1. Starting from:

$$dH = T\,dS + V\,dP$$

Show that:

$$\left(\frac{\partial H}{\partial P}\right)_T = V - T\left(\frac{\partial V}{\partial T}\right)_P$$

2. Suppose the internal energy U is a function of temperature T and volume V

(a) Starting from:

$$U = A + TS$$

Show that:

$$\left(\frac{\partial U}{\partial V}\right)_T = -P + T\left(\frac{\partial P}{\partial T}\right)_V$$

(b) Use your result to show that internal energy has no volume dependence for an ideal gas, but for real gases internal energy can have volume dependance.

3. Starting from:

$$dU = TdS - PdV$$

Show that:

$$\left(\frac{\partial U}{\partial S}\right)_T = -P^2 \left(\frac{\partial (T/P)}{\partial P}\right)_V$$

Homework Problem 20

1. Starting from:

$$C_P = T\left(\frac{\partial S}{\partial T}\right)_P$$

Show that:

$$\left(\frac{\partial C_P}{\partial P}\right)_T = -T\left(\frac{\partial^2 V}{\partial T^2}\right)_P$$