MA 138 Worksheet #27

Section 11.1

4/16/24

1. Indicate which pairs of functions satisfy this system of linear differential equations:

$$\begin{cases} y_1' &= 2.5y_1 - 1.5y_2 \\ y_2' &= -1.5y_1 + 2.5y_2 \end{cases}$$

(a) $y_1 = e^x, \quad y_2 = e^{-x}$

(b) $y_1 = \sin(x) + \cos(x), \quad y_2 = \cos(x) - \sin(x)$

(c) $y_1 = \cos(x), \quad y_2 = \sin(x)$

(d) $y_1 = \sin(x), \quad y_2 = \cos(x)$

(e) $y_1 = 2e^{-2x}, \quad y_2 = 3e^{-2x}$

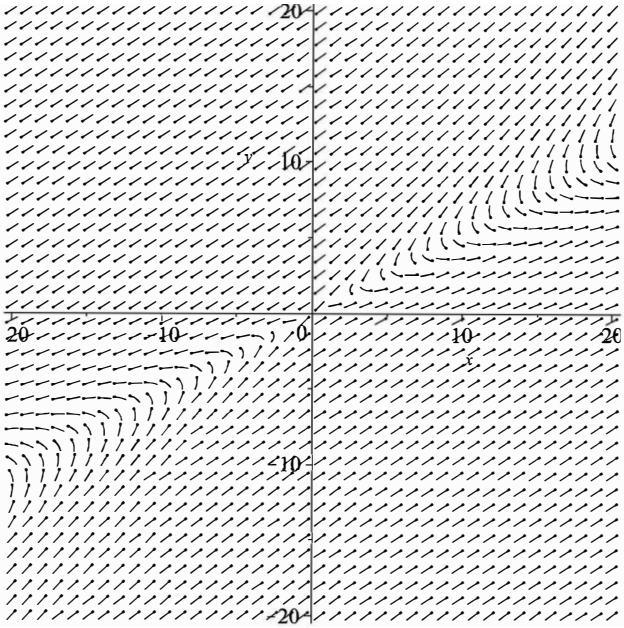
(f) $y_1 = e^x, \quad y_2 = e^x$

(g) $y_1 = e^{4x}, \quad y_2 = -e^{4x}$

2. Find the general solution of the system of differential equations

$$\begin{cases} x_1' &= 4x_1 - 7x_2 \\ x_2' &= 2x_1 - 5x_2 \end{cases}$$

In the direction field given below, sketch the lines in the direction of the eigenvectors. Indicate on each line of eigenvectors the direction in which the solution would move if it starts on that line.



Classify the stability of the equilibrium point $(0, 0)$.

3. Solve the system $\dfrac{d}{dt}\mathbf{x} = \begin{bmatrix} 22 & -54 \\ 9 & -23 \end{bmatrix}\mathbf{x}$ with the initial value $\mathbf{x}(0) = \begin{bmatrix} 16 \\ 7 \end{bmatrix}$.

4. Find the real valued general solution of the system of differential equations

$$\begin{cases} \dfrac{dx}{dt} &= 3x + 2y \\ \dfrac{dy}{dt} &= -5x - 3y \end{cases}$$

Classify the stability of the equilibrium point $(0, 0)$.

Verify your conclusions by analyzing the direction field associated to the given system of differential equations below