# **Numerov method**

*Study [Numerov method](https://www.dsedu.org/courses/dft/numerov) to solve differential equation with boundary condition numerically.*

*Literature: Salvadori, M.G. Numerical methods in engineering. New York, 1952*

*Hint: In Numerov method, using finite differences you can transform differential equation to matrix equation. Since you have second derivative then the matrix will be tridiagonal. Next task describes the most efficient algorithm to solve tridiagonal matrix equation numerically.*

The Numerov method can be used to solve differential equations of the kind

on the segment  with boundary condition of different kind, for example

The segment  can be divided evenly by *N* points with step .

We can use Taylor expansion for around point

And for around point

Then using sum of Eqs. (3) and (4) we get

here .

To calculate we can use finite differences for second derivative . We get

here and .

Then combine Eqs. (6), (5) and (1) we get the final formula for Numerov method

for , and using boundary condition (2)

The set of equations (7) and (8) is the matrix equation

where matrix  has three nonzero diagonal elements

here

**Idea:**Modify this method to divide the segment unevenly using logarithmic scale in order to reduce total number of points for infinite segment .