Step 5: What is the right way to rewrite $\left(\dfrac{\partial g}{\partial P}\right)_v$ **?**

$$\left[\left(\frac{\partial g}{\partial T}\right)_P \left(\frac{\partial T}{\partial P}\right)_v + \left(\frac{\partial g}{\partial P}\right)_T \left(\frac{\partial P}{\partial P}\right)_v\right] = -s\left(\frac{\partial T}{\partial P}\right)_v + v = s\left(\frac{\partial T}{\partial v}\right)_P \left(\frac{\partial v}{\partial P}\right)_T + v =$$
$$v - \frac{s\kappa}{\beta}$$