(1) Compute the equilibria of the following nonlinear differential equations, and use that information to match each equation with a trajectory plot from the following page. It may be helpful to compute the eigenvalues at an equilibrium.

(a) \( x' = x - y, \ y' = x + 3y - 4 \).
(b) \( x' = 2x - y, \ y' = x - 3y \).
(c) \( x' = 2\sin(x) + \sin(y), \ y' = \sin(x) + 2\sin(y) \).
(d) \( x' = x - 2y, \ y' = -x^3 + 4x \).
(e) \( x' = 1 - y^2, \ y' = x + 2y \).
(f) \( x' = x - 2y + 3, \ y' = x - y + 2 \).

(2) Find the unique equilibrium of the system \( x' = x - y, \ y' = 5x - 3y - 2 \). Compute the eigenvalues of its linearization to determine the stability of the equilibrium (see Theorem 2 in section 9.2).

(3) In 1958, Tsuneji Rikitake formulated a simple model of the Earth’s magnetic core to explain the oscillations in the polarity of the magnetic field. The equations for his model are:

\[
\begin{align*}
x' &= -\mu x + yz \\
y' &= -\mu y + (z - a)x \\
z' &= 1 - xy
\end{align*}
\]

where \( a \) and \( \mu \) are positive constants. Find the equilibria for this system for \( a = \mu = 1 \), and write down the Jacobian matrix of the linearized system at these equilibria.