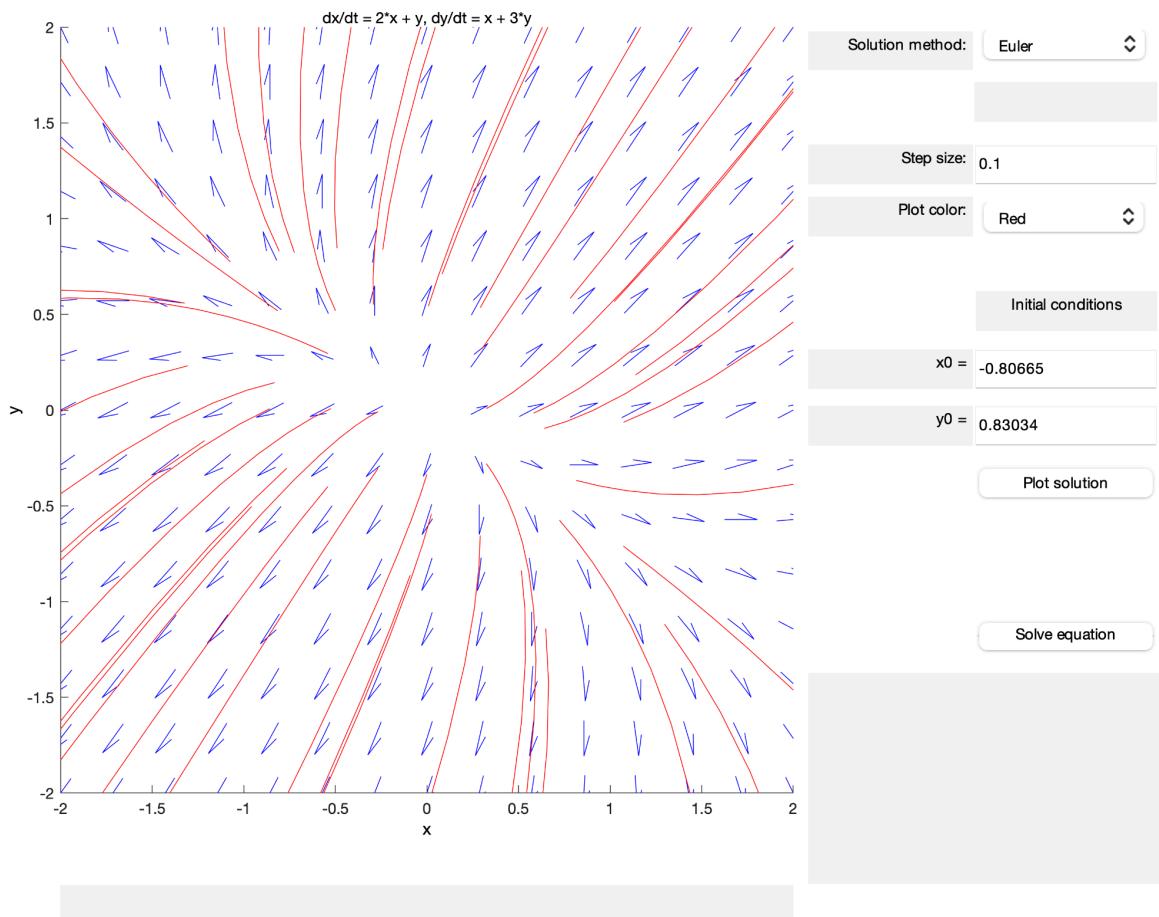


4.1. $\frac{dx}{dt} = [2 \ 1; 1 \ 3] x$



b) Asymptotic Stability: Unstable

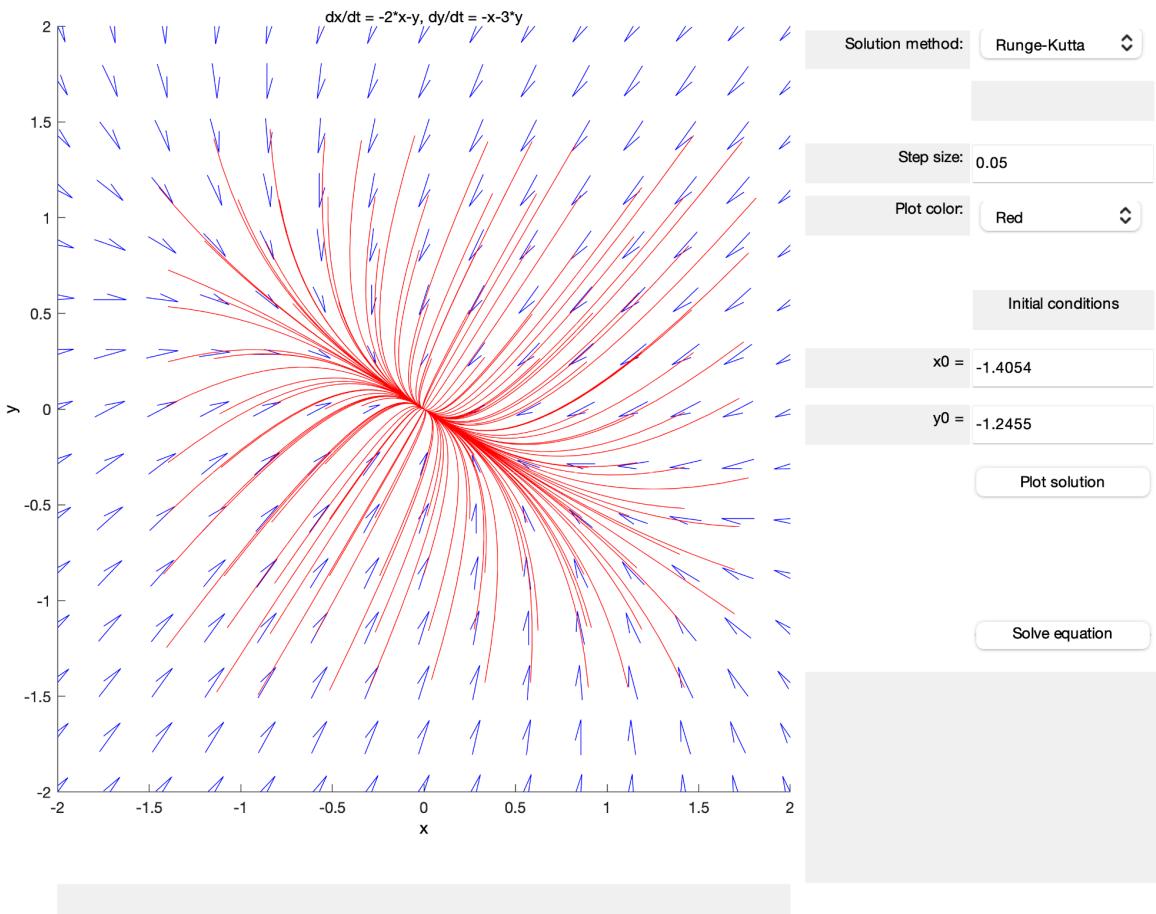
Behaviour: Nodal Source

Direction: N/A

c) Eigenvalues: $0.5(5 + \sqrt{5})$, $0.5(5 - \sqrt{5})$

Justification: Real, distinct, positive eigenvalues; unstable nodal source.

