

# HW #6

## Exercise 3.1.2:

For the problem

$$\begin{cases} -4u''(x) + u(x) = x, & 0 < x < 1, \\ u(0) = 3, & u(1) = 0. \end{cases}$$

(1). Set up the system

$$\sum_{i=1}^{n-1} a(\varphi_i, \varphi_j) c_i = (f, \varphi_j) - 3a(\varphi_0, \varphi_j), \quad j=1, 2, \dots, n-1,$$

where the basis functions  $\varphi_j(x)$ ,  $j=0, 1, 2, \dots, n-1$ , are given in Eq. (3.1.4) and (3.1.15). That is, set up  $A\vec{c} = \vec{b}$  and calculate the elements in  $A$  and  $\vec{b}$ .

(2) Let  $x_i = ih$ ,  $i=0, 1, 2, \dots, n$ , and  $h = \frac{1}{n}$ . Use the Thomas algorithm to solve  $\{c_i\}_{i=1}^{n-1}$  where  $n=200$ .

(3) Plot the numerical solution  $\{u_i\}_{i=0}^n$  and the exact solution  $\{u_i^*\}_{i=0}^n$  versus  $\{x_i\}_{i=0}^n$ .