Exercise 10-5

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

$$\left(\frac{\partial S}{\partial T}\right)_V = \frac{C_V}{T} = \frac{bT^\alpha}{T} = bT^{\alpha-1}$$

$$dS = \int bT^{\alpha-1}\,dT$$

$$\Delta S = S - S_0 = \frac{b}{\alpha}\left(T^\alpha - T_0^\alpha\right)$$

$\Delta S = 0$ implies $T^\alpha \to T_0^\alpha$, which, as $T > T_0$, implies that $\alpha > 0$

$$C_V = aT + bT^3$$

$$dS = \frac{C_V}{T}dT$$

$$\Delta S = \int_{T_0}^{T} \frac{aT + bT^3}{T}\,dT$$

$$= \int_{T_0}^{T} a + bT^2\,dT$$

$$= a\left(T - T_0\right) + \frac{b}{3}\left(T^3 - T_0^3\right)$$