Callen

3.5-2. Find the relationship between volume and temperature on an isentropic of van't Waals fluid.

The entropy is given by

$$S = NR\ln\left[(v-b)(u+a/v)^c\right] + Ns_0.$$

with $T = \frac{u+a/v}{cR}$,

$$\Rightarrow S = cNR\ln\left[(v-b)\left[cRT\right]\right]$$

$\Rightarrow$ an isentropic is given by

$$(v-b)\left[cRT\right]^c = \text{constant}.$$