EXAMPLE 3.19

ORIGIN := 1

$T_c := 461$ $P_c := 33.8$ $\omega := 0.227$ $R := 8.314$

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

$$\mathrm{Dep}(T, P) := \begin{array}{|l} T_r \leftarrow \dfrac{T}{T_c} \\ P_r \leftarrow \dfrac{P}{P_c} \\ \alpha \leftarrow \left[1 + \left(0.37464 + 1.54226\omega - 0.26992\omega^2\right)\cdot\left(1 - \sqrt{T_r}\right)\right]^2 \\ A \leftarrow 0.45724\cdot\dfrac{P_r\cdot\alpha}{T_r^{\,2}} \\ B \leftarrow 0.07780\cdot\dfrac{P_r}{T_r} \\ p \leftarrow -1 + B \\ q \leftarrow A - 2B - 3B^2 \\ r \leftarrow -A\cdot B + B^2 + B^3 \\ Z \leftarrow \mathrm{root}(p, q, r)_1 \\ \Gamma \leftarrow \left(0.37464 + 1.54226\omega - 0.26992\omega^2\right)\cdot\sqrt{\dfrac{T_r}{\alpha}} \\ H \leftarrow R\cdot T\cdot\left[Z - 1 - \dfrac{A\cdot(1+\Gamma)}{\sqrt{8}\,B}\cdot\ln\left[\dfrac{Z + \left(1+\sqrt{2}\right)\cdot B}{Z + \left(1-\sqrt{2}\right)\cdot B}\right]\right] \\ S \leftarrow R\cdot\left[\ln(Z - B) - \dfrac{A\cdot\Gamma}{\sqrt{8}\,B}\cdot\ln\left[\dfrac{Z + \left(1+\sqrt{2}\right)\cdot B}{Z + \left(1-\sqrt{2}\right)\cdot B}\right]\right] \\ \begin{pmatrix} H \\ S \end{pmatrix} \end{array}$$

$H(T, P) := \mathrm{Dep}(T, P)_1$ $\qquad$ $S(T, P) := \mathrm{Dep}(T, P)_2$

This is Eq. (3.6-3)

$$\Delta H := -H(500, 3) + H(500, 20) = -2.282 \times 10^3$$

This is Eq. (3.6-4)

$$\Delta S := -S(500, 3) - R\cdot\ln\left(\frac{20}{3}\right) + S(500, 20) = -19.058$$