1

2.

$$\dot{m}_{air} = 800\ \frac{kg}{s} \qquad \dot{m}_{fuel} = 8\ \frac{kg}{s}$$

$$h = 43{,}000\ \frac{kJ}{kg} = 4.3 \times 10^7\ \frac{J}{kg}$$

$$T_{t_1} = 500\ K$$

$$\dot{m}_2 h_{t_2} - \dot{m}_1 h_{t_1} = \dot{m}_{fuel}\, h$$

$$h_t = c_p T_t$$

$$(\dot{m}_{air} + \dot{m}_{fuel})\, c_p T_{t_2} - \dot{m}_{air}\, c_p T_{t_1} = \dot{m}_{fuel}\, h$$

$$808\ \frac{kg}{s}\ 1004.9\ \frac{J}{kg\,K}\ T_{t_2} - 800\ \frac{kg}{s}\ 1004.9\ \frac{J}{kg\,K}\ 500\,K = 8\ \frac{kg}{s}\ 4.3\times 10^7\ \frac{J}{kg}$$

$$T_{t_2} = 918.7\ K$$

$$\boxed{\tau_b = \frac{T_{t_2}}{T_{t_1}} = \frac{918.7\,K}{500\,K} = 1.837}$$

For M_2, solve

$$\left(\frac{1+\gamma M_1^2}{1+\gamma M_2^2}\right)^2 \left(\frac{M_2}{M_1}\right)^2 \left(\frac{1+\frac{\gamma-1}{2}M_2^2}{1+\frac{\gamma-1}{2}M_1^2}\right) = \tau_b$$

$$M_2^2\ \frac{1+\frac{\gamma-1}{2}M_2^2}{(1+\gamma M_2^2)^2} = M_1^2\ \frac{1+\frac{\gamma-1}{2}M_1^2}{(1+\gamma M_1^2)^2}\,\tau_b = \Gamma$$