

NMA – homework from week 7

1. Consider boundary value problem

$$-y''(x) + (x + 1)y(x) = -3x, \quad y(0) = -1, \quad y(0.5) = 2.$$

- a) Verify the existence and uniqueness of the solution.
- b) Write the linear system of equations (in matrix form) obtained by the discretization of the problem using finite difference method with step-size  $h = 0.1$ .
- c) Would Gauss-Seidel method converge for this system? (Give reasons for your answer.)

2. Consider boundary value problem

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

- a) Verify the existence and uniqueness of the solution.
- b) Write the first two equations of the linear system obtained by the discretization of the problem using finite difference method with step-size  $h = 0.2$ .

(hint: use the formula

$$-p_{i-\frac{1}{2}} y_{i-1} + (p_{i-\frac{1}{2}} + h^2 q_i + p_{i+\frac{1}{2}}) y_i - p_{i+\frac{1}{2}} y_{i+1} = h^2 f_i \quad )$$