**ETH**
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# Computational Quantum Physics

## Exercise 2

FS 10
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### Problem 2.1   Bound states in 1-D Schrödinger equation and eigenvalue problem

Find the bound state solutions of the 1D Schrödinger equation with $E < 0$ using the Numerov algorithm and a root solver. Note that the solution exists only for discrete energy eigenvalues.

Proceed as described in lecture notes in section 3.1.3.

Take the potential zero outside the interval [0,1] and inside the interval it can be taken as

$$v(x) = c(x^2 - x), 0 \leq x \leq 1, \tag{1}$$

where $c$ is a constant. Please check the dependency of the number of bound states on the values of $c$.

Start with finding the ground state energy (which has zero nodes) and proceed further with 1, 2, 3... nodes.

*Hint:* Check the number of zeros (nodes) in the solution. For your guessed energy, if you find more nodes in your solution than the desired number of nodes, decrease the guess-energy and vice versa.