

The phase portrait gallery

Lesson 57 · Module 4 — Systems of ODEs · Differential Equations · dailymaths.uk/diffeq

Practice problems

1. Classify the equilibrium point of a system with eigenvalues $\lambda = -3 \pm 4i$. Is it stable or unstable?
2. A system has eigenvalues $\lambda_1 = 5$ and $\lambda_2 = -2$. What is the type of equilibrium point at the origin?
3. A system has eigenvalues $\lambda_1 = -2$ and $\lambda_2 = -5$. Classify the equilibrium point.

Solutions

1. Classify the equilibrium point of a system with eigenvalues $\lambda = -3 \pm 4i$. Is it stable or unstable?

- The eigenvalues are complex, which indicates rotation.
- The real part is -3 , which is negative.
- A negative real part with complex eigenvalues corresponds to a stable spiral.

Answer: Stable Spiral

2. A system has eigenvalues $\lambda_1 = 5$ and $\lambda_2 = -2$. What is the type of equilibrium point at the origin?

- The eigenvalues are real.
- The eigenvalues have opposite signs (one positive, one negative).
- This configuration defines a saddle point.

Answer: Saddle Point

3. A system has eigenvalues $\lambda_1 = -2$ and $\lambda_2 = -5$. Classify the equilibrium point.

- The eigenvalues are real.
- Both eigenvalues are negative.
- This configuration defines a stable node.

Answer: Stable Node