

9.

a) \dot{W} is work done by turbine

$$\dot{m} (h_{E_{out}} - h_{E_{in}}) = -\dot{W}$$

\Rightarrow

$$-\dot{W} = \dot{m}_0 c_p (T_{E5} - T_{E4})$$

$$H = \dot{m}_0 c_p (T_{E4} - T_{E5})$$

in turbine $T_{E4} > T_{E5}$ so $H > 0$.

\Rightarrow

$$H = \dot{m}_0 c_p T_0 \frac{T_{E4}}{T_0} \left(1 - \frac{T_{E5}}{T_{E4}} \right)$$

$$H = \dot{m}_0 c_p T_0 \tau_2 (1 - \tau_E)$$

b) can use turbojet equation before power balance is applied, but with no compressor

$$\tau_c = \tau_c = 1$$

\Rightarrow

$$\frac{F}{\dot{m}} = a_0 \left\{ \left[\frac{2}{\gamma-1} \frac{\tau_2}{\tau_r \tau_c} (\tau_r \tau_c \tau_E - 1) \right]^{\frac{1}{2}} - M_0 \right\}$$

$$\frac{F}{\dot{m}} = a_0 \left\{ \left[\frac{2}{\gamma-1} \frac{\tau_2}{\tau_r} (\tau_r \tau_E - 1) \right]^{\frac{1}{2}} - M_0 \right\}$$