4.2. $\frac{dx}{dt} = [-2 -1; -1 -3] x$



b) Asymptotic Stability: Asymptotically stable

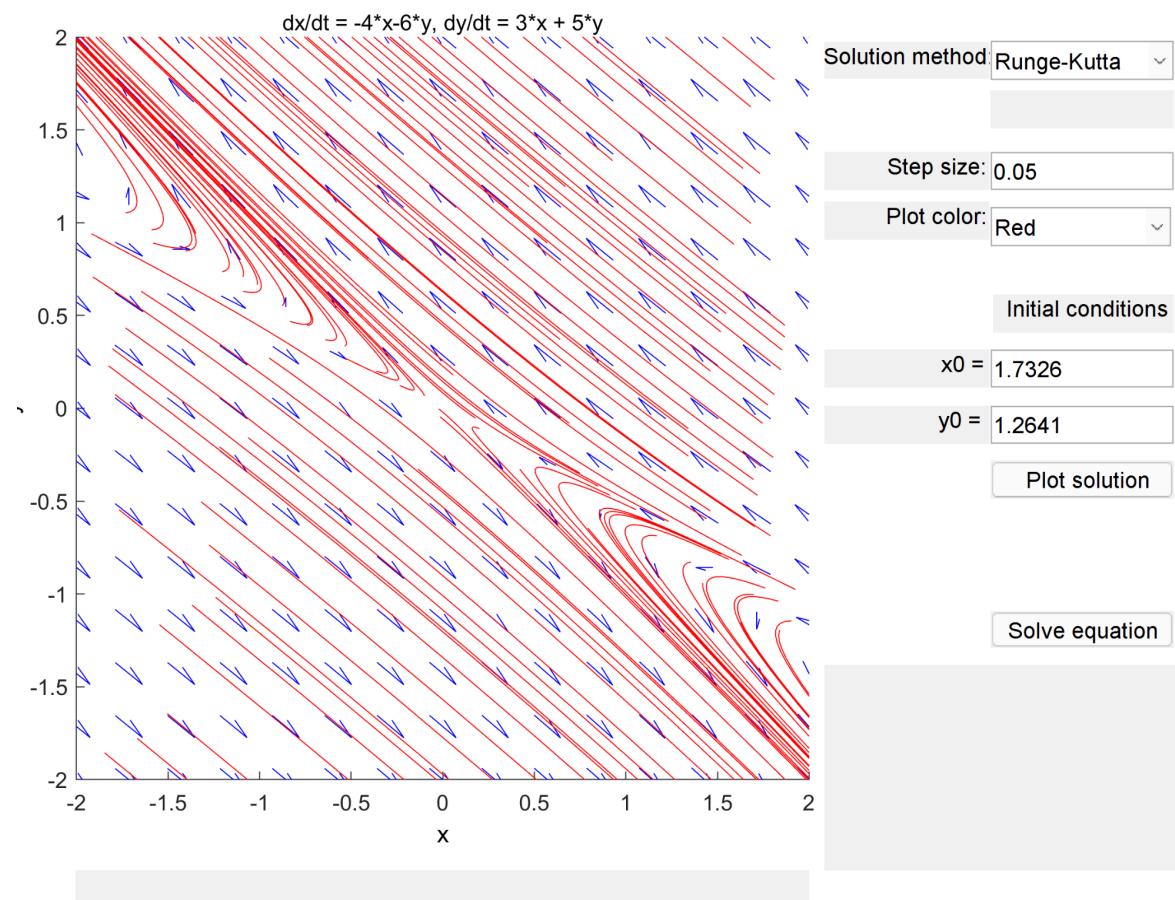
Behaviour: Nodal Sink

Direction: N/A

c) Eigenvalues: $0.5(-5 - \sqrt{5})$, $0.5(-5 + \sqrt{5})$

Justification: Real, distinct, negative eigenvalues; stable nodal sink.

4.3. $\frac{dx}{dt} = [-4 \ -6; 3 \ 5] x$



b) Asymptotic Stability: Unstable

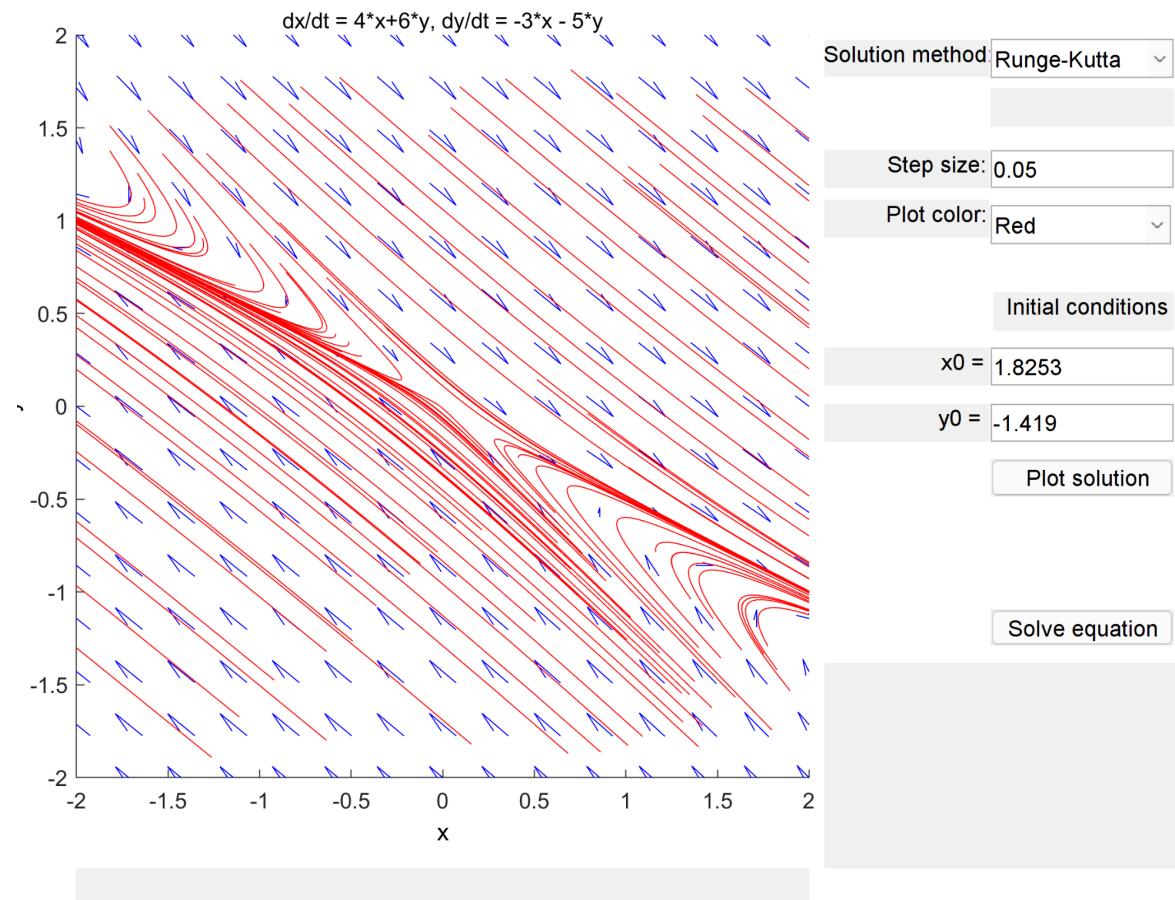
Behaviour: Saddle Point

Direction: N/A

c) Eigenvalues: 2, -1

Justification: Real, distinct, opposite-sign eigenvalues; unstable saddle point.

