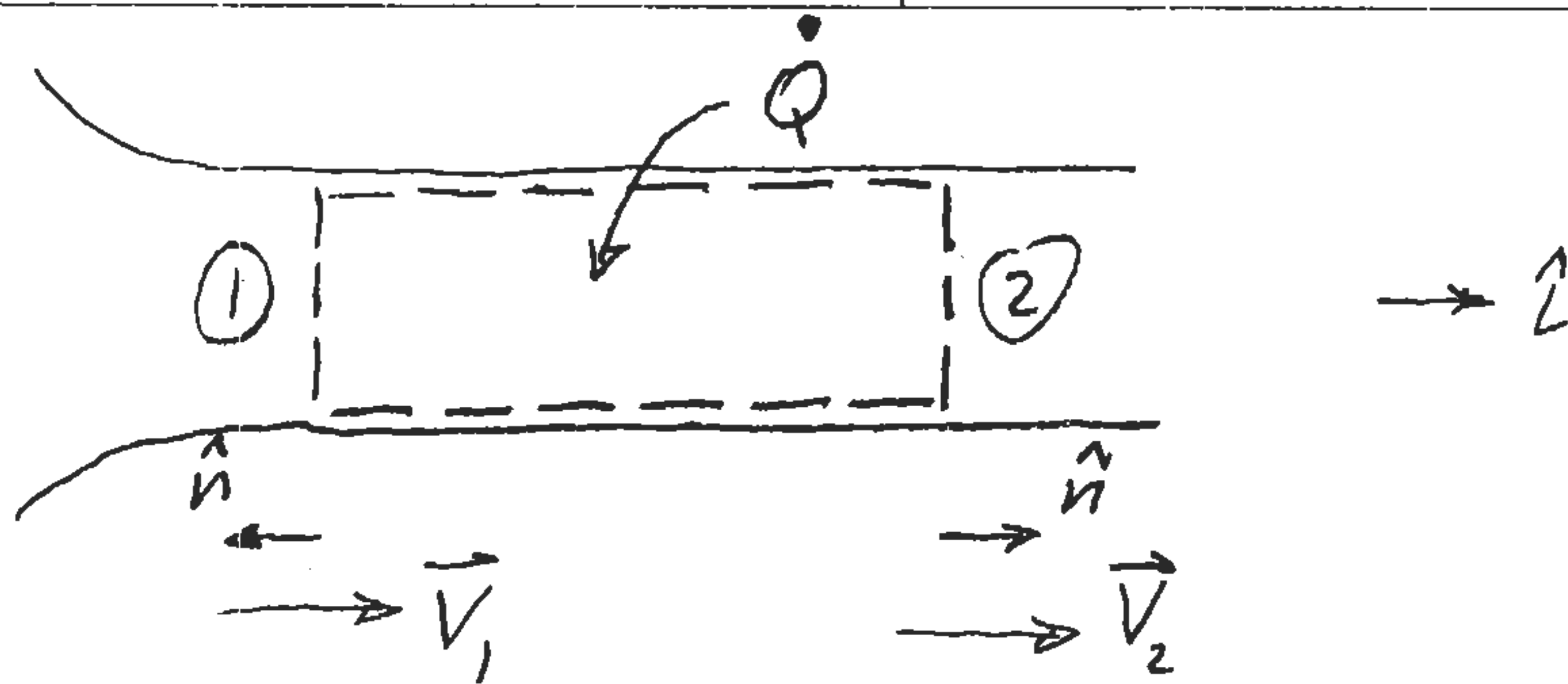


Control Volume



Mass: $\oint \rho \vec{V} \cdot \hat{n} dA = 0 \Rightarrow -\rho_1 V_1 A + \rho_2 V_2 A = 0$

or $\boxed{\rho_1 V_1 = \rho_2 V_2} \quad (1)$

Momentum: $\oint \rho (\vec{V} \cdot \hat{n}) \vec{V} dA + \oint p \hat{n} dA + \vec{R} = 0$ ↙ force on radiator

$\Rightarrow -\rho_1 V_1 A V_1 \hat{z} + \rho_2 V_2 A V_2 \hat{z} - p_1 A \hat{z} + p_2 A \hat{z} + R \hat{z} = 0$

or $\boxed{\rho_1 V_1^2 + p_1 = \rho_2 V_2^2 + p_2 + R} \xrightarrow{\text{neglect as given}} (2)$

Energy: $\oint \rho (\vec{V} \cdot \hat{n}) h_0 dA = \iiint \rho \dot{q} dV + \iiint \rho \vec{g} \cdot \vec{V} dV = 0$

$-\rho_1 V_1 A h_{01} + \rho_2 V_2 A h_{02} = \dot{Q}$

or $\boxed{\rho_1 V_1 h_{01} + \dot{Q}/A = \rho_2 V_2 h_{02}} \quad (3)$