

4-5-3 Total differential: Entropy representation 3

Compute the partial derivative $\left(\frac{\partial s}{\partial v}\right)_u$.

$$\left(\frac{\partial s}{\partial v}\right)_u = -\frac{\left(\frac{\partial u}{\partial v}\right)_s}{\left(\frac{\partial u}{\partial s}\right)_v} = -\frac{-P}{T} = \frac{P}{T} \quad (1)$$

Here the -1 rule is used:

$$\left(\frac{\partial x}{\partial y}\right)_z \left(\frac{\partial z}{\partial x}\right)_y \left(\frac{\partial y}{\partial z}\right)_x = -1 \rightarrow \left(\frac{\partial x}{\partial y}\right)_z \left(\frac{\partial z}{\partial x}\right)_y = -\left(\frac{\partial z}{\partial y}\right)_x \rightarrow \left(\frac{\partial x}{\partial y}\right)_z = -\frac{\left(\frac{\partial z}{\partial y}\right)_x}{\left(\frac{\partial z}{\partial x}\right)_y} \quad (2)$$