Numerical Analysis

MAT 542 – FALL 2010

Homework # 7 Due October 27

1. Turn the differential equation below into a system of first-order equations suitable for applying the Runge-Kutta method:

$$\begin{cases} x''' = 2x' + \log(x'') + \cos(x) \\ \\ x(0) = 1 \quad x'(0) = -3 \quad x''(0) = 5 \end{cases}$$

2a). Assuming that a program is available for solving initial-value problems of the form

$$\begin{cases} \mathbf{X}' = \mathbf{F}(t, \mathbf{X}) \\ \mathbf{X}(a) = \mathbf{S}, \quad \text{given} \end{cases},$$

how can it be used to solve the following differential equation?

$$\begin{cases} x''' = t + x + 2x' + 3x'' \\ \\ x(1) = 3 \quad x'(1) = -7 \quad x''(1) = 4 \end{cases}$$

(b). How would this problem be solved if the initial conditions were $x(1) = 3,\ x'(1) = -7,$ and $x''(1) = 0$?

3. Consider

$$\begin{cases} x'' = x' - x \\ \\ x(0) = 0 \quad x'(0) = 1 \end{cases}$$

Determine the associated first-order system and its auxiliary initial conditions.

4. **(G)** Turn this pair of differential equations into a second order differential equation involving x alone:

$$\begin{cases} x' = -x + axy \\ \\ y' = 3y - xy \end{cases}$$