Strategy for solving Thermodynamics Problems

- Identify form of dU (e.g. $dU = TdS + xdX$)
- Identify relevant thermodynamic coefficients and moduli (e.g. C_V, C_p, κ_T, etc)
- Thermodynamic potentials:
  U
  $H = U - xX$
  $F = U - TS$
  $G = H - TS$
- Exact differentials:
  $dH = TdS - Xdx$
  $dF = -SdT + xdX$
  $dG = -SdT - Xdx$
- Identify relevant partial derivatives
- Maxwell's relations e.g. $\left(\frac{\partial S}{\partial V}\right)_T = \left(\frac{\partial P}{\partial T}\right)_V$
- Reciprocal and reciprocity theorems

$$\left(\frac{\partial y}{\partial x}\right)_z = \frac{1}{\left(\frac{\partial x}{\partial y}\right)_z} \qquad \left(\frac{\partial y}{\partial x}\right)_z \left(\frac{\partial x}{\partial z}\right)_y \left(\frac{\partial z}{\partial y}\right)_x = -1$$