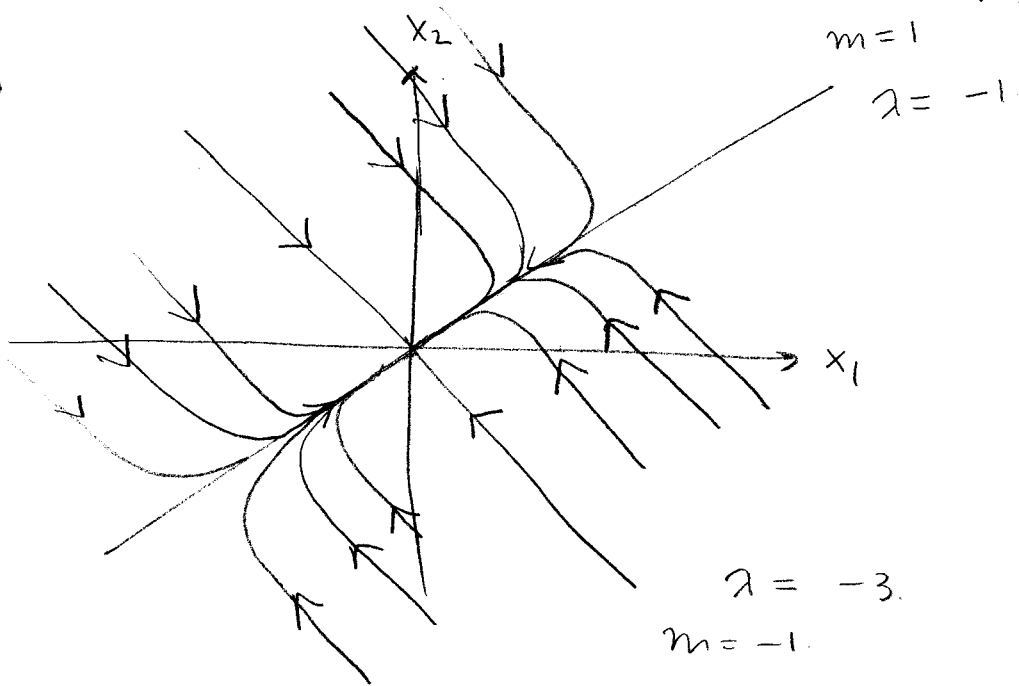


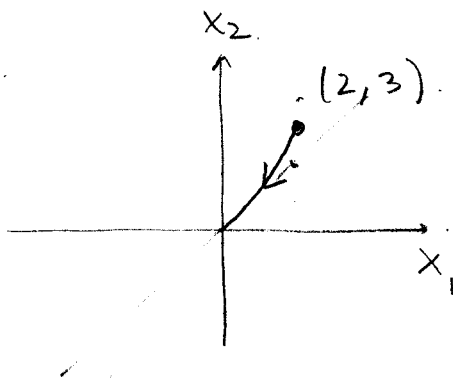
hw 10 - A solⁿ

AGM I
Gross
F2007.

(1a)



(1b)



(1d). $(0,0)$ is an asymptotically stable improper node

$$(2) \quad \underline{x}' = \begin{bmatrix} 8 & 12 \\ -9 & 47 \end{bmatrix} \underline{x}$$

$$\begin{array}{r} 47 \\ 8 \\ \hline 376 \\ + 108 \\ \hline 484 \end{array}$$

$$\begin{vmatrix} 8-\lambda & 12 \\ -9 & 47-\lambda \end{vmatrix} = (47-\lambda)(8-\lambda) + 12(9) =$$

$$= \lambda^2 - 55\lambda + 484 = 0 \rightarrow \lambda = \frac{55 \pm \sqrt{(55)^2 - 4(484)}}{2}$$

