25 points   1. Apply the Linear Shooting method to solve

$$y'' = 4(y - x), \quad x \in (0, 1),$$
$$y(0) = 0, \quad y(1) = 2$$

and write down the detailed algorithm using the 4th order Runge-Kutta method.

25 points   2. Apply the Nonlinear Shooting method to solve

$$y'' = -(y')^2 - y + \ln x, \quad x \in (1, 2),$$
$$y(1) = 0, \quad y(2) = \ln 2$$

and write down the detailed algorithm using the 4th order Runge-Kutta method.

25 points   3. Apply the Linear Finite-Difference method to solve

$$y'' = 4(y - x), \quad x \in (0, 1),$$
$$y(0) = 0, \quad y(1) = 2$$

and write down the detailed algorithm.

25 points   4. Apply the Nonlinear Finite-Difference method to solve

$$y'' = -(y')^2 - y + \ln x, \quad x \in (1, 2),$$
$$y(1) = 0, \quad y(2) = \ln 2$$

and write down the detailed algorithm using the Newton method.