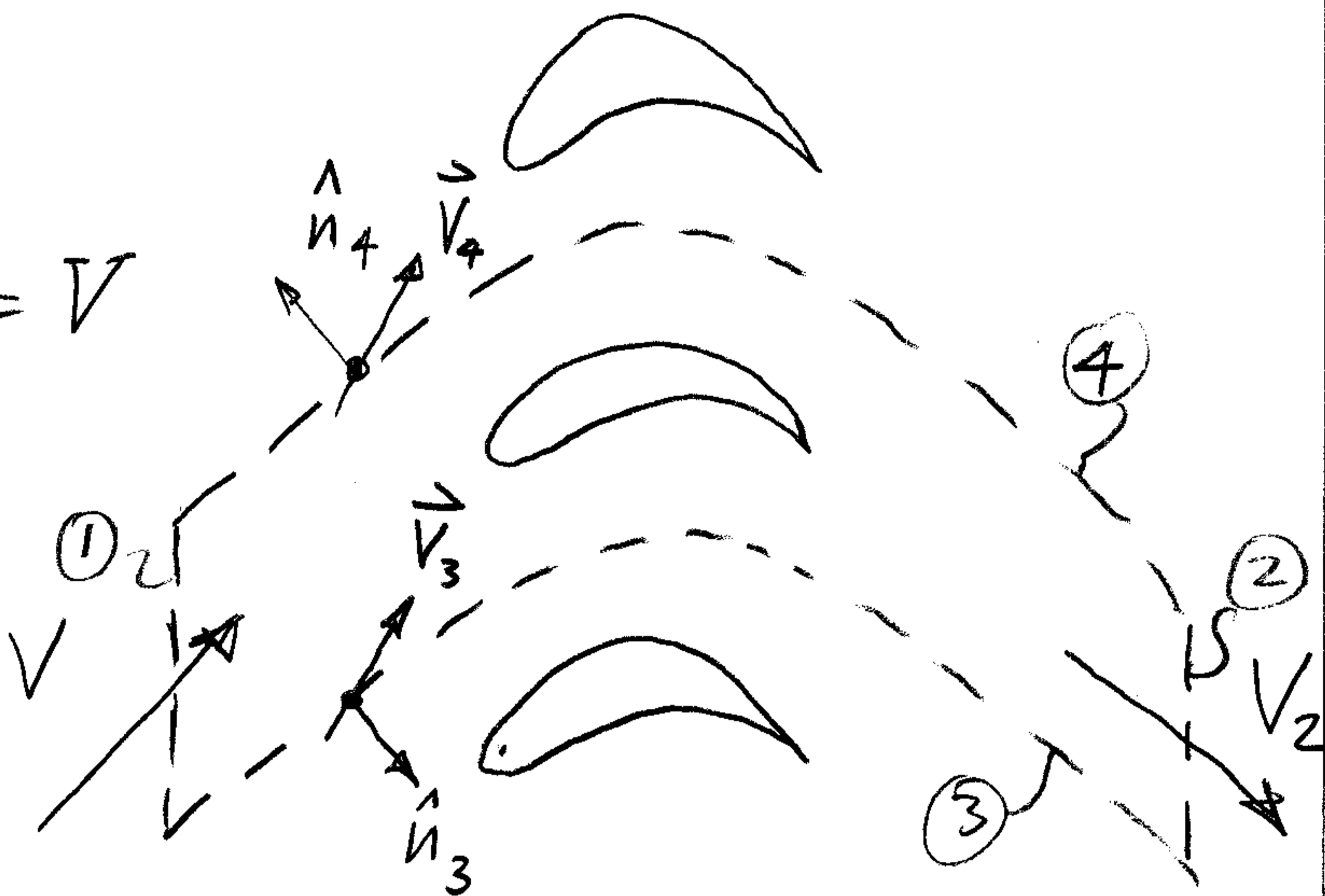


Control Volume :