4.4. $\frac{dx}{dt} = [4 \ 6; -3 \ -5] x$



b) Asymptotic Stability: Unstable

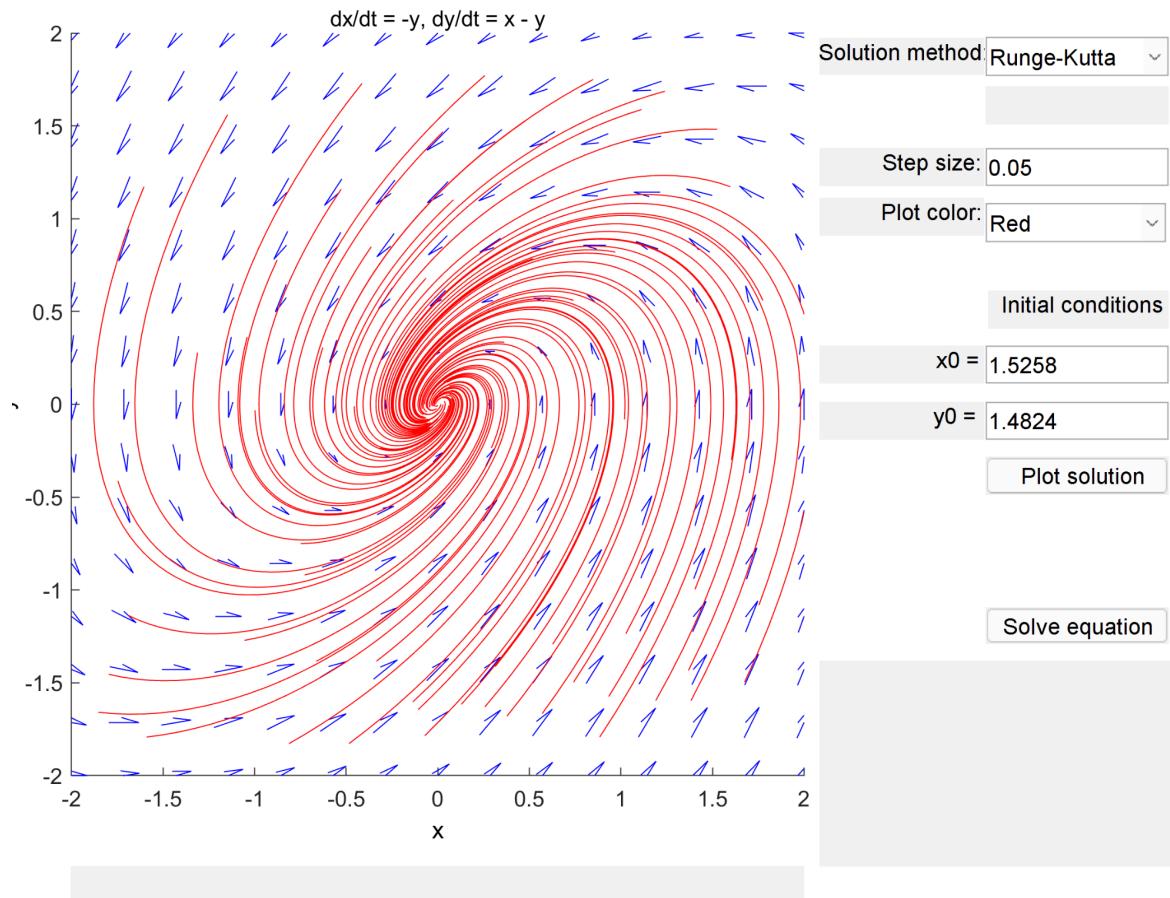
Behaviour: Saddle Point

Direction: N/A

c) Eigenvalues: -2, 1

Justification: Real, distinct, opposite-sign eigenvalues; unstable saddle point.

