① $K = -V\frac{dP}{dV}$

$$\frac{1}{V}dV = -\frac{1}{K}dP$$

$$\int_{V_1}^{V_2} \frac{1}{V}dV = \int_{0}^{\frac{ma}{A}} -\frac{1}{K}dP$$

↑ constant

$$\ln V_2 - \ln V_1 = -\frac{ma}{AK}$$

$$\ln\left(\frac{V_2}{V_1}\right) = -\frac{ma}{AK}$$

③ $$\frac{V_2}{V_1} = e^{-\frac{ma}{AK}}$$