01:640:252 ELEMENTARY DIFFERENTIAL EQUATIONS: HW6

(1) For the following system, find and classify all equilibrium points.

$$\begin{cases} \frac{dx}{dt} = x(-x - 3y + 150), \\ \frac{dy}{dt} = y(-2x - y + 100). \end{cases}$$

(2) Sketch the x-nullcline and y-nullcline of the system in the previous question. Sketch the phase portrait in the first quadrant.

(3) For the following system, find all equilibria.

$$\begin{cases} x' = x(2 - x - y), \\ y' = y(y - x^2). \end{cases}$$

(4) Sketch the x-nullcline and y-nullcline of the system in the previous question. Sketch the phase portrait in the first quadrant.

(5) For the following systems, check if it is Hamiltonian. If yes, find a Hamiltonian function.

(a) $\begin{cases} x' = 3xy^2 + e^x + 1 \\ y' = -y^3 - ye^x \end{cases}$,

(b) $\begin{cases} x' = 2y\cos(y^2) + x^2e^y \\ y' = -2xe^y \end{cases}$,