Digital Signal Processing
Lab 1

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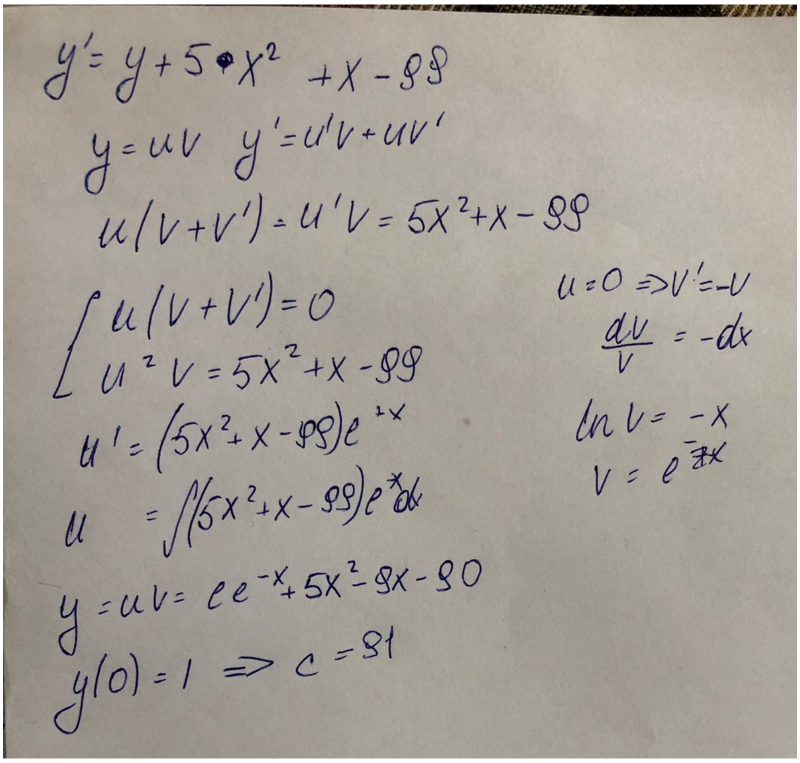
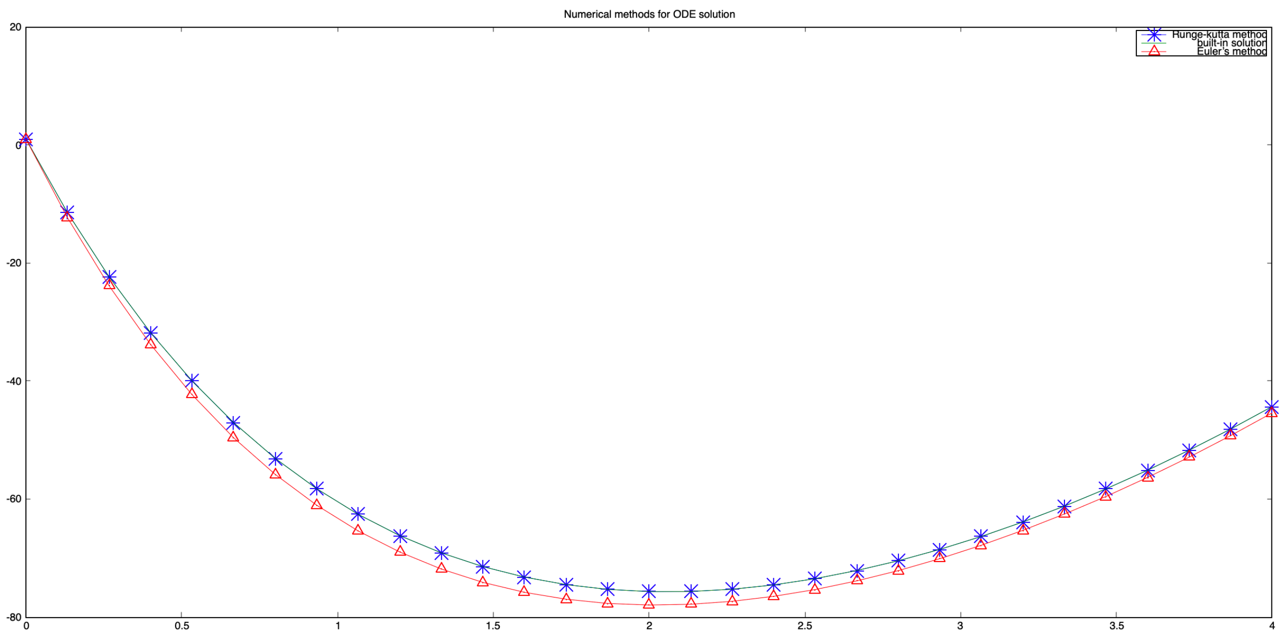
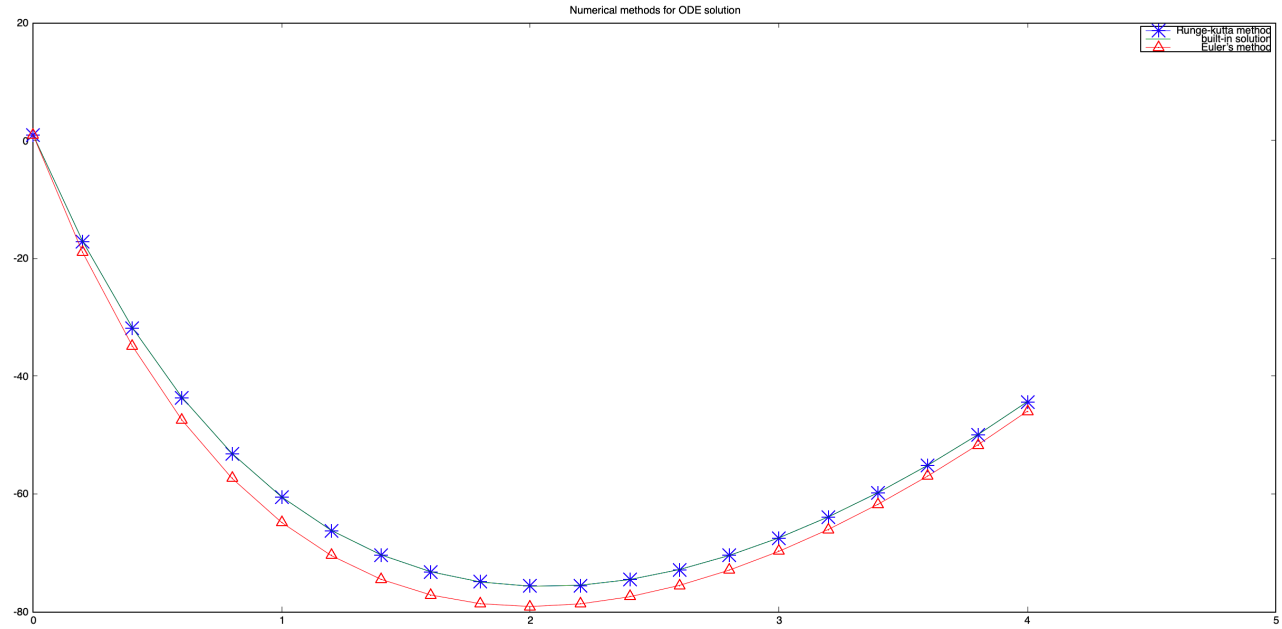
Alternative #2
ODE: y’= -y + a*x2 + b*x + c
In my case: y’= -y + 5*x2 + x - 99
