1. Consider a system of two differential equations describing interactions of two competing species (rabbits and sheep).

\[
\begin{align*}
\frac{dx}{dt} &= x(3-x) - 2xy, \\
\frac{dy}{dt} &= y(2-y) - xy.
\end{align*}
\]

a) Find all equilibrium points. Show all your work.

b) Find horizontal field and vertical field nullclines for the system. Draw the nullclines on the (x,y) - plane. On each nullcline draw vectors of the direction field.

c) Use information in b) to draw as much direction field as you can (assume x > 0, y > 0). Verify your work with HPG system solver.

d) Draw phase portrait in the window -1 ≤ x ≤ 4, -1 ≤ y ≤ 4.

e) Describe all possible fates of solutions starting at x(0) = a, y(0) = b, a > 0, b > 0.