$\vec{x} = c_1\begin{bmatrix}-1\\5\end{bmatrix}e^{5t} + c_2\begin{bmatrix}-1\\5\end{bmatrix}e^{-t}$

Give that the solution to $\mathbf{x}' = \begin{bmatrix} a & b \\ c & d \end{bmatrix}\mathbf{x}$ is $\mathbf{x} = c_1\begin{bmatrix} v_1 \\ v_2 \end{bmatrix}e^{r_1 t} + c_2\begin{bmatrix} w_1 \\ w_2 \end{bmatrix}e^{r_2 t}$

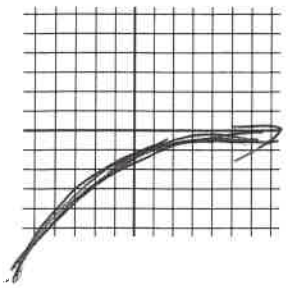
$\begin{bmatrix} x_1(0) \\ x_2(0) \end{bmatrix} = \begin{bmatrix} -1 \\ 5 \end{bmatrix} \Rightarrow c_1 = 0 \text{ & } c_2 = 1$

$\begin{bmatrix} x_1(t) \\ x_2(t) \end{bmatrix} = \begin{bmatrix} -1 \\ 5 \end{bmatrix}e^{-t}$

[7] 2a.) Graph the solution to the IVP $\begin{bmatrix} x_1(0) \\ x_2(0) \end{bmatrix} = \begin{bmatrix} w_1 \\ w_2 \end{bmatrix}$ in the

$x_1 = -e^{-t}$

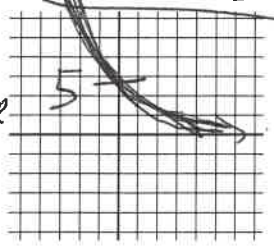
t, x_1-plane



as $t \to \infty$, $x_1 \to 0$ since e. value is negative

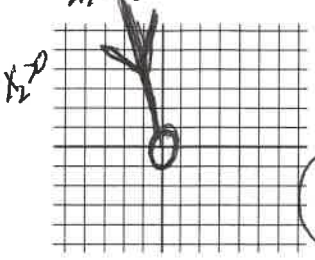
$x_1 < 0$

t, x_2-plane $x_2 = 5e^{-t}$



$x_2 > 0$

x_1, x_2-plane



$\frac{x_2}{x_1} = \frac{5e^{-t}}{-1e^{-t}}$

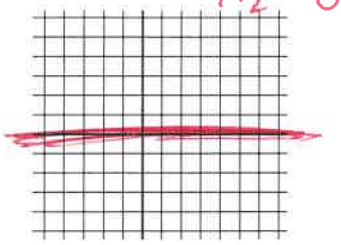
$x_2 = \frac{5}{-1}x_1$

[3] 2b.) Graph the solution to the IVP $\begin{bmatrix} x_1(0) \\ x_2(0) \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$ in the

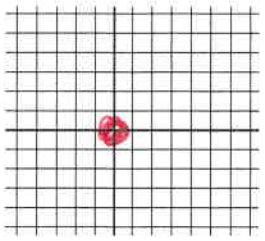
$c_1 = c_2 = 0 \Rightarrow \begin{bmatrix} x_1(t) \\ x_2(t) \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$

t, x_1-plane $x_1 = 0$

t, x_2-plane $x_2 = 0$



x_1, x_2-plane



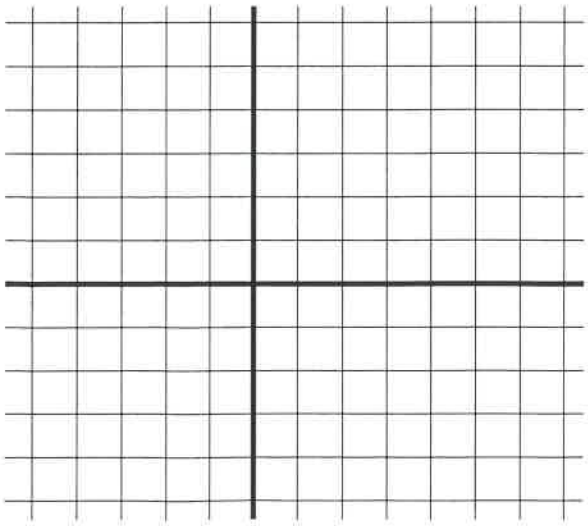
[2] 2c.) The equilibrium solution for this system of equations is $\begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} \quad \end{bmatrix}$.

