1. Starting from the total differential of $S(T, P)$, show that:

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

2. Starting from:

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

   Show that:

$$C_P - C_V = T\left(\frac{\partial V}{\partial T}\right)_P \left(\frac{\partial P}{\partial T}\right)_V$$

   You can use your result from 1 to help solve this problem.

3. Starting from:

$$\left(\frac{\partial T}{\partial V}\right)_U \left(\frac{\partial V}{\partial U}\right)_T \left(\frac{\partial U}{\partial T}\right)_V = -1$$

Show that:

$$\left(\frac{\partial T}{\partial V}\right)_U = \frac{1}{C_V}\left[P - T\left(\frac{\partial P}{\partial T}\right)_V\right]$$

Instead of using your result from activity 20, determine a relation from $dU = T\,dS - P\,dV$.

Homework Problem 21

1. Starting from:

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

Show that:

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