**4.1 dx/dt = [2 1; 1 3] x**

Chart

Description automatically generated

Equilibrium: Unstable, nodal source.

Eigenvalues: , . We have two real, distinct, positive eigenvalues. Since , the solutions are unstable and diverge to infinity – this is of type nodal source.

**4.2 dx/dt = [-2 -1; -1 -3] x**

Graphical user interface, chart

Description automatically generated

Equilibrium: Stable, nodal sink

Eigenvalues: , . We have two real, distinct, negative eigenvalues. Since , the solutions are stable and a nodal sink – all solutions converge to (0,0).

**4.3 dx/dt = [-4 -6; 3 5] x**

Equilibrium classification: Saddle point, unstable

Eigenvalues: , - We have two real, distinct eigenvalues. Since and , the solutions are unstable since the term approaches infinity. However, solutions starting on the line where the constant for the eigenvector of the negative eigenvalue is 0 converges to zero. This is due to the term present (from the negative eigenvalue). The solution is a saddle point because the two eigenvalues have different signs.Graphical user interface

Description automatically generated with medium confidence

**4.4 dx/dt = [4 6; -3 -5] x**

Graphical user interface

Description automatically generated

Equilibrium: Saddle point, unstable

Eigenvalues: 1, -2. We have two real, distinct eigenvalues. Since we have the term from the positive eigenvalue, the solution is unstable. The eigenvalues have opposing signs, therefore the solutions are a saddle point.

**4.5 dx/dt = [0 -1; 1 -1] x**

Equilibrium: spiral sink, stable, counter-clockwise

Eigenvalues: , . Complex eigenvalues with negative real part mean that the solution is stable (converges to (0,0)).

A picture containing graphical user interface

Description automatically generated

**4.6 dx/dt = [0 1; -1 1] x**

Chart, radar chart

Description automatically generated

Equilibrium: spiral source, unstable, clockwise

Eigenvalues: , . Complex eigenvalues with positive real part mean that the solution is unstable.

**4.7 dx/dt = [2 8; -1 -2] x**

A picture containing graphical user interface

Description automatically generated

Equilibrium: centre, stable, clockwise

Eigenvalues: . The real part of the eigenvalues is zero therefore the solutions are stable and circle in ellipses around (0,0).

**4.8 dx/dt = [-2 -8; 1 2] x**

Equilibrium: centre, stable, counter-clockwise

Eigenvalues: . The real part of the eigenvalues is zero therefore the solutions are stable and circle in ellipses around (0,0).

Graphical user interface, application

Description automatically generated

**4.9 dx/dt = [-8 5; -13 8] x**

A picture containing chart

Description automatically generated

Equilibrium: centre, stable, clockwise

Eigenvalues: . The real part of the eigenvalues is zero. Therefore, the solutions do not diverge to infinity or converge to (0,0).

**4.10 dx/dt = [8 -5; 13 -8] x**

Equilibrium: centre, stable, counter-clockwise.

Eigenvalues: . The real part of the eigenvalues is zero. Therefore, the solutions do not diverge to infinity or converge to (0,0).

A picture containing scatter chart

Description automatically generated