Question 1

Solve Problem 5-3 in Kirk.

Question 2

Solve Problem 5-7 in Kirk.

Question 3

Solve Problem 5-10 in Kirk.

Question 4

Solve Problem 5-14 in Kirk.

Question 5

Solve Problem 5-15 in Kirk.

Question 6

Consider the following optimal control problem. The dynamics are given as

$$\begin{aligned}\dot{x} &= V\cos\theta + u \\ \dot{y} &= V\sin\theta\end{aligned}$$

where V is a constant and θ is the control. The boundary conditions are given as

$$\begin{aligned}x(T) &= x(0) \\ y(T) &= y(0)\end{aligned}$$

Assuming that T is fixed, determine the optimal trajectory $(x(t), y(t))$ and the optimal control $\theta(t)$ that maximizes the area enclosed by the region that the aircraft flies over the interval from $t \in [0, T]$. Knowing that the area enclosed by the trajectory is given as

$$J = \int_0^T y\dot{x}dt \tag{1}$$

determine the optimal solution $(x^*(t), y^*(t), u^*(t))$