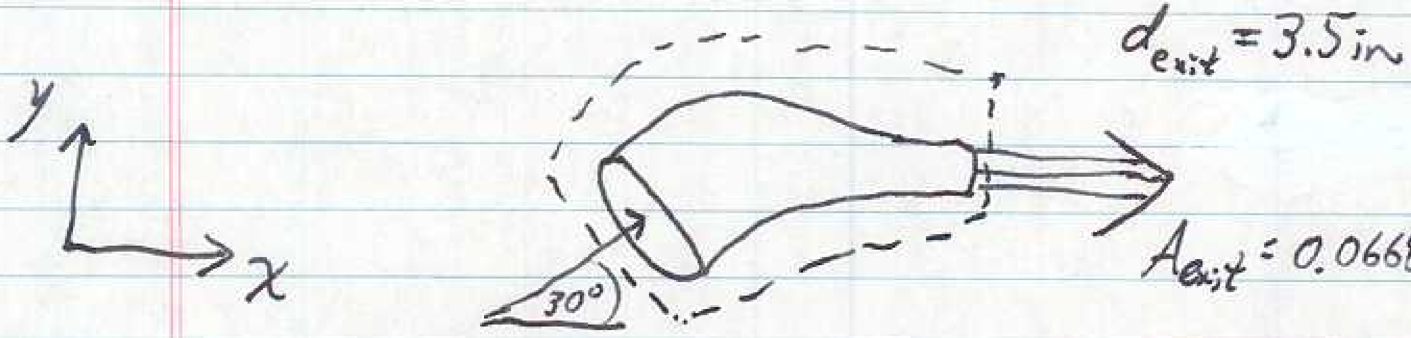
$\boxed{\text{MYO 5.36}}$ Jet-Ski Problem



$A_{in} = 25\,in^2 = .174\,ft^2$

$p_{in} = p_{exit} = 0$

$$\text{Thrust} = -300\,lb$$

$$\Sigma F_{x,\,\text{contents of C.V.}} = +300\,lb$$

$$\Sigma F_x = \underbrace{\frac{\partial}{\partial t}\int_{C.V.} \rho \vec{V}\, d\forall}_{0 \text{ steady flow}} + \int_{C.S.} \vec{V} \rho \vec{V}\cdot\hat{n}\, dA$$

$$300\,lb = \underbrace{V_x \rho \vec{V}\cdot\hat{n}}_{\text{Assuming uniform flow at inlets/outlets}} \int_{C.S.} dA$$

$\boxed{\text{MYO 5.36 continued}}$

$$300 = \rho\left[\left(V_x\, \vec{V}\cdot\hat{n}\, A\right)_{inlet} + \left(V_x\, \vec{V}\cdot\hat{n}\, A\right)_{exit}\right]$$

$$\frac{300\,lb}{\rho} = V_{in}(\cos 30^\circ)(-V_{in})A_{in} + V_{exit}\, V_{exit}\, A_{exit}$$

Two unknowns: V_{in}, V_{exit}.

Need a 2^{nd} Equation

<u>Conservation of Mass</u> $\Rightarrow$ $V_{in} A_{in} = V_{exit} A_{exit}$

$$V_{exit} = V_{in}\frac{A_{in}}{A_{exit}}$$

$$\frac{300\,lb}{\rho} = -\cos 30^\circ\, V_{in}^2 A_{in} + V_{in}^2\left(\frac{A_{in}}{A_{exit}}\right)^2 A_{exit}$$

$$\frac{300\,lb}{1.94\,\frac{slugs}{ft^3}} = -.866\, V_{in}^2\,(.17\,ft^2) + (V_{in}^2)(.453\,ft^2)$$

$V_{in} = 22.6\,ft/s$

$$\boxed{\dot{\forall} = A_{in} V_{in} = 3.93\,ft^3/s}$$