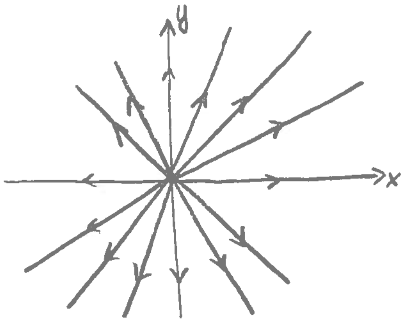
$\dot{\vec{x}} = A\vec{x}$ WITH $\det(A) \neq 0$:

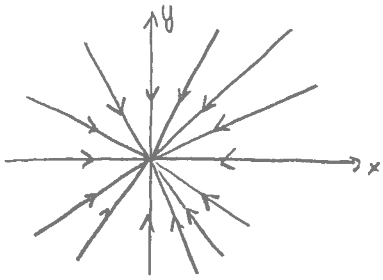
(ii) A... $\lambda_1 = \lambda_2$, TWO LIN. IND. EIGENVECTORS:

$\lambda_1 > 0$:



DEGENERATE UNSTABLE NODE

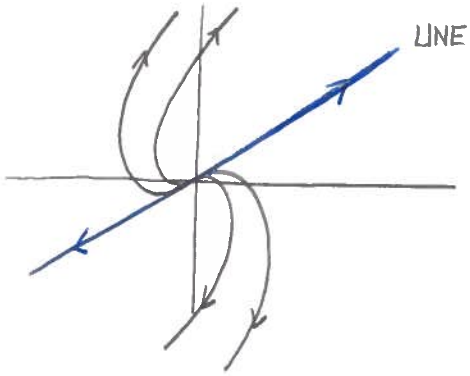
$\lambda_1 < 0$:



DEGENERATE STABLE NODE

(iii) A... $\lambda_1 = \lambda_2$, ONE LIN. IND. EIGENVECTOR: $A\vec{v_1} = \lambda_1 \vec{v_1}$, $A\vec{v_2} = \lambda \vec{v_2} + \vec{v_1}$

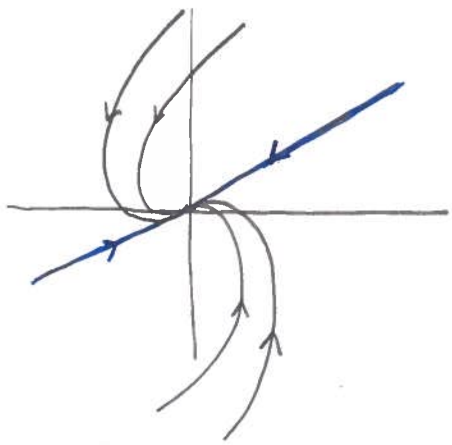
$\lambda_1 > 0$



LINE SPANED BY $\vec{v_1}$

DEGENERATE UNSTABLE NODE

$\lambda_1 < 0$



DEGENERATE STABLE NODE.

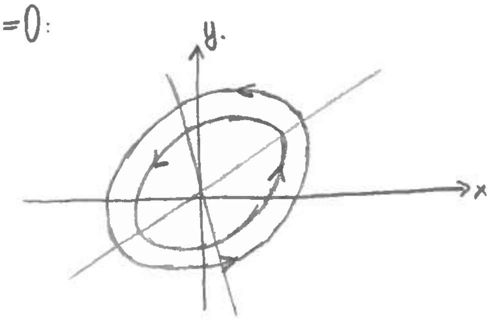
SOLUTION IS OF THE FORM

$$\vec{x}(t) = (B + Ct)e^{\lambda_1 t}\vec{v_1} + Ce^{\lambda_1 t}\vec{v_2}$$

$\dot{\vec{x}} = A\vec{x}$ WITH $\det(A) \neq 0$

(iv) A... $\lambda_1 = \bar{\lambda}_2 \in \mathbb{C} \setminus \mathbb{R}$, $A\vec{v}_1 = \lambda_1 \vec{v}_1$

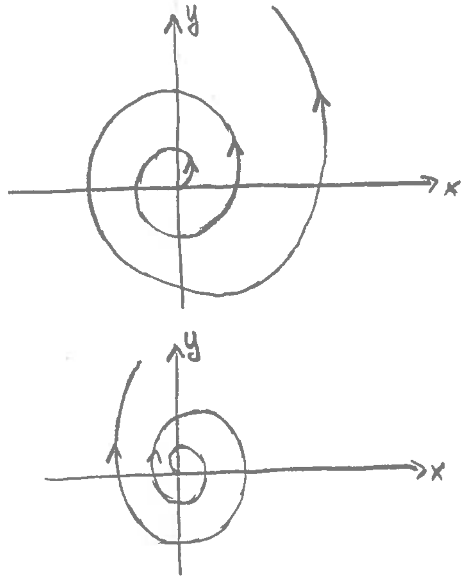
$\mathrm{Re}(\lambda_1) = 0$:



CENTER

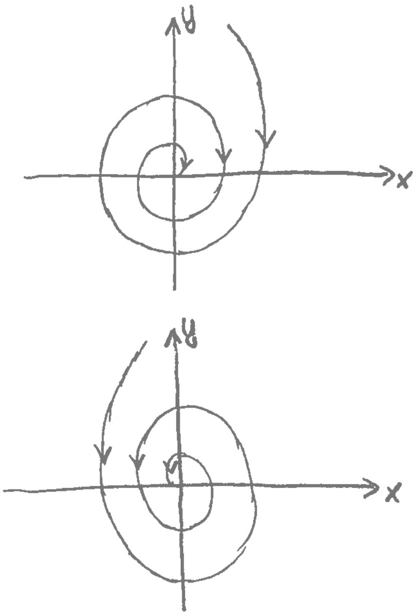
ALSO ARROWS IN THE OPPOSITE DIRECTION POSSIBLE.

$\mathrm{Re}(\lambda_1) > 0$:



UNSTABLE SPIRAL

$\mathrm{Re}(\lambda_1) < 0$



STABLE SPIRAL

SOLUTION IS OF THE FORM

$$\vec{x}(t) = e^{\mathrm{Re}(\lambda_1)t}\Big((B\cos(\mathrm{Im}(\lambda_1)t) + C\sin(\mathrm{Im}(\lambda_1)t))\mathrm{Re}(\vec{v}_1) + (-B\sin(\mathrm{Im}(\lambda_1)t) + C\cos(\mathrm{Im}(\lambda_1)t))\mathrm{Im}(\vec{v}_1)\Big)$$