EXAMPLE 3.2

$ORIGIN := 1$

$T := 340 \quad P := 30 \quad R := 83.14 \quad T_c := 190.6 \quad P_c := 46.1 \quad \omega := 0.011$

$T_r := \frac{T}{T_c} \quad P_r := \frac{P}{P_c}$

$$\alpha := \left[1 + \left(0.37464 + 1.54226 \cdot \omega - 0.26992 \cdot \omega^2\right) \cdot \left(1 - \sqrt{T_r}\right)\right]^2$$

$A := 0.45724 \cdot \left(\frac{P_r}{T_r^{\,2}}\right) \cdot \alpha \quad B := 0.0778 \cdot \frac{P_r}{T_r}$

$p := -1 + B \quad q := A - 2 \cdot B - 3 \cdot B^2 \quad r := -A \cdot B + B^2 + B^3$

$$M := Z^3 + p \cdot Z^2 + q \cdot Z + r = 0 \left| \begin{array}{l} \text{solve} \\ \text{assume}, Z = \text{real} \end{array} \right. \rightarrow 0.96106207724021429375$$

$Z := \max(M) = 0.961$

$V := \frac{Z \cdot R \cdot T}{P} = 905.564$

Alternative Approach

$$root(p, q, r) := \left| \begin{array}{l} v \leftarrow \begin{pmatrix} r \\ q \\ p \\ 1 \end{pmatrix} \\ x \leftarrow polyroots(v) \\ \text{for } i \in 1..3 \\ \quad x_i \leftarrow 0 \text{ if } Im(x_i) \neq 0 \\ x1 \leftarrow \max(x) \\ y \leftarrow \min(x) \\ x2 \leftarrow \left| \begin{array}{ll} \max(x) & \text{if } y = 0 \\ y & \text{otherwise} \end{array} \right. \\ \begin{pmatrix} x1 \\ x2 \end{pmatrix} \end{array} \right.$$

$$Z := \mathrm{root}(p, q, r) = \begin{pmatrix} 0.961 \\ 0.961 \end{pmatrix}$$

$$V(T, P) := \left| \begin{array}{l} T_r \leftarrow \dfrac{T}{T_c} \\ P_r \leftarrow \dfrac{P}{P_c} \\ \alpha \leftarrow \left[1 + \left(0.37464 + 1.54226 \cdot \omega - 0.26992 \cdot \omega^2\right) \cdot \left(1 - \sqrt{T_r}\right)\right]^2 \\ A \leftarrow 0.45724 \cdot \left(\dfrac{P_r}{T_r^{\,2}}\right) \cdot \alpha \\ B \leftarrow 0.0778 \cdot \dfrac{P_r}{T_r} \\ p \leftarrow -1 + B \\ q \leftarrow A - 2 \cdot B - 3 \cdot B^2 \\ r \leftarrow -A \cdot B + B^2 + B^3 \\ Z \leftarrow \mathrm{root}(p, q, r)_1 \\ V \leftarrow \dfrac{Z \cdot R \cdot T}{P} \\ V \end{array} \right.$$

$$V(340, 30) = 905.564$$