This code provides a numerical solution to the **time-independent Schrödinger equation** for a one-dimensional potential well. The Schrödinger equation is fundamental in quantum mechanics, describing how quantum systems behave under a given potential.

We use the **determinant** function to calculate the determinant of a square matrix using a recursive approach. The **poly_char** function calculates the characteristic polynomial of a matrix, modified to find the eigenvalues, which involves shifting the diagonal of the matrix by a variable x, representing the energy eigenvalues.

The **eigenvalues** function implements a bisection method to locate roots of the characteristic polynomial. These roots correspond to the eigenvalues (allowed energy levels in the quantum system).

The **schroedinger_solver** function builds the Hamiltonian matrix, which combines the kinetic energy and potential energy matrices: The kinetic energy matrix is derived using finite-difference approximations of the second derivative in the Schrödinger equation. The potential energy matrix is diagonal, with each diagonal element corresponding to the potential energy at a given spatial point.

The Hamiltonian matrix encapsulates the system's total energy, and its eigenvalues represent the allowed energy levels of the particle.

The potential is defined as a harmonic oscillator $\left(V(x) = \frac{1}{2}x^2\right)$.

As a summary, the eigenvalues of the Hamiltonian matrix are computed using the custom functions, which find the allowed energy levels for the particle in the potential well.