

Use the Rayleigh-Ritz method to approximate the solution to the following BVP

$$\begin{aligned} -(xy')' + 4y &= 4x^2 - 8x + 1, \quad 0 \leq x \leq 1, \\ y(0) &= y(1) = 0. \end{aligned}$$

Compute the integrals in the linear system by hands. Compare the results to the exact solution $y(x) = x^2 - x$. Use $N = 10, 20, 40, 80$ and plot the error versus h . What's the order of convergence?