

QUIZ #1

12:30PM, October 27 (Thursday), 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

1. Show the relationship between the order of a finite-difference approximation of a derivative $f'(x)$ and the structure of the corresponding differentiation matrix.
($3\frac{1}{3}$ points)
2. You are given a (stable) system of ODEs $\frac{d}{dt}X = AX$ in \mathbb{R}^N . Without performing actual calculations, state the steps required in order to determine the maximum time step Δt allowed when using an explicit Euler method to solve this problem.
($3\frac{1}{3}$ points)
3. You are given a partial differential equation in the form $\mathcal{L}u = f$, where u is the solution and \mathcal{L} is a second-order differential operator. Show how
 - *the spectral Galerkin method*, and
 - *the spectral collocation method*

can be derived as special cases of the Weighted Residual Method for the solution of the above problem.

($3\frac{1}{3}$ points)