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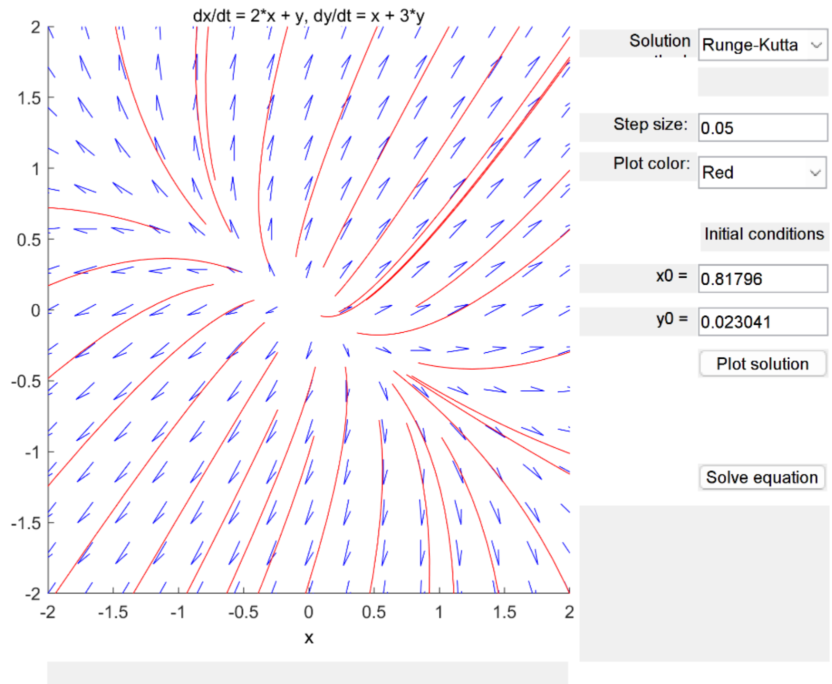
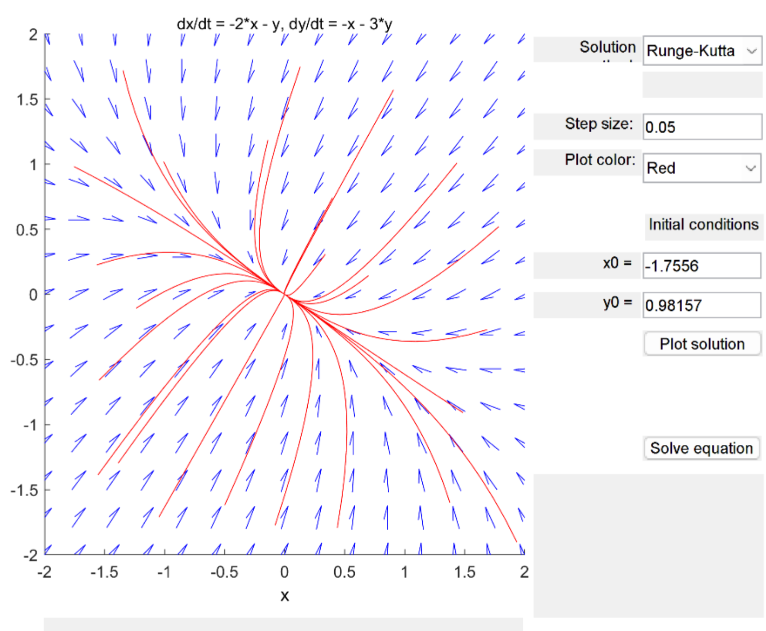
MAT 292 - Exercise 4

1. Plot



   a.
   b. Unstable, Nodal Source, Motion N/A
   c. $\lambda1 = (5+\sqrt{5})/2$; $\lambda2 = (5-\sqrt{5})/2$. Since there're 2 distinct positive real eigenvalues, therefore, Unstable Node.

