ε is the gas void fraction, equal to:

$$\varepsilon = \frac{A_g}{A_l + A_g}$$

A VBA function named "e_simpson" is provided to calculate the void fraction using the gas density, liquid density, and non-slip gas volume fraction (λ_g).

• The following matrix to convert from standard conditions to local conditions

$$\begin{bmatrix} q_g \\ q_o \\ q_w \end{bmatrix} = \begin{bmatrix} \frac{B_g}{1 - R_s \cdot r_s} & \frac{-R_s \cdot B_g}{1 - R_s \cdot r_s} & 0 \\ \frac{-B_o \cdot r_s}{1 - R_s \cdot r_s} & \frac{B_o}{1 - R_s \cdot r_s} & 0 \\ 0 & 0 & B_w \end{bmatrix}_{(p,T)} \cdot \begin{bmatrix} q_{\bar{g}} \\ q_{\bar{o}} \\ q_{\bar{w}} \end{bmatrix}$$

There are two VBA functions available in the Excel sheet.: "qg_local", to calculate local gas rates from SC oil and gas rates and black oil properties and "qo_local", to calculate local oil rates from SC oil and gas rates and black oil properties

• A VBA function called "TwoDimInterpol" is provided to find BO properties at any p-T by interpolating on the table provided on the sheet "BO_tables"