e.vector $\begin{bmatrix} -1 \\ 5 \end{bmatrix} \Rightarrow x_2 = \frac{5}{-1}x$

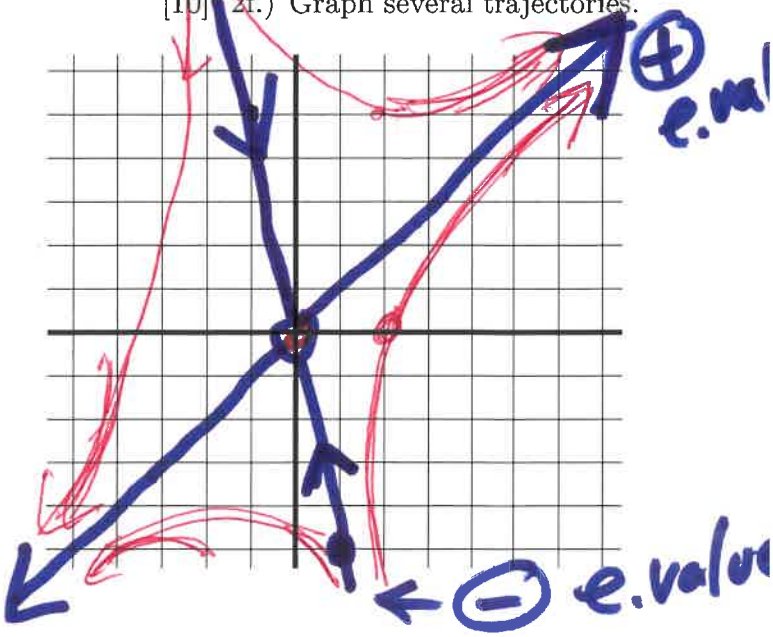
e.vector $\begin{bmatrix} 1 \\ 1 \end{bmatrix} \Rightarrow x_2 = \frac{1}{1}x$

[3] 2d.) $\frac{dx_2}{dx_1} =$ _____

[2] 2e.) Plot several direction vectors where the slope is 0 and where slope is vertical.



[10] 2f.) Graph several trajectories.



$\vec{x}' = [\ ]\vec{x} \Rightarrow \vec{x} = c_1 \begin{bmatrix} 1 \\ 1 \end{bmatrix} e^{5t} + c_2 \begin{bmatrix} -1 \\ 5 \end{bmatrix} e^{-t}$

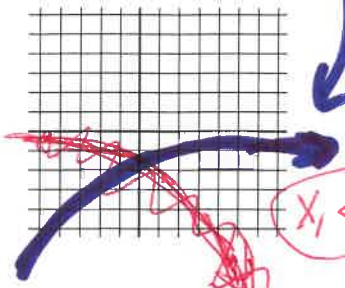
Give that the solution to $\mathbf{x}' = \begin{bmatrix} a & b \\ c & d \end{bmatrix}\mathbf{x}$ is $\mathbf{x} = c_1 \begin{bmatrix} v_1 \\ v_2 \end{bmatrix} e^{r_1 t} + c_2 \begin{bmatrix} w_1 \\ w_2 \end{bmatrix} e^{r_2 t}$

IVP soln $\begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} -1 \\ 5 \end{bmatrix} e^{-t}$

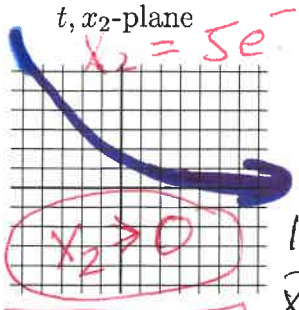
[7] 2a.) Graph the solution to the IVP $\begin{bmatrix} x_1(0) \\ x_2(0) \end{bmatrix} = \begin{bmatrix} w_1 \\ w_2 \end{bmatrix}$ in the

$\begin{bmatrix} x_1(0) \\ x_2(0) \end{bmatrix} = \begin{bmatrix} -1 \\ 5 \end{bmatrix}$

t, x_1-plane $x_1 = -e^{-t}$ $x_1 < 0$



t, x_2-plane $x_2 = 5e^{-t}$ $x_2 > 0$

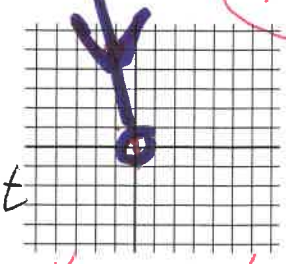


$c_1 = 0$

$c_2 = 1$

IVP soln $\vec{x} = \begin{bmatrix} -1 \\ 5 \end{bmatrix} e^{-t}$

x_1, x_2-plane $x_2 = \frac{5}{-1} x_1$



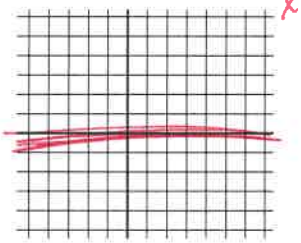
$\frac{x_2}{x_1} = \frac{5e^{-t}}{-e^{-t}} = \frac{5}{-1}$

