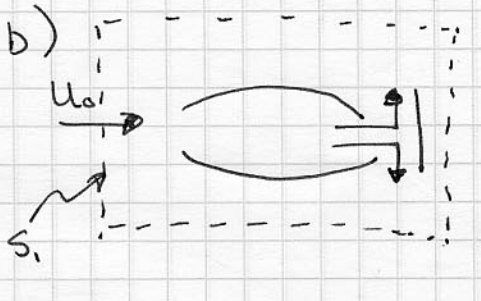
a) $T = \dot{m}(u_e - u_o) = 150(200-60) = \boxed{21\ kN}$

b)



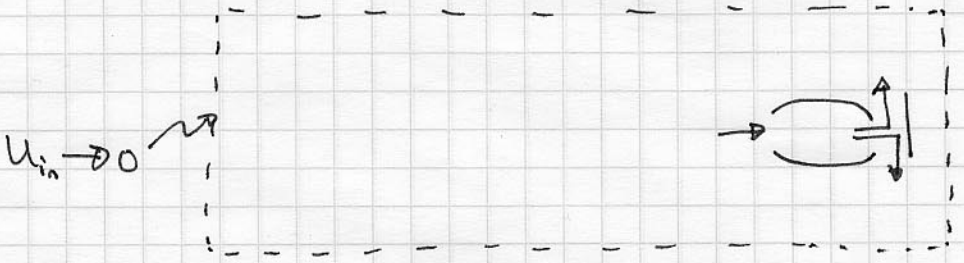
ONLY FLUX OF x-MOM IS ACROSS SURFACE S_1

$T = \dot{m}(0 - u_o)$

$= 150(-60) = \boxed{9\ kN}$

c) WHEN AIRPLANE COMES TO REST, THERE IS NO NET FORCE IN THE X-DIR. YOU CAN SEE THIS BY DRAWING THE CONTROL VOLUME LARGE RELATIVE TO THE ENGINE

$\boxed{T = 0\ kN}$

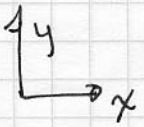


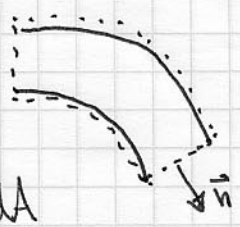
d) INTEGRAL MOMENTUM THEOREM IN FRAME ATTACHED TO VEHICLE:

$$\sum F_y - F_{y_o} = \int_V \frac{d}{dt}(\rho u_y)\, dV + \int_{S'} \rho u_y (\vec{u}\cdot\vec{n})\, dA$$

$F_{y_o} = 0$ assume no accel. of coord. frame

$\int_V \frac{d}{dt}(\rho u_y)\, dV = 0$ assume steady





$$\sum F_y = \int_{inlet} \rho u_y (\vec{u}\cdot\vec{n})\, dA + \int_{exit} \rho u_y (\vec{u}\cdot\vec{n})\, dA$$

$$= \rho(-U_e \sin\alpha)\cdot U_e \cdot A_e$$

$$\boxed{F_y = -\rho A_e U_e^2 \sin\alpha}$$