Fourier-mode error analysis of a transport discretization — review sheet

Use this after attempting the worked examples and practice. Explain each claim in words before calculating.

Key ideas

- Match equation, boundaries, initial state and state representation in a benchmark.
- Observed order is measured from a controlled error sequence.
- Use a fixed spatial model to isolate time error.
- A zero-sum unstable mode can pass global conservation.

Common errors and repairs

Calling any two closer curves a convergence study. Specify the reference, error norm, controlled refinement and endpoint.

Treating formal order as a universal measured result. Measure observed order for the actual scheme, boundaries and tested solution.

Retrieve without your notes

- If halving h divides error by eight, what order is observed?
- What is the checkerboard factor at μ=0.5?

Readiness check

- Construct an exact periodic transport benchmark with compatible initial and boundary data.
- Measure observed error order from a controlled refinement table.
- Separate time error from space error rather than changing both without a reference.
- Identify an unstable diffusion setting and explain why conservation cannot rescue it.