2. Plot

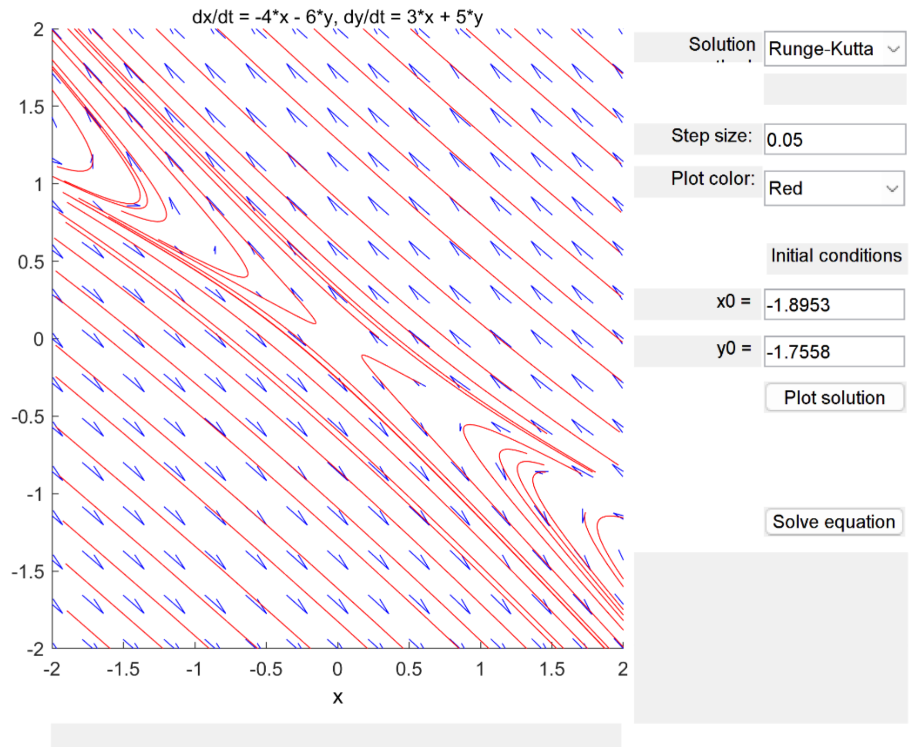


   a.

b. Stable, Nodal Sink, Motion N/A

c. $\lambda 1 = (-5+\sqrt{5})/2$; $\lambda 2 = (-5-\sqrt{5})/2$. Since there're 2 distinct negative real eigenvalues, therefore, Stable Node.

3. Plot

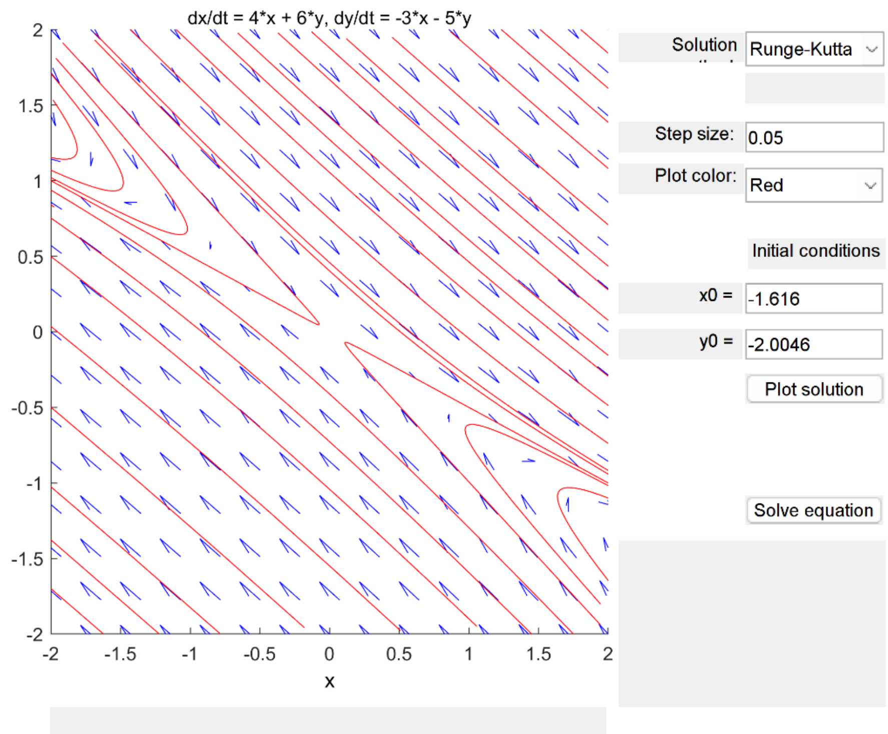


a.