4.5. $\frac{dx}{dt} = [0 \ -1; 1 \ -1] x$



b) Asymptotic Stability: Asymptotically stable

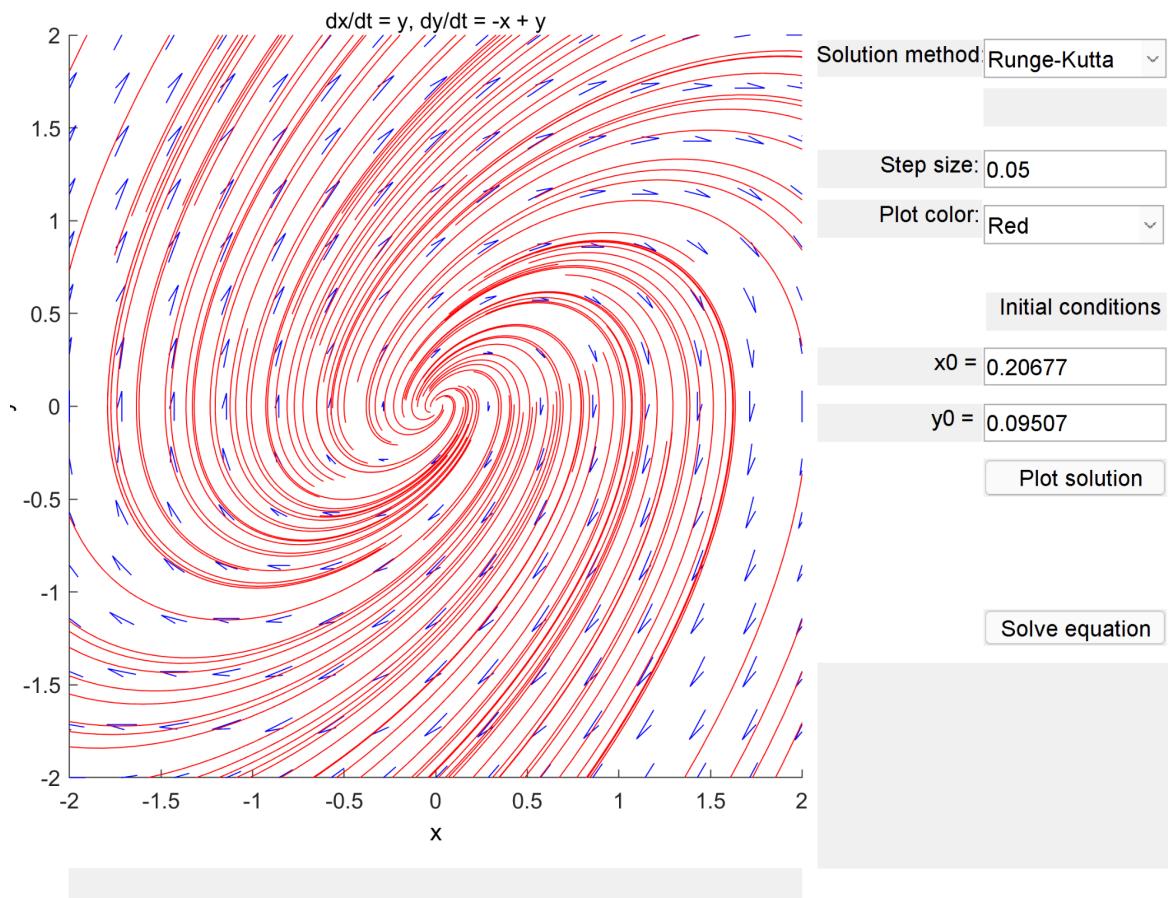
Behaviour: Spiral Sink

Direction: Counterclockwise

c) Eigenvalues: $0.5(-1 + i\sqrt{3})$, $0.5(-1 - i\sqrt{3})$

Justification: Complex with negative real parts; stable counterclockwise spiral sink.

