Numerical Analysis II
Homework 8

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1. Solve the two-point boundary-value problem

$$\begin{cases} x'' + 2x' + 10t = 0, \\ x(0) = 1, \quad x(1) = 2, \end{cases}$$

   for $x\left(\frac{1}{2}\right)$ using the finite-difference method with $h = \frac{1}{2}$.

2. Consider the multistep method

$$x_n + \alpha x_{n-1} - (1 + \alpha) x_{n-2} = \frac{1}{2} h \left[-\alpha f_n + (4 + 3\alpha) f_{n-1} \right].$$

   Determine α so that the method is stable, consistent, convergent, A-stable, and of second order. (see sections 8.4 and 8.5, p. 549 and p. 557, respectively.)

3. Find the region of absolute stability of the implicit trapezoid rule:

$$x_n - x_{n-1} = \frac{1}{2} h \left[f_n + f_{n-1} \right]. \tag{1}$$