MATH 131: Numerical Methods for scientists and engineers – Discussion 9: Coding

The goals of this discussion section are:

- Stability of numerical methods and stiff equations. Use the codes you developed for Assignment 5.

Consider the IVP

$$\frac{dy}{dt} = -12y, \quad 0 \leq t \leq 1, \quad y(0) = 1. \tag{1}$$

1. Give the exact solution of (1).
2. Apply `AB4` and `AM4` (functions that you implemented in your Assignment 5) to approximate (1) for $N = 5, 10, 20, 50$. Compare the solution at $t = 1$ with the exact solution at $t = 1$. Comment on the result (is the method converging or not, etc.)
3. Is the IVP (1) stiff ? Explain your answer.
4. Download the function `test_time_step.m` on Catcourses. This function indicates if there is a time-step restriction or not, for the two methods above. Use that function while considering $N = 5, 10, 20, 50$. If there is a restriction what is the minimum number of time-steps N to choose to ensure stability of the method ?