1. Exercise 14.33 of the textbook.

2. Exercise 14.46 of the textbook. (Hint: Use the Cascade Connection method in Lecture 29, or Theorem 14.5 in the textbook.)

3. Consider the system
\[ \dot{x}_1 = x_2, \quad \dot{x}_2 = -x_1^3 + ku \]
Let the nominal value of $k$ be $k = 1$.

(a) Use feedback linearization to design a globally stabilizing state feedback control. Take the closed-loop eigenvalues as -1 and -1.

(b) Find a CLF from part (a) and design another stabilizing controller using Sontag’s formula.

(c) Verify that $u = -\text{sat}(x_2)$ is a globally stabilizing controller that is passivity based.

(d) Verify a CLF from part (c) and design another stabilizing controller using Sontag’s formula.