Question:	1	2	3	Total
Points:	13	12	0	25
Score:				

Answer the questions in the spaces provided. If you run out of room for an answer, continue on the back of the page.

Name: _____

1. Legendre transforms

   (a) (5 points) In going from internal energy $U(S,V,N)$ to Helmholtz free energy $F(T,V,N)$, we can find F as $F = U - TS$. What is a similar expression to go from Helmholtz free energy $F(T,V,N)$ to Gibbs free energy $G(T,p,N)$?

   $G =$

   (b) (8 points) Enthalpy H is $H(S,p,N) = U + pV$. What is an expression for dH in terms of S, p, and N for a single component system?

   $dH =$

2. (12 points) Partial derivative expressions

   Here, we are looking for partial derivatives of energy terms. For example,

   $$T = \left(\frac{\partial U}{\partial S}\right)_{V,N} \tag{1}$$

   is an expression for T as a partial derivative of the internal energy U with V and N held constant.

   (a) What is an expression for p as a derivative of F?

   $p =$

   (b) S as a derivative of F?

   $S =$

   (c) V as a derivative of H?

   $V =$

3. For fun if you have time: In class we derived a Maxwell relation from $U(S, V)$:

$$\left(\frac{\partial T}{\partial V}\right)_S = -\left(\frac{\partial p}{\partial S}\right)_V.$$

Again assuming constant N, what Maxwell relation can be derived from $H(S, p)$? $F(T, V)$?