

ORIGIN := 1

T := 328

P := 118.6

$T_c := \begin{pmatrix} 304.2 \\ 748 \end{pmatrix}$

$P_c := \begin{pmatrix} 73.8 \\ 41 \end{pmatrix}$

$\omega := \begin{pmatrix} 0.239 \\ 0.302 \end{pmatrix}$

$k := \begin{pmatrix} 0 & 0.08246 \\ 0.08246 & 0 \end{pmatrix}$

$\text{root}(p, q, r) :=$

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v ←  $\begin{pmatrix} r \\ q \\ p \\ 1 \end{pmatrix}$ 
x ← polyroots(v)
for i ∈ 1..3
  xi ← 0 if Im(xi) ≠ 0
x1 ← max(x)
y ← min(x)
x2 ←  $\begin{cases} \max(x) & \text{if } y = 0 \\ y & \text{otherwise} \end{cases}$ 
 $\begin{pmatrix} x1 \\ x2 \end{pmatrix}$ 
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 $\phi(y) :=$ 
  n  $\leftarrow$  2
  for i  $\in$  1 .. n
     $T_{r_i} \leftarrow \frac{T}{T_{C_i}}$ 
     $P_{r_i} \leftarrow \frac{P}{P_{C_i}}$ 
     $\alpha_i \leftarrow \left[ 1 + \left[ 0.37464 + 1.54226 \cdot \omega_i - 0.26992 \cdot (\omega_i)^2 \right] \cdot \left( 1 - \sqrt{T_{r_i}} \right) \right]^2$ 
     $A_{i,j} \leftarrow 0.45724 \cdot \frac{P_{r_i}}{(T_{r_i})^2} \cdot \alpha_i$ 
     $B_i \leftarrow 0.07780 \cdot \left( \frac{P_{r_i}}{T_{r_i}} \right)$ 
  for i  $\in$  1 .. n
    for j  $\in$  1 .. n
       $A_{i,j} \leftarrow (1 - k_{i,j}) \cdot \sqrt{A_{i,i} \cdot A_{j,j}}$ 
     $A_{mix} \leftarrow \sum_{i=1}^n \sum_{j=1}^n (y_i \cdot y_j \cdot A_{i,j})$ 
     $B_{mix} \leftarrow \sum_{i=1}^n (y_i \cdot B_i)$ 
    p  $\leftarrow$  -1 + Bmix
    q  $\leftarrow$  Amix - 2 · Bmix - 3 · Bmix2
    r  $\leftarrow$  -Amix · Bmix + Bmix2 + Bmix3
    Z  $\leftarrow$  root(p, q, r)1
    C  $\leftarrow$  ln  $\left[ \frac{Z + (1 + \sqrt{2}) \cdot B_{mix}}{Z + (1 - \sqrt{2}) \cdot B_{mix}} \right]$ 
  for i  $\in$  1 .. n
     $\phi_i \leftarrow \exp \left[ \frac{B_i \cdot (Z - 1)}{B_{mix}} - \ln(Z - B_{mix}) - \frac{A_{mix} \cdot C}{2\sqrt{2} \cdot B_{mix}} \cdot \left[ \frac{2 \cdot \sum_{j=1}^n (y_j \cdot A_{i,j})}{A_{mix}} - \frac{B_i}{B_{mix}} \right] \right]$ 
   $\phi$ 

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$$y := \begin{pmatrix} 0.9 \\ 0.01 \end{pmatrix}$$

Given

$$\phi(y)_2 \cdot P \cdot y_2 = 15.9 \cdot 10^{-4} \cdot \exp \left[111.9 \cdot \left(\frac{118.6 - 15.9 \cdot 10^{-4}}{83.14 \cdot T} \right) \right]$$

$$y_1 + y_2 = 1$$

$$y := \text{Find}(y) = \begin{pmatrix} 0.992 \\ 8.01 \times 10^{-3} \end{pmatrix}$$