HW7.1 Consider second order equation ("one-sided pendulum")

$$x'' + x^2 - x = 0$$

Find all the equilibria and compute linearization matrices.
Apply Theorems P.5 and P.6 from the practicum, if possible.
Furthermore, find the first integral and sketch its level sets.

Combine the above to outline the dynamics close to equilibria. In particular:
what can you say about their stability?

HW7.2 Consider the linear equation $X' = AX$, where $X = (x, y)$ and

$$A = \begin{pmatrix} -2 & 1 \\ 0 & -2 \end{pmatrix}$$

Using elementary qualitative analysis, sketch the behavior of solutions.
Also, try to find the first integral.

HW7.3 Same as HW7.2, but for a simpler matrix

$$A = \begin{pmatrix} 0 & 0 \\ 0 & 2 \end{pmatrix}$$