[3] 2b.) Graph the solution to the IVP $\begin{bmatrix} x_1(0) \\ x_2(0) \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$ in the

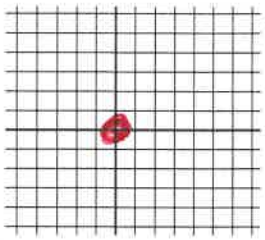
$\Rightarrow c_1 = 0, c_2 = 0$

t, x_1-plane $x_1 = 0$

t, x_2-plane $x_2 = 0$



x_1, x_2-plane



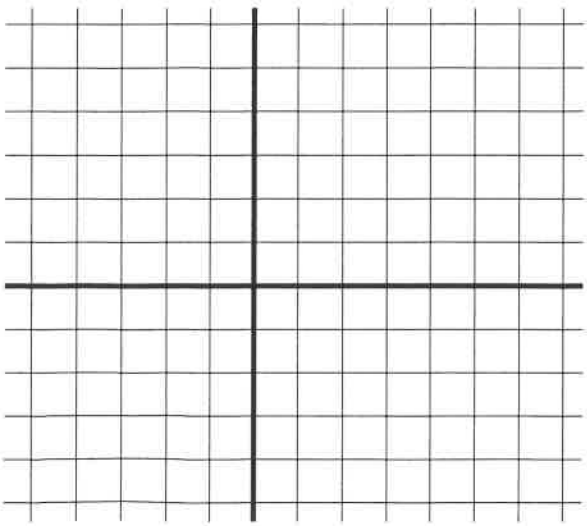
[2] 2c.) The equilibrium solution for this system of equations is $\begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} \ \end{bmatrix}$.

e.vals: + e.vector $\begin{bmatrix} 1 \\ 1 \end{bmatrix} \Rightarrow x_2 = \frac{1}{1} x_1$

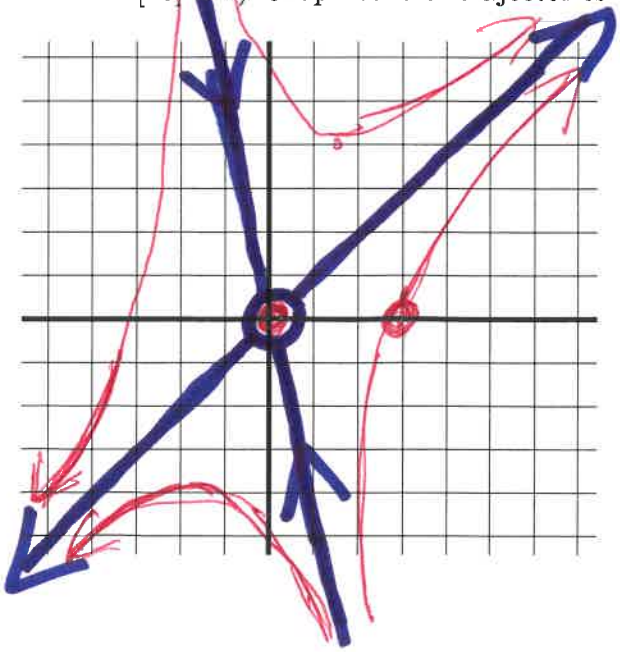
− e.vector $\begin{bmatrix} -1 \\ 5 \end{bmatrix} \Rightarrow x_2 = \frac{5}{-1} x_1$

[3] 2d.) $\frac{dx_2}{dx_1} =$ _____

[2] 2e.) Plot several direction vectors where the slope is 0 and where slope is vertical.



[10] 2f.) Graph several trajectories.



