MATH 246 GROUP WORK 14
11 DEC 2020, INSTRUCTOR: RUIWEN SHU

Each group only needs to submit ONE file containing your solutions!

Problem 1. Consider the cooperating species model

$$\begin{cases} \dfrac{\mathrm{d}x}{\mathrm{d}t} = (4 - 2x + y)x \\ \dfrac{\mathrm{d}y}{\mathrm{d}t} = (-1 + x - y)y \end{cases}$$

Compared to the cooperating species example in the lecture, the major difference is that the parameter $r_2 = -1$ is now negative: the y population (a 'cooperating parasite' population) cannot survive without the x population.

(1) Find all stationary points and determine their types.

(2) Sketch the phase portrait based on linearization (you only need to draw the part in the first quadrant). What is the behavior of the solution do you expect if the initial condition satisfies $x(0) > 0$, $y(0) > 0$?