Numerical Methods for the Solution of Differential Equations (AM 213B)

Homework 2 - Grading rubric

Question 1 (30 points):

(a) (10 points) for determining the correct value of Δt^*

(b) (10 points) for plotting the correct region of absolute stability of AB3

(c) (10 points)

- 5 points for implementing AM3 correctly
- 5 points for the plots of the numerical solution for the various values of Δt (3 different figures total: for $\Delta t = 10^{-4}$, $\Delta t = \Delta t^* + 0.0001$, and $\Delta t = \Delta t^* - 0.0001$).

Question 2 (20 points):

(a) (10 points)

- 5 points for showing consistency with order 3
- 5 points for showing zero stability and stating the convergence theorem (consistency + zero stability $\Rightarrow$ convergence)

(b) (10 points)

- 5 points for plotting the absolute stability region
- 5 points for showing that BDF3 is not A-stable.

Question 3 (30 points):

(a) (10 points)

- 5 points for showing that the scheme is consistent
- 5 points for the correct order of consistency.

(b) (10 points) for showing that the scheme is not zero-stable. Thus, its is not convergent due to the convergence theorem (consistency + zero stability $\Rightarrow$ convergence)

(c) (10 points) for showing that the scheme is unconditionally absolutely stable via theoretical, numerical, or combined theoretical/numerical arguments.

Question 4 (20 points):

(a) (10 points)

- 3 points for writing down the RK scheme
- 3 points for showing consistency
- 4 points for showing zero-stability and convergence.

(b) (10 points) for plotting the region of absolute stability and stating that the given RK3 method is conditionally absolutely stable, i.e., not A-stable.