4.6. $\frac{dx}{dt} = [0 \ 1; -1 \ 1] x$



b) Asymptotic Stability: Unstable

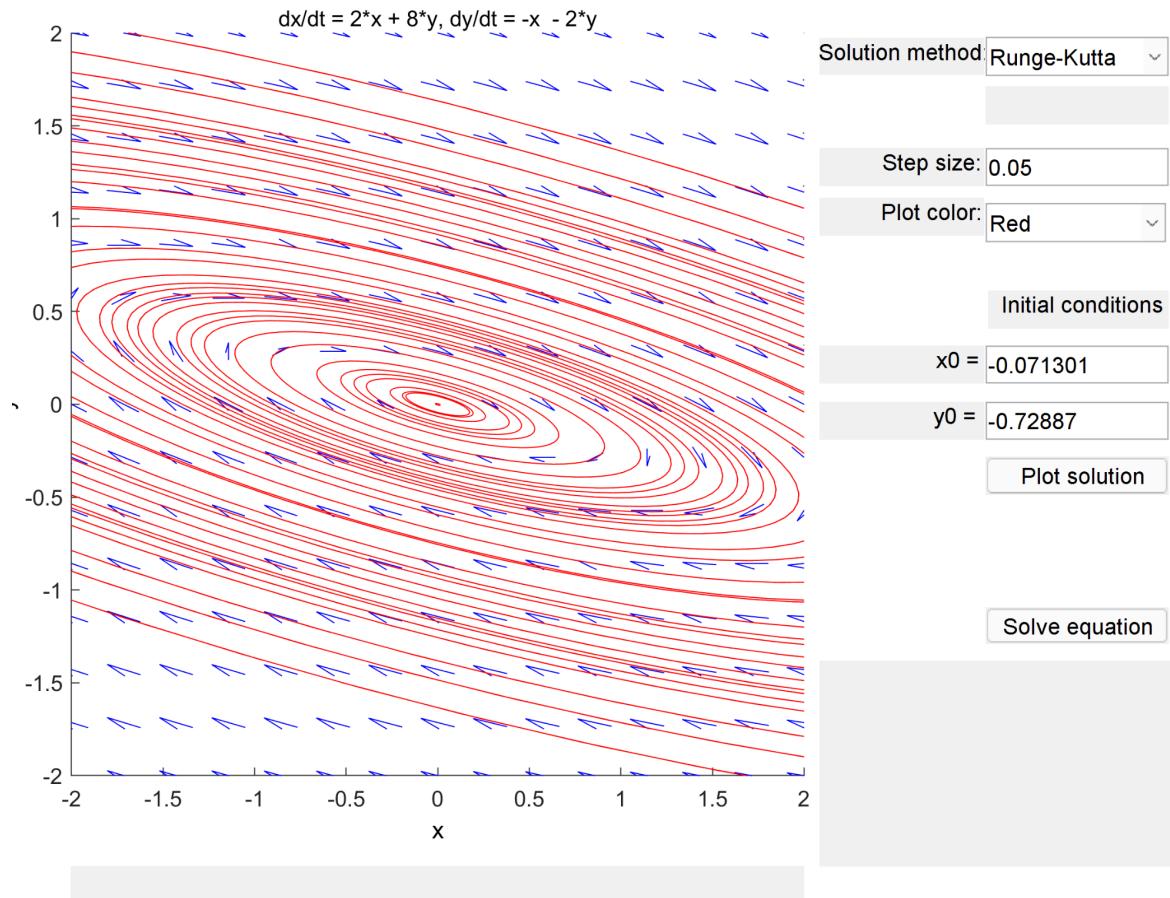
Behaviour: Spiral Source

Direction: Clockwise

c) Eigenvalues: $0.5 + i\sqrt{3}/2, 0.5 - i\sqrt{3}/2$

Justification: Complex with positive real parts; unstable clockwise spiral source.