$\vec{X} = c_1\begin{bmatrix}1\\1\end{bmatrix}e^{5t} + c_2\begin{bmatrix}-1\\5\end{bmatrix}e^{-t}$

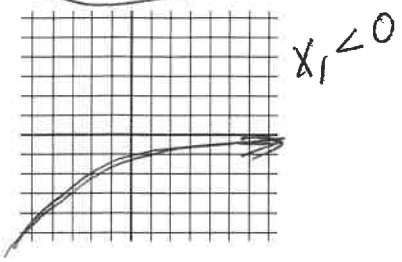
Give that the solution to $\mathbf{x}' = \begin{bmatrix} a & b \\ c & d \end{bmatrix}\mathbf{x}$ is $\mathbf{x} = c_1\begin{bmatrix} v_1 \\ v_2 \end{bmatrix}e^{r_1 t} + c_2\begin{bmatrix} w_1 \\ w_2 \end{bmatrix}e^{r_2 t}$

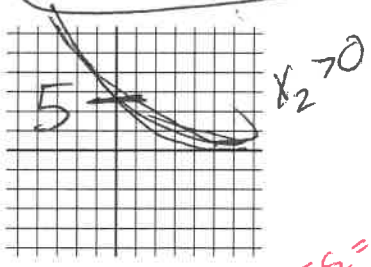
$\begin{bmatrix} X_1(0) \\ X_2(0) \end{bmatrix} = \begin{bmatrix} -1 \\ 5 \end{bmatrix} \Rightarrow c_1 = 0,\ c_2 = 1$ IVP soln $\vec{X} = \begin{bmatrix} -1 \\ 5 \end{bmatrix}e^{-t}$

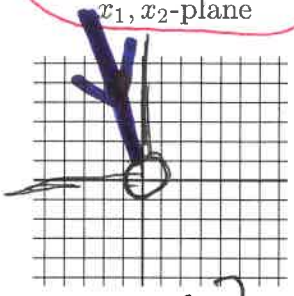
[7] 2a.) Graph the solution to the IVP $\begin{bmatrix} x_1(0) \\ x_2(0) \end{bmatrix} = \begin{bmatrix} w_1 \\ w_2 \end{bmatrix}$ in the

$X_1 = -e^{-t}$ $X_2 = 5e^{-t}$ $X_2 = \frac{5}{-1}X_1$

t, x_1-plane t, x_2-plane x_1, x_2-plane

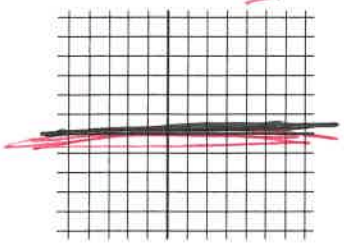


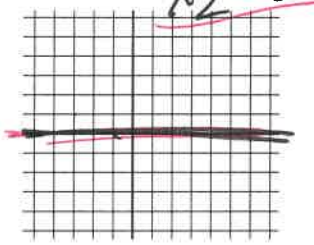


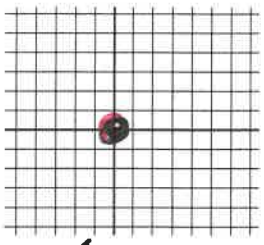


[3] 2b.) Graph the solution to the IVP $\begin{bmatrix} x_1(0) \\ x_2(0) \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$ in the $\Rightarrow c_1 = c_2 = 0$ $\begin{bmatrix} X_1(t) \\ X_2(t) \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$

t, x_1-plane $X_1 = 0$ t, x_2-plane $X_2 = 0$ x_1, x_2-plane







$(X_1, X_2) = (0, 0)$

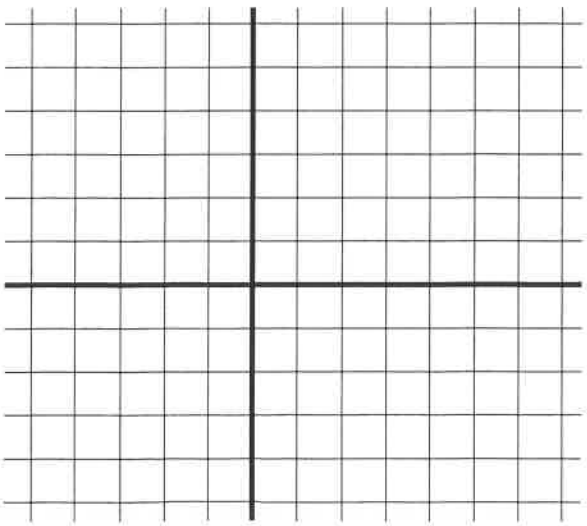
[2] 2c.) The equilibrium solution for this system of equations is $\begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$.

e. vector $\begin{bmatrix} 1 \\ 1 \end{bmatrix}$ $\rightarrow$ slope $\frac{1}{1}$

e. vector $\begin{bmatrix} -1 \\ 5 \end{bmatrix}$ $\rightarrow$ slope $\frac{5}{-1}$

[3] 2d.) $\frac{dx_2}{dx_1} =$ _____

[2] 2e.) Plot several direction vectors where the slope is 0 and where slope is vertical.



[10] 2f.) Graph several trajectories