1. Consider the system

\[
\begin{align*}
\dot{x}_1 &= -x_1 + 2x_2 + x_1 x_2 + x_2^2 \\
\dot{x}_2 &= -x_1 - x_1^2 - x_1 x_2
\end{align*}
\]

(a) Is the right-hand-side function locally Lipschitz? Is it globally Lipschitz?
(b) Find all equilibrium points and determine the type of each one.
(c) Construct the phase portrait and discuss the qualitative behavior of the system.

2. Exercise 1.18 of the textbook. Add the following part. (c) Find another state model with the state variables: \(z_1 = y, z_2 = \dot{y}\) and \(z_3 = \phi\). Find the change of variables that relates the state variables in (a) and (c) and verify that it is invertible.

3. Exercise 2.16 of the textbook.

4. Exercise 3.20 of the textbook.