b. Unstable, Saddle Point, Motion N/A

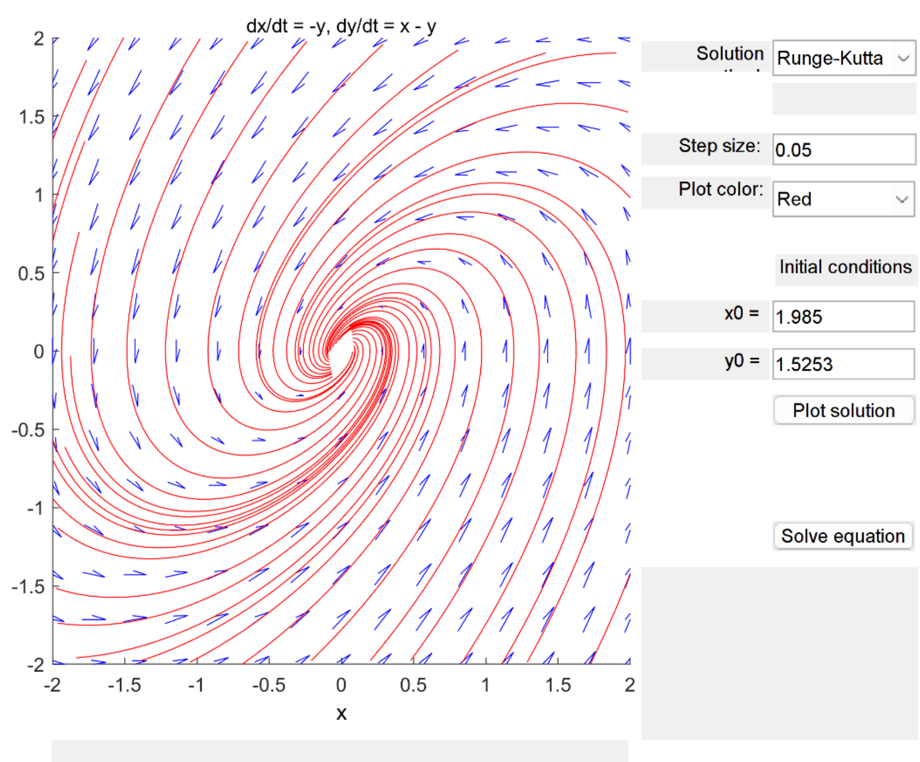
c. $\lambda 1 = -1$; $\lambda 2 = 2$. Since eigenvalues are real, distinct, and $\lambda 1 = -k(\lambda 2)$. Thus, Saddle Point

4. Plot



a.
b. Unstable, Saddle Point, Motion N/A
c. $\lambda 1$ = -2; $\lambda 2$ = 1. Since eigenvalues are real, distinct, and $\lambda 1$ = -k($\lambda 2$). Thus, Saddle Point

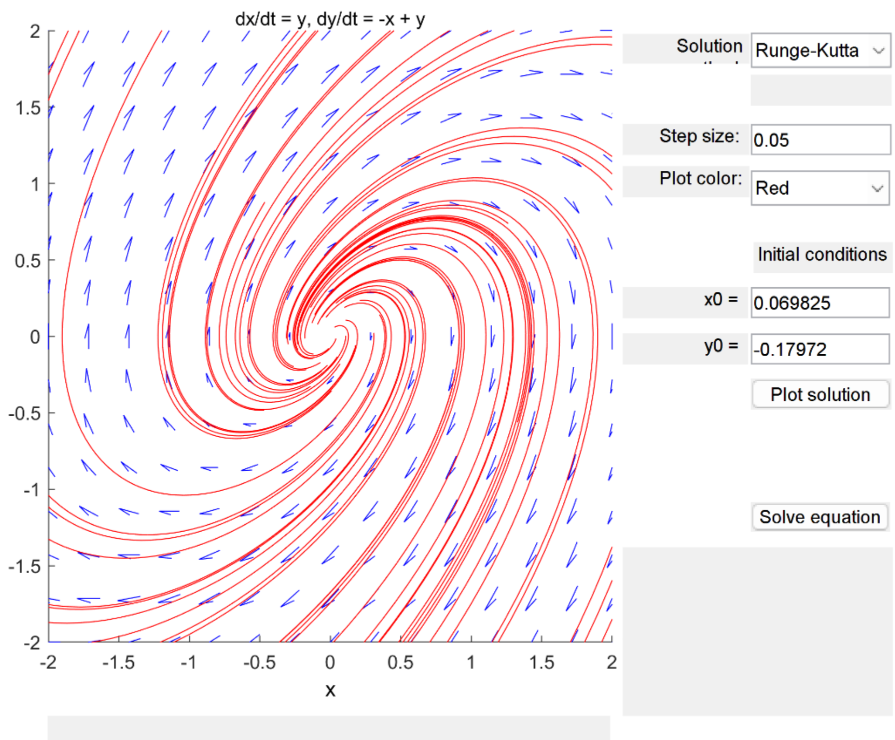
5. Plot



a.
b. Stable, Spiral Sink, Motion: CCW

c. $\lambda 1 = -1/2 + i\surd 3/2$; $\lambda 2 = -1/2 - i\surd 3/2$. Since distinct and complex eigenvalues with negative real parts. Thus, Spiral Sink

