FVM: Practical Assignment 2

Deadline: 09/04/2017
We discretize the Laplace equation with Robin boundary condition by finite volume method:

$$\begin{cases} -u_{xx}(x) & = f(x) \text{ in } \Omega \\ u'(0) - \lambda_0 u(0) & = u'(1) + \lambda_1 u(1) = 0 \end{cases} \tag{1}$$

1. Solve equation (1) with regular grid and the control point be midpoint of control volume($(x_i = 1/2x_{i-1/2} + 1/2x_{i+1/2})$
2. Solve equation (1) with regular grid and the control point be 1/3 from the left of each control volume ($x_i = 2/3x_{i-1/2} + 1/3x_{i+1/2}$).
3. Solve equation (1) with singular grid (not uniform grid).
4. Find the some approximations to error between the exact and discrete solutions in discrete H_0^1 norm be 2 order for the equations such that Laplace equation with Dirichlet, Neumann, Robin boundary conditions.