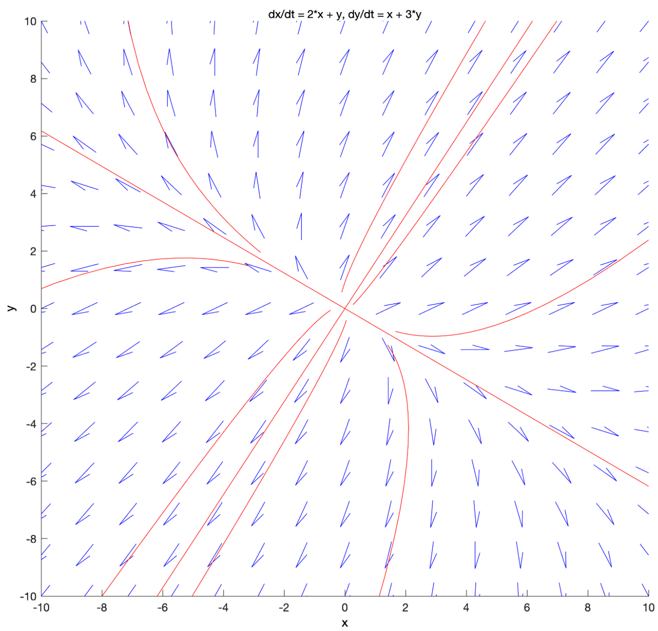
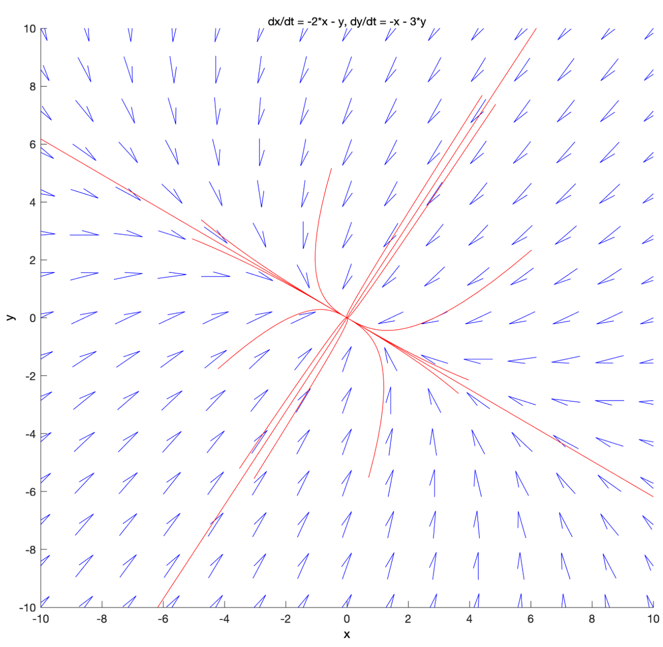
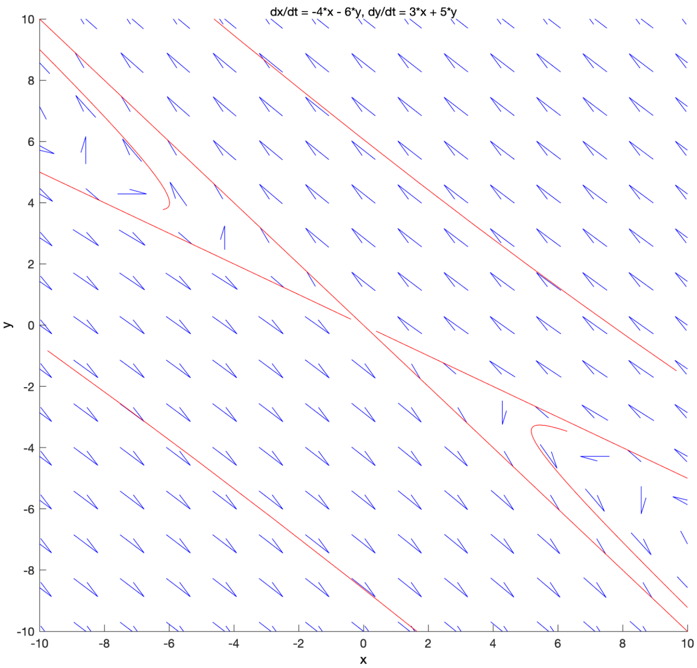
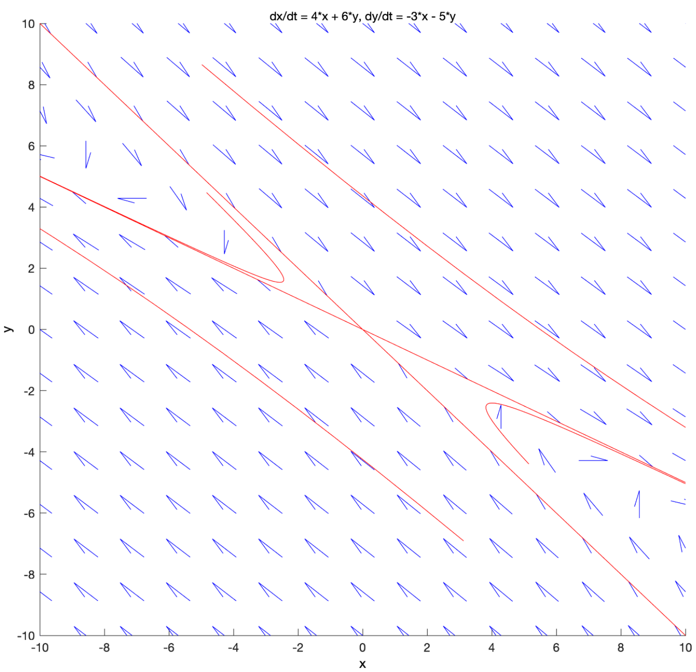
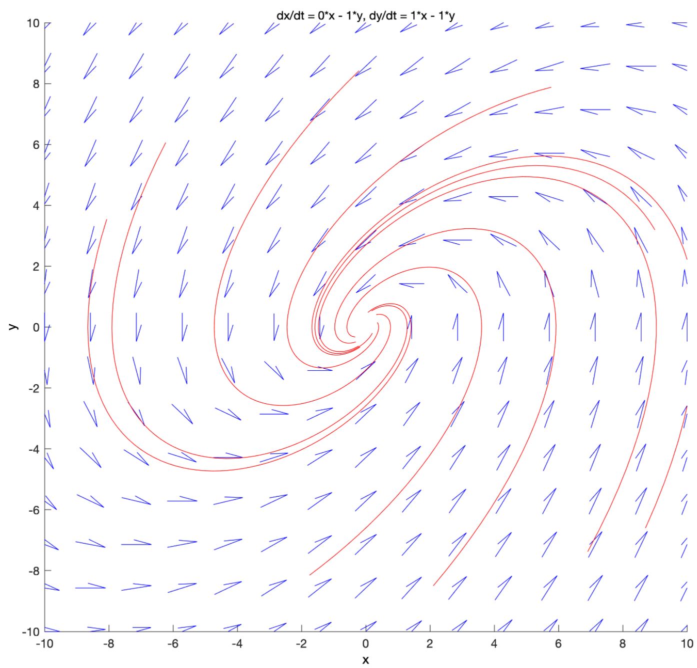
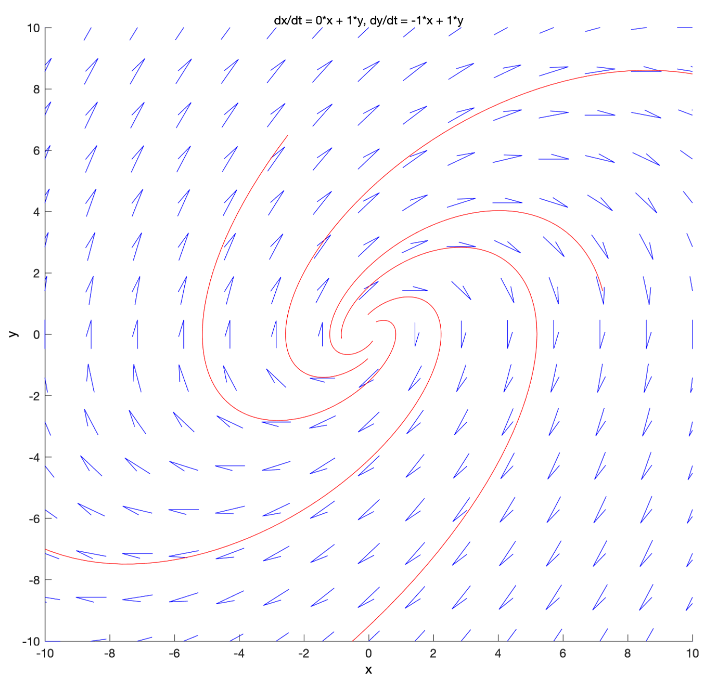
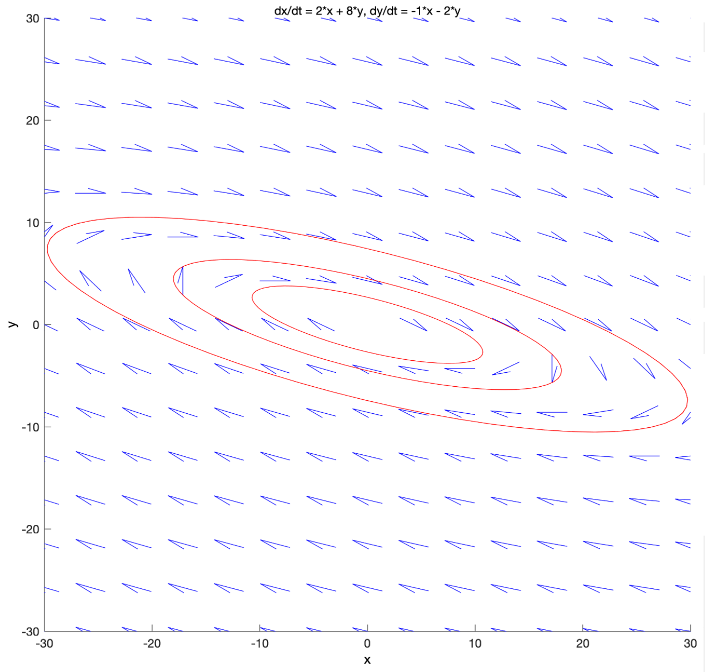
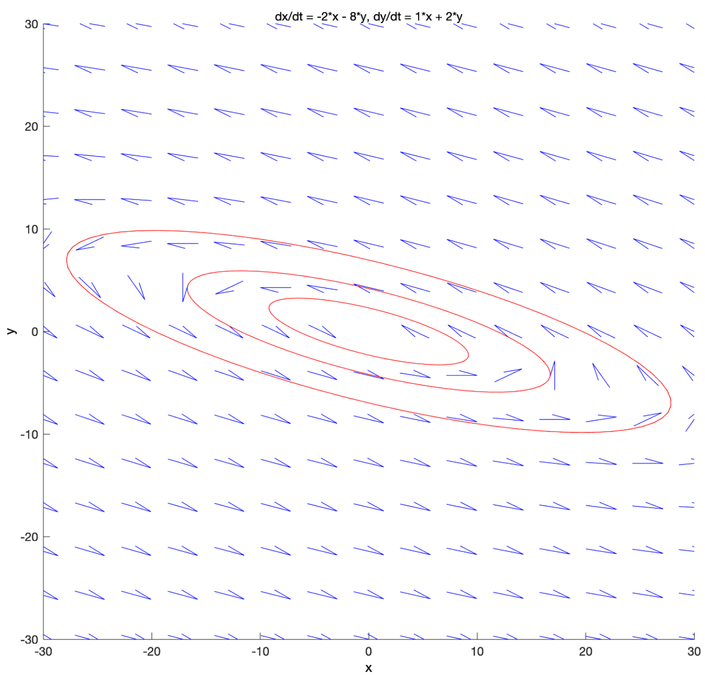
Lab 4 - Exercise 4: Analyze Phase Portraits

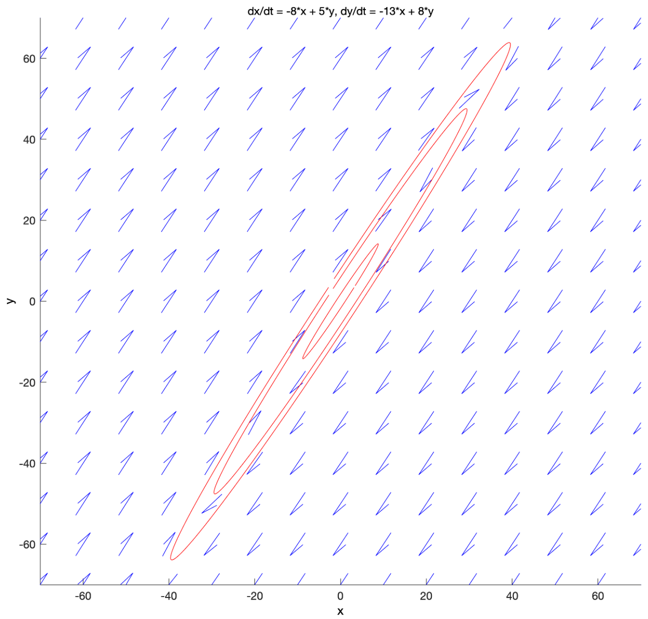
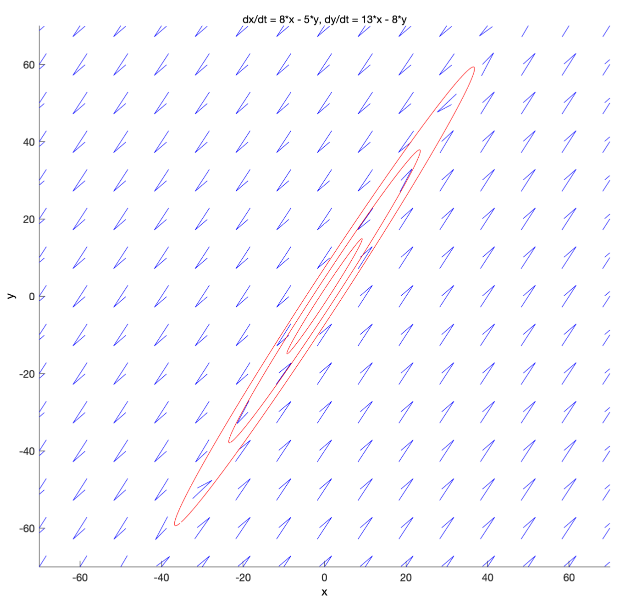
Mustafa Khan (khanm382)

#	Phase Portrait Plot	Eigenvalues	Description
4.1		$\lambda = \frac{5+\sqrt{5}}{2}$, $\lambda = \frac{5-\sqrt{5}}{2}$	The eigenvalues are both positive, thus the differential equation is unstable and (0, 0) is a nodal source.