4.7. $\frac{dx}{dt} = [2 \ 8; -1 \ -2] x$



b) Asymptotic Stability: Stable

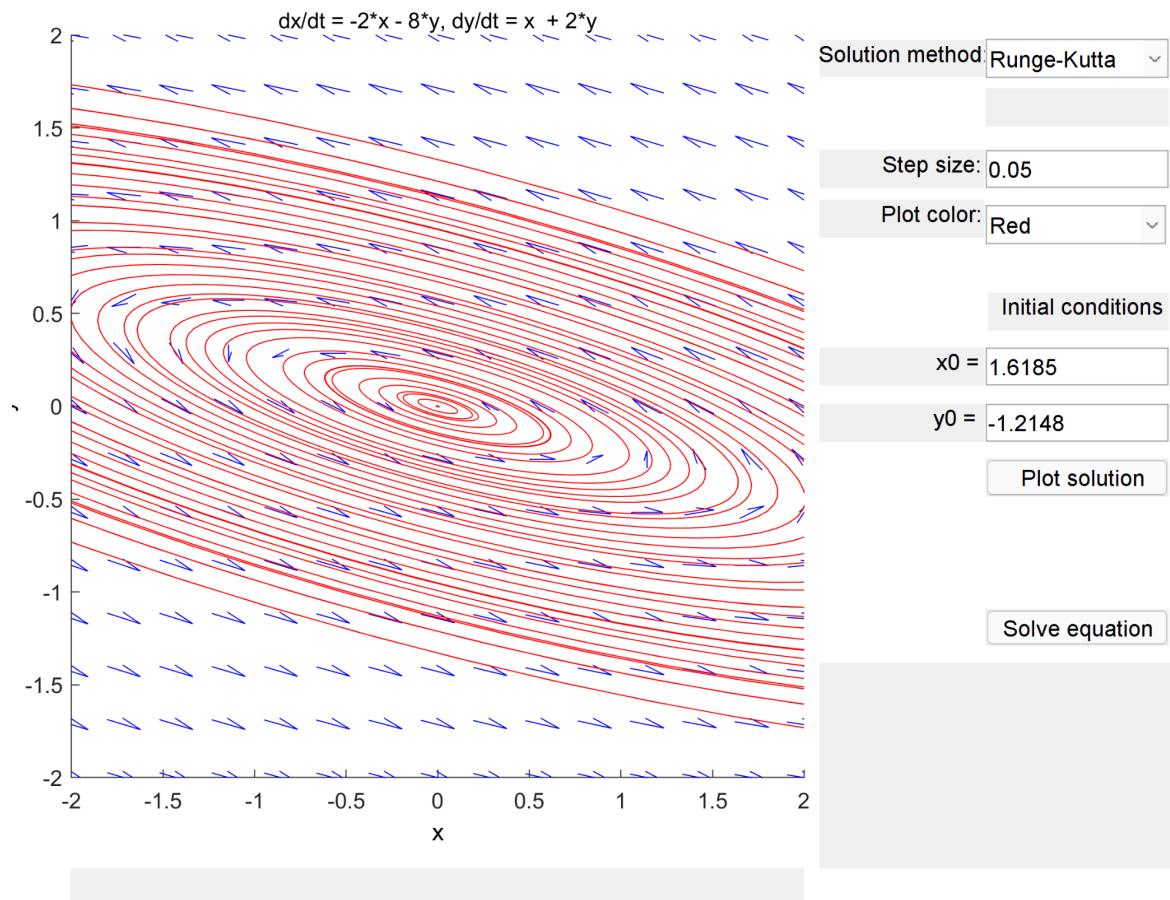
Behaviour: Center

Direction: Clockwise

c) Eigenvalues: $2i, -2i$

Justification: Purely imaginary; stable center with clockwise motion.