6. Plot

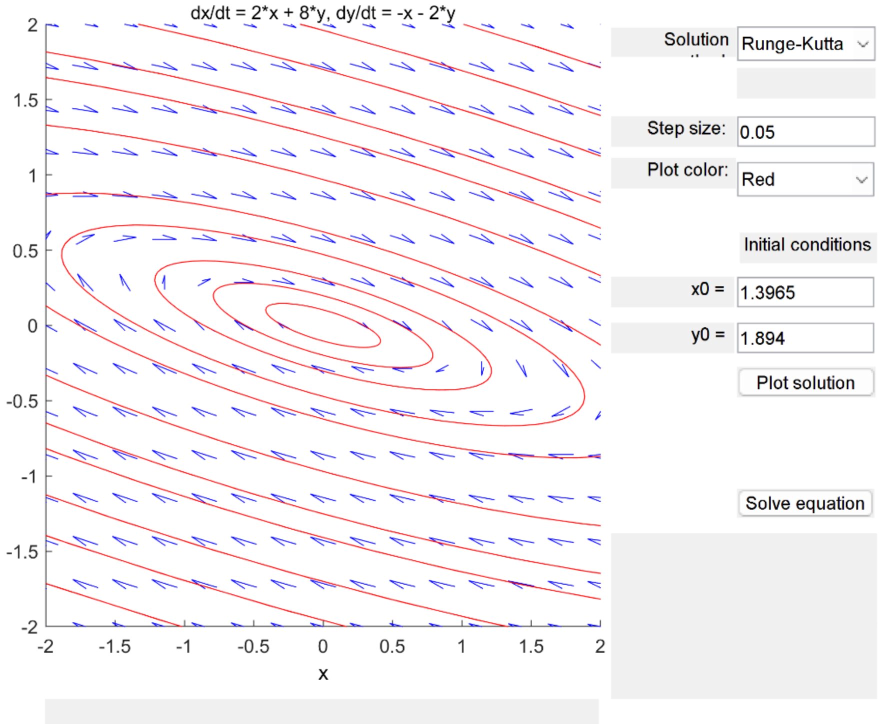


a.

b. Unstable, Spiral Source, Motion: CW

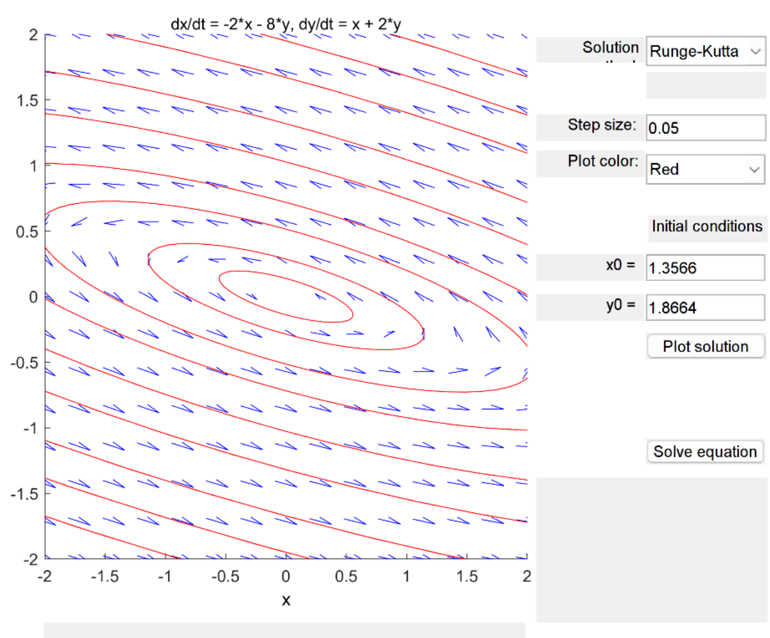
c. $\lambda 1 = 1/2 + i\surd 3/2$; $\lambda 2 = 1/2 - i\surd 3/2$. Since distinct and complex eigenvalues with positive real parts. Thus, Spiral source.