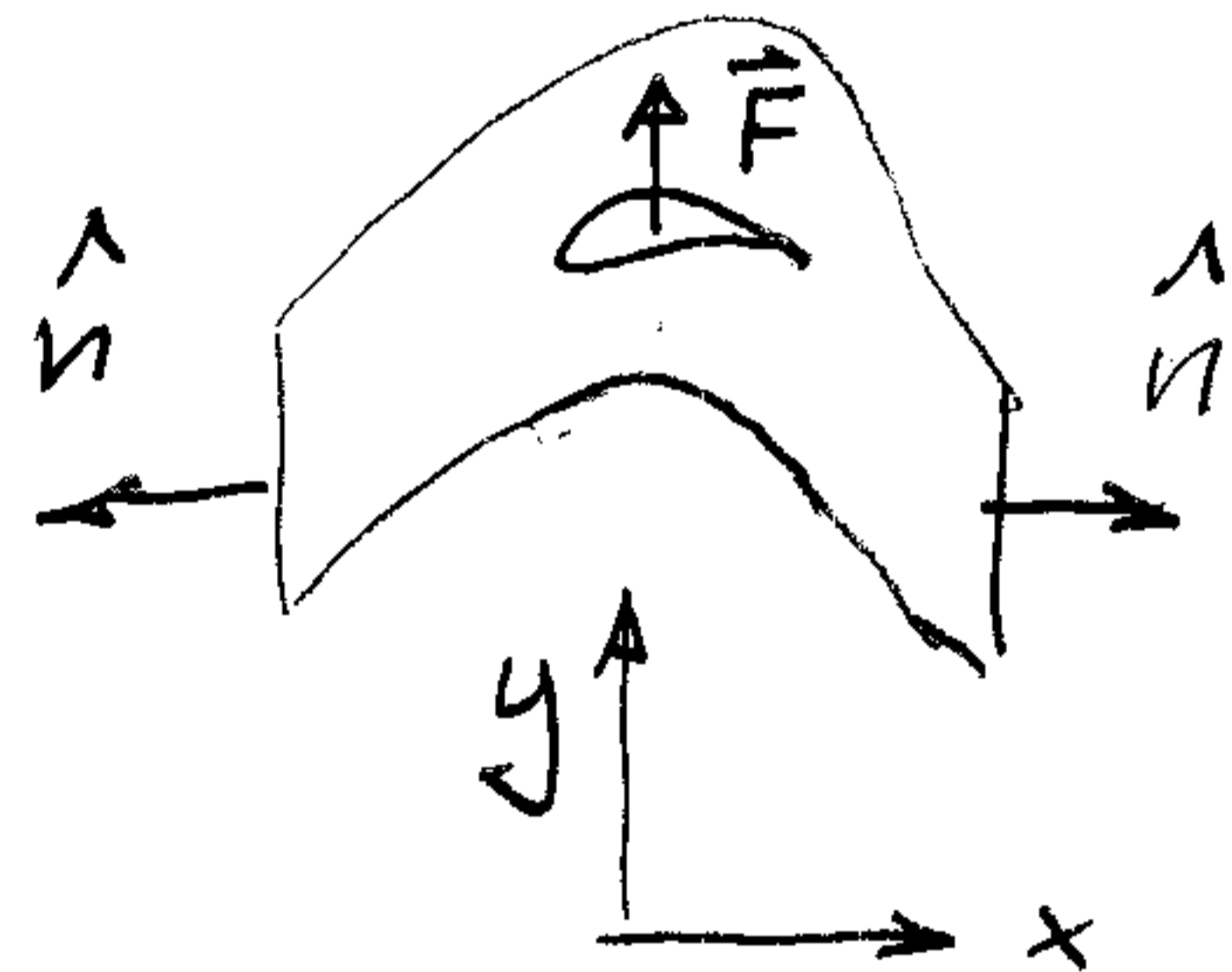
By mass conservation, $V_2 = V$



Because flow is periodic, $\vec{V}_3 = \vec{V}_4$, $p_3 = p_4$
 And since $\hat{n}_4 = -\hat{n}_3$, then sides ③ and ④ will cancel in momentum integral.

$$\oint_{\text{①}} (\rho \hat{n} + \rho \vec{V} \cdot \hat{n} \vec{V}) dA + \oint_{\text{②}} (\rho \hat{n} + \rho \vec{V} \cdot \hat{n} \vec{V}) dA = -\vec{F}$$

By symmetry, $\oint_{\text{①}} \rho \hat{n} dA + \oint_{\text{②}} \rho \hat{n} dA = 0$



$$\oint_{\text{①}} (\rho \vec{V} \cdot \hat{n} \vec{V}) dA + \oint \rho \vec{V} \cdot \hat{n} \vec{V} dA = -\vec{F}$$

$$-\rho V \frac{\sqrt{2}}{2} \cdot V \begin{bmatrix} \sqrt{2}/2 \\ \sqrt{2}/2 \end{bmatrix} h + \rho V \frac{\sqrt{2}}{2} \cdot V \begin{bmatrix} -\sqrt{2}/2 \\ -\sqrt{2}/2 \end{bmatrix} = -\vec{F}$$

$\vec{F} = \begin{bmatrix} 0 \\ \rho V^2 h \end{bmatrix}$	Vertical Force
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