VARIANT 10

In operation let the oil well with a constant flow rate. What is the pressure bottomhole and at a distance for some time such data
well flow rate changes from 20 t/d with a step of 2 t/d;
initial reservoir pressure changes from 17 MPa with a step of 0.5 MPa;
well radius of 0.1 m;
permeability coefficient changes from 0.09 mkm^2 with a step of 0.01 mkm^2;
layer thickness changes from 8 m with a step of 0.5 m;
porosity of 20%;
coefficient of dynamic viscosity of oil changes from 1.2 mPa·s with a step of 0.05 mPa·s;
volume factor changes from 1.05 with a step of 0.05;
relative density 0.85;
time varies changes from 5 days with a step of 1day;
compressibility factor of oil changes from $2.1 \cdot 10^{-9}$ Pa^{-1} with a step of $0.05 \cdot 10^{-9}$ Pa^{-1};
compressibility factor of rocks changes from $2.4 \cdot 10^{-10}$ Pa^{-1} with a step of $0.05 \cdot 10^{-10}$ Pa^{-1}
distance from the wells changes from 50 m with a step of 10 m.

Problem 2

Flow rate

$Q := 20 + 2 \cdot 9$

$Q = 38 \quad \frac{ton}{day}$

Initial reservoir pressure

$Pinres := (17 + 0.5 \cdot 9) \cdot 10^6$

$Pinres = 2.15 \times 10^7 \quad Pa$

Well radius

$rw := 0.1 \quad m$

permeability cofficient

$k := (0.09 + 0.01 \cdot 9) \cdot 10^{-12}$

$k = 1.8 \times 10^{-13} \quad m$

Thickness

$h := 8 + 0.5 \cdot 9$

$h = 12.5 \quad m$

Porosity

$m := 20\%$

$m = 0.2$

Dynamic viscosity of oil $\mu o := 1.2 + 0.05 \cdot 9$

$\mu o := 1.4 \cdot 10^{-3}$ pa·s

Volume factor $B := 1.05 + 0.05 \cdot 9$

$B = 1.5$

Density $\rho := 0.85$

Time $t := 5 + 1 \cdot 9$

$t = 14$

$t := 9 \cdot 86400 = 7.776 \times 10^5$ s

Compressibility factor of oil

$\beta o := 2.1 \cdot 10^{-9} + 0.05 \cdot 10^{-9} \cdot 9$

$\beta o = 2.55 \times 10^{-9}$ Pa^{-1}

Compressibility factor of Rock

$\beta r := 2.4 \cdot 10^{-9} + 0.05 \cdot 10^{-9} \cdot 9$

$\beta r = 2.85 \times 10^{-9}$ Pa^{-1}

Distance

$r := 50 + 10 \cdot 9$

$r = 140$ m

Pr pressure at distance

solution

$\beta := m \cdot \beta o + \beta r$

$\chi := \frac{k}{\mu o \cdot \beta}$ explicit, ALL $= \frac{(0.09 + 0.01 \cdot 9) \cdot 10^{-12}}{1.4 \cdot 10^{-3} \cdot [20 \cdot \% \cdot (2.1 \cdot 10^{-9} + 0.05 \cdot 10^{-9} \cdot 9) + 2.4 \cdot 10^{-9} + 0.05 \cdot 10^{-9} \cdot 9]} = 0.0 \frac{m^2}{2}$

$Qv := \frac{Q \cdot B}{\rho \cdot 86400} = 7.761 \times 10^{-4}$

$$Pbh := Pinres - \frac{Qv \cdot \mu o}{4 \cdot \pi \cdot k \cdot h} \cdot \ln\left(\frac{2.25 \chi \cdot t}{rw^2}\right) = 2.09 \times 10^7 \quad Pa$$

$$Pr := Pinres - \frac{Qv \cdot \mu o}{4 \cdot \pi \cdot k \cdot h} \cdot \ln\left(\frac{2.25 \cdot \chi \cdot t}{r^2}\right) = 2.145 \times 10^7 \quad Pa$$