4.2		$\lambda = \frac{-5+\sqrt{5}}{2}$, $\lambda = \frac{-5-\sqrt{5}}{2}$	The eigenvalues are both negative, thus the differential equation is asymptotically stable and (0, 0) is a nodal sink.

4.3		$\lambda = 2, \lambda = -1$	There is one positive eigenvalue and one negative eigenvalue, thus the differential equation is unstable and (0, 0) is a saddle.
4.4		$\lambda = 1,$ $\lambda = -2$	There is one positive eigenvalue and one negative eigenvalue, thus the differential equation is unstable and (0, 0) is a saddle.

4.5		$\lambda =-\frac{1}{2}+i\frac{\sqrt{3}}{2}$, $\lambda =-\frac{1}{2}-i\frac{\sqrt{3}}{2}$	We have complex eigenvalues of the form $\lambda = \mu \pm iv$. Notice that $\mu < 0$ for both eigenvalues. Thus, the ODE is asymptotically stable and (0,0) is a spiral sink moving counter clockwise.
4.6		$\lambda = \frac{1}{2}+i\frac{\sqrt{3}}{2}$, $\lambda = \frac{1}{2}-i\frac{\sqrt{3}}{2}$	We have complex eigenvalues of the form $\lambda = \mu \pm iv$. Notice that $\mu > 0$for both eigenvalues. . Thus, the ODE is unstable and (0,0) is a spiral source moving clockwise.

4.7		$\lambda = 2i,$ $\lambda = -2i$	We have complex eigenvalues of the form $\lambda = \mu \pm iv.$ Notice that $\mu = 0$for both eigenvalues. Thus, the ODE is stable and (0,0) is a centre. The solutions around equilibrium are moving clockwise.
4.8		$\lambda = 2i,$ $\lambda = -2i$	We have complex eigenvalues of the form $\lambda = \mu \pm iv.$ Notice that both $\mu = 0$. Thus, the ODE is stable and (0,0) is a centre. The solutions around equilibrium are moving counter clockwise.

4.9		$\lambda = i, \lambda =- i$	We have complex eigenvalues of the form $\lambda = \mu \pm iv$. Notice that both $\mu = 0$. Thus, the ODE is stable and (0,0) is a centre. The solutions around equilibrium are moving clockwise.
4.10		$\lambda = i, \lambda =- i$	We have complex eigenvalues of the form $\lambda = \mu \pm iv$. Notice that both $\mu = 0$. Thus, the ODE is stable and (0,0) is a centre. The solutions around equilibrium are moving counter clockwise.