$$= \frac{55 \pm 33}{2} = 44, 11.$$

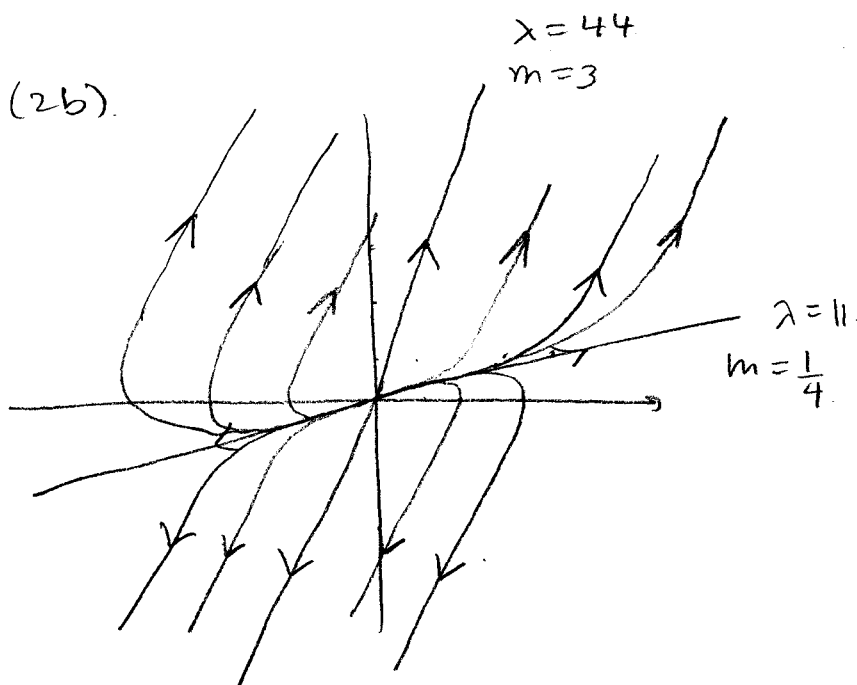
$$\begin{array}{r} 44 \\ -8 \\ \hline \end{array}$$

$$\lambda = 11: \quad \begin{bmatrix} -3 & 12 \\ -9 & 36 \end{bmatrix} \underline{x} = \underline{0} \quad \text{if } \underline{x} = \begin{bmatrix} 4 \\ 1 \end{bmatrix}$$

$$\lambda = 44: \quad \begin{bmatrix} -36 & 12 \\ -9 & 3 \end{bmatrix} \underline{x} = \underline{0} \quad \text{if } \underline{x} = \begin{bmatrix} 1 \\ 3 \end{bmatrix}$$

$$\underline{x}(t) = c_1 e^{11t} \begin{bmatrix} 4 \\ 1 \end{bmatrix} + c_2 e^{44t} \begin{bmatrix} 1 \\ 3 \end{bmatrix}$$

(2b).



(2c) $(0,0)$ is an unstable improper node.

$$(3) \begin{bmatrix} x \\ y \end{bmatrix}' = \begin{bmatrix} 0 & -2 \\ -1 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix}$$

HW 10, p 3

$$\begin{vmatrix} -\lambda & -2 \\ -1 & 1-\lambda \end{vmatrix} = \lambda^2 - \lambda - 2 = (\lambda - 2)(\lambda + 1) = 0$$

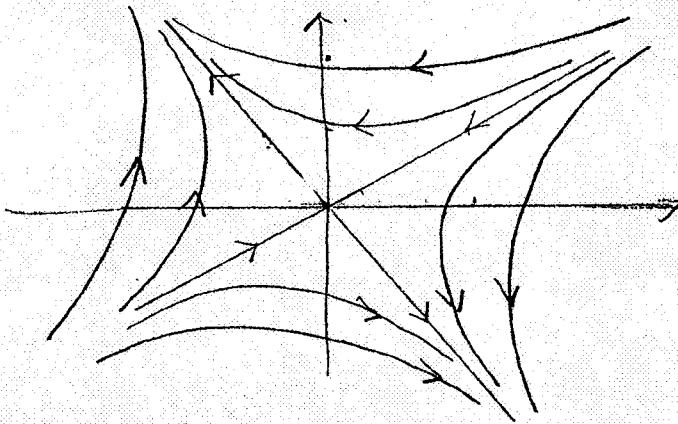
$$\lambda = 2, -1$$

$$\lambda = 2: \begin{bmatrix} -2 & -2 \\ -1 & -1 \end{bmatrix} \underline{E} = \underline{0} \text{ if } \underline{E} = \begin{bmatrix} 1 \\ -1 \end{bmatrix}$$

$$\lambda = -1: \begin{bmatrix} 1 & -2 \\ -1 & 2 \end{bmatrix} \underline{E} = \underline{0} \text{ if } \underline{E} = \begin{bmatrix} 2 \\ 1 \end{bmatrix}$$

$$(a) \underline{x} = c_1 e^{2t} \begin{bmatrix} 1 \\ -1 \end{bmatrix} + c_2 e^{-t} \begin{bmatrix} 2 \\ 1 \end{bmatrix}$$

(b)



(c) $(0,0)$ is an UNSTABLE SADDLE.