4.8. $\frac{dx}{dt} = [-2 -8; 1 2] x$



b) Asymptotic Stability: Stable

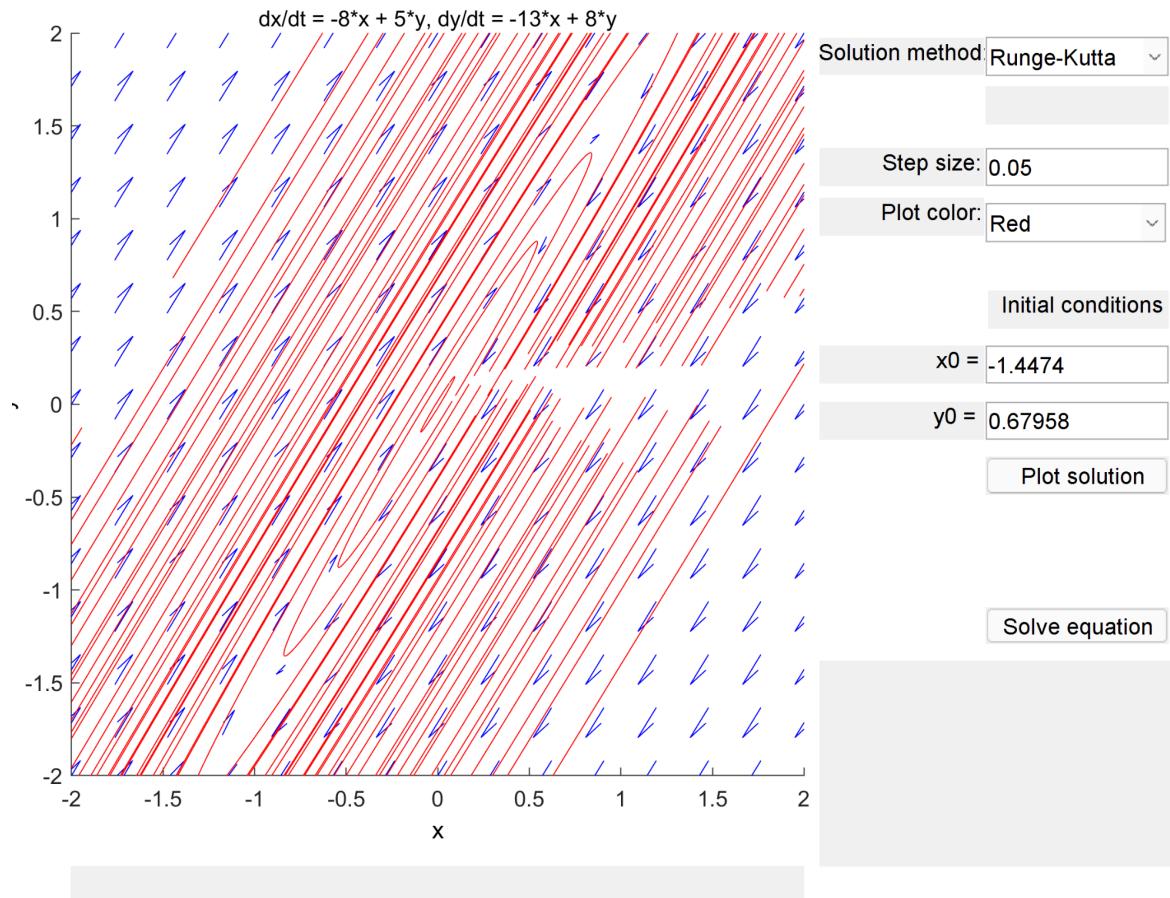
Behaviour: Center

Direction: Counterclockwise

c) Eigenvalues: $2i, -2i$

Justification: Purely imaginary; stable center with counterclockwise motion.

4.9. $\frac{dx}{dt} = [-8 \ 5; -13 \ 8] x$



b) Asymptotic Stability: Stable

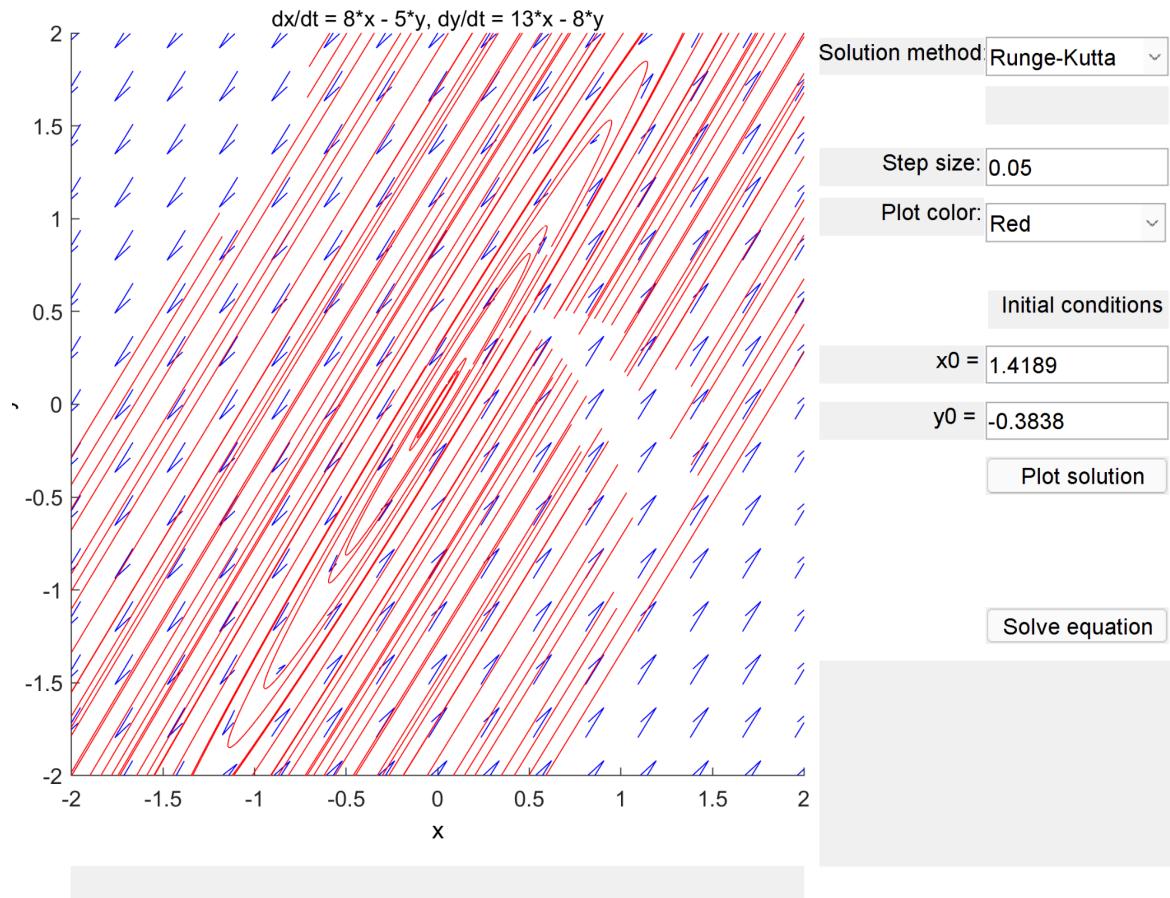
Behaviour: Center

Direction: Clockwise

c) Eigenvalues: i, -i

Justification: Purely imaginary; stable center with clockwise motion.

4.10. $\frac{dx}{dt} = [8 \ -5; 13 \ -8] x$



b) Asymptotic Stability: Stable

Behaviour: Center

Direction: Counterclockwise

c) Eigenvalues: i, -i

Justification: Purely imaginary; stable center with counterclockwise motion.