

QUIZ #2

9:30am, November 28 (Friday), 20 minutes, 10 points max
(no books, no notes)

Write your name and Email address on the top of this sheet
Write your answers on the reverse side and/or attach additional sheets as
necessary.

1. You are given the following partial differential equation

$$\begin{aligned} \partial_t u + u \partial_x u - \nu \partial_x^2 u &= f && \text{in } [-\pi, \pi] \times [0, T] \\ u &= u_0 && \text{in } [-\pi, \pi] \text{ at } t = 0 \end{aligned}$$

with periodic boundary conditions and where $f : [-\pi, \pi] \times [0, T] \rightarrow \mathbb{R}$. Suppose we solve this problem numerically using a *spectral method*.

- (a) State the key operations which need to be performed at every time step in order to advance the solution to a new time level ensuring that it is free from aliasing errors.
(4 points)
- (b) Assuming that the spatial domain $[-\pi, \pi]$ is discretized with N points, how will the computational cost of a single time step depend on N ?
(2 points)
- (c) Discuss the choice of the time-integration schemes (first-order accurate, for simplicity) for the linear and nonlinear terms.
(4 points)