7. Plot



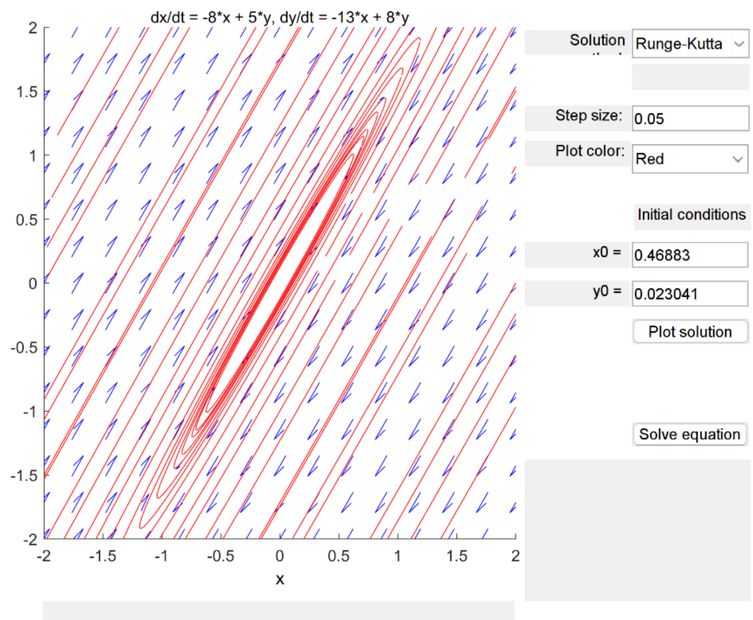
a.
b. Stable, Center, Motion: CW
c. $\lambda 1 = -2i$; $\lambda 2 = 2i$. Since distinct, opposite signs, complex without real parts. Thus, clockwise stable center.

8. Plot



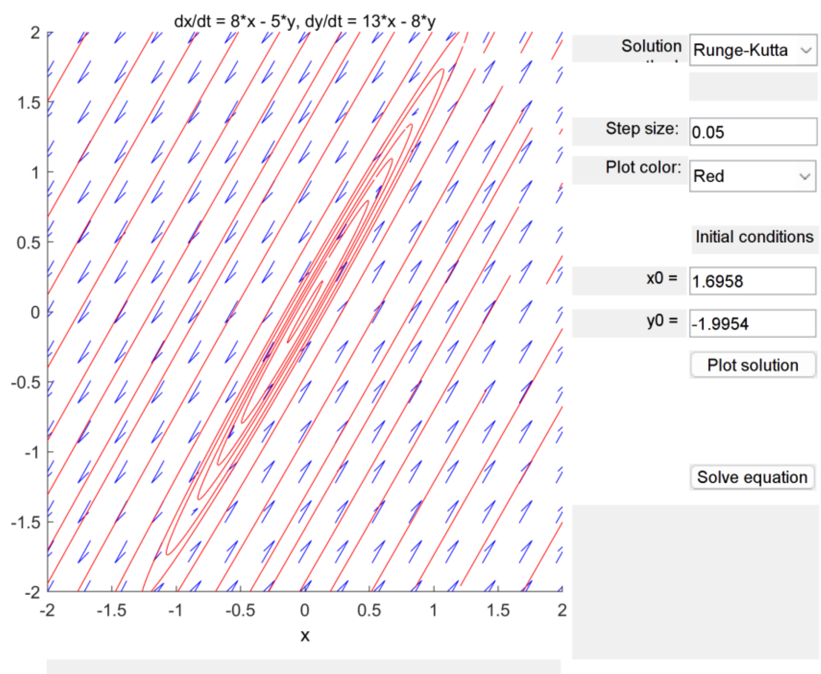
a.
b. Stable, Center, Motion: CCW
c. $\lambda 1 = -2i$; $\lambda 2 = 2i$. Since distinct, opposite signs, complex without real parts. Thus, counterclockwise stable center.

9. Plot



a.
b. Stable, Center, Motion: CW
c. $\lambda 1 = -i$; $\lambda 2 = i$. Since distinct, opposite, complex with no real parts. Thus, clockwise stable center.

10. Plot



a.
b. Stable, Center, Motion: CCW
c. $\lambda 1 = -i$; $\lambda 2 = i$. Since distinct, opposite, complex with no real parts. Thus, counterclockwise stable center.