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1. Consider a particle-in-a-box with length 5 units and the mass of the particle be 1 unit. Write a Fortran code to construct the hamiltonian matrix and diagonalize it to find out the eigenvalues and eigenvectors. Compare the numerical eigenvalues to exact eigenvalues by making a plot of the eigenvalues versus the number of points. Take the number of points to be 100. Remember that using finite differences, we derived the following: $\hat{H}_{ij} = (V_i + 2t)\delta_{i,j} - t\delta_{i,j-1} - t\delta_{i,j+1}$, where $\delta_{i,j}$ is the Kronecker delta. $t = \hbar^2/2mdx^2$.
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2. Write a program for bisection method to solve the equation $x^2 + x - 2 = 0$ using two sets of data points, (0.0,2.0) and (0.5,2.0). The code will print the final root, the functional value at the final root and the number of iterations.
 3. Find the root using the false position method with two sets of starting points, (1.5,2.0) and (-3.0,0.0) The code will print the final root, the functional value at the final root and the number of iterations.