Initial condition: y(0)=1
Interesting interval: [0;4]


$$y' = y + 5x^2 + x - 99$$
$$y = uv \quad y' = u'v + uv'$$
$$u(v+v') = u'v = 5x^2+x-99$$
$$\begin{cases} u(v+v') = 0 \\ u^2 v = 5x^2+x-99 \end{cases}$$
$$u' = (5x^2+x-99)e^{+x}$$
$$u = \int(5x^2+x-99)e^{x}dx$$
$$y = uv = ce^{-x} + 5x^2 - 9x - 90$$
$$y(0) = 1 \Rightarrow c = 91$$
$$u = 0 \Rightarrow v' = -v$$
$$\frac{dv}{v} = -dx$$
$$\ln v = -x$$
$$v = e^{-x}$$

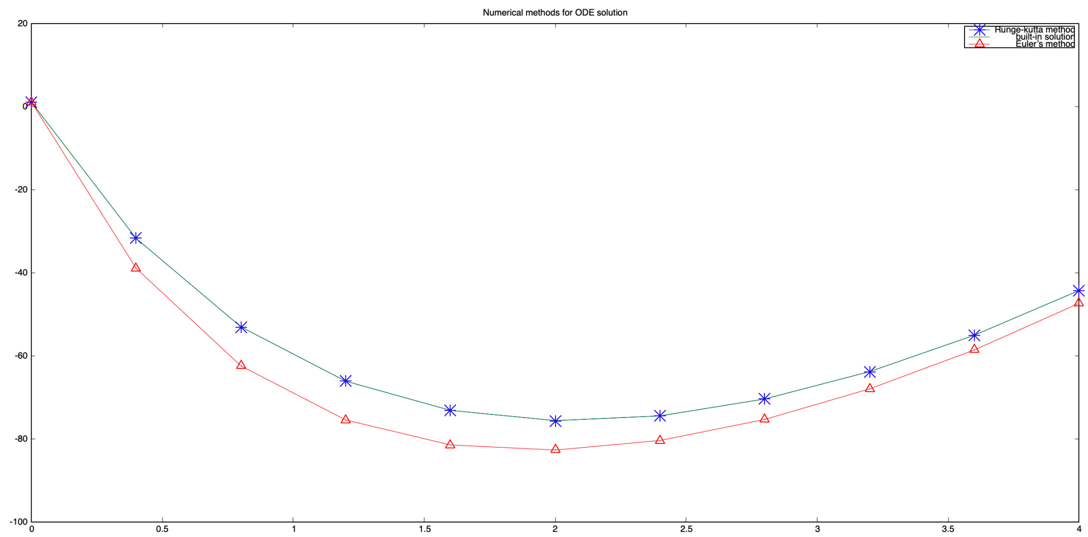
Runge Kutta and Euler’s methods for 30 steps



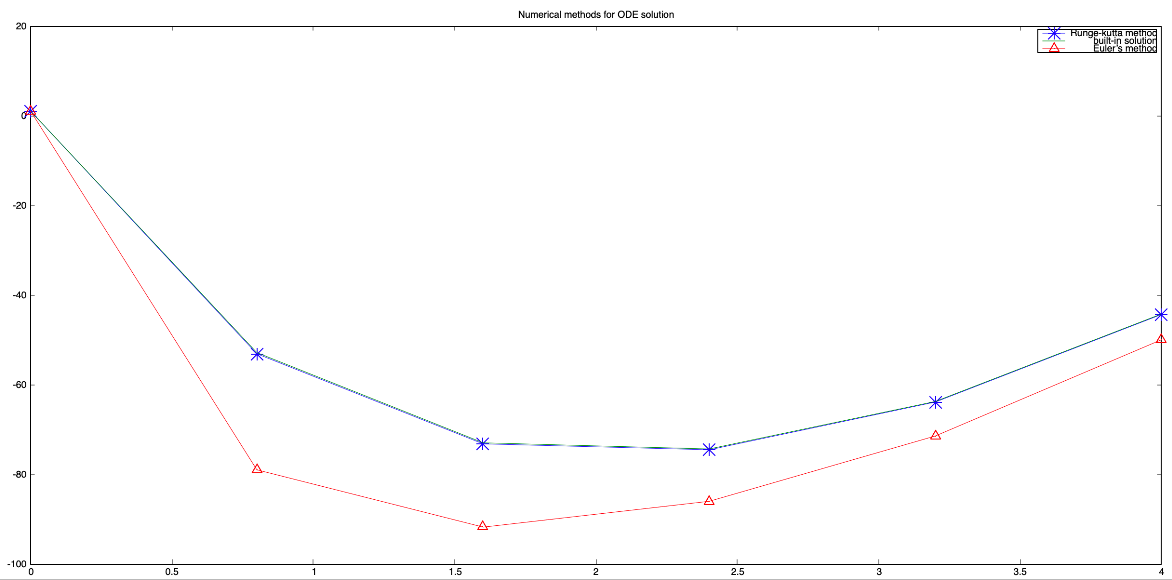
Runge Kutta and Euler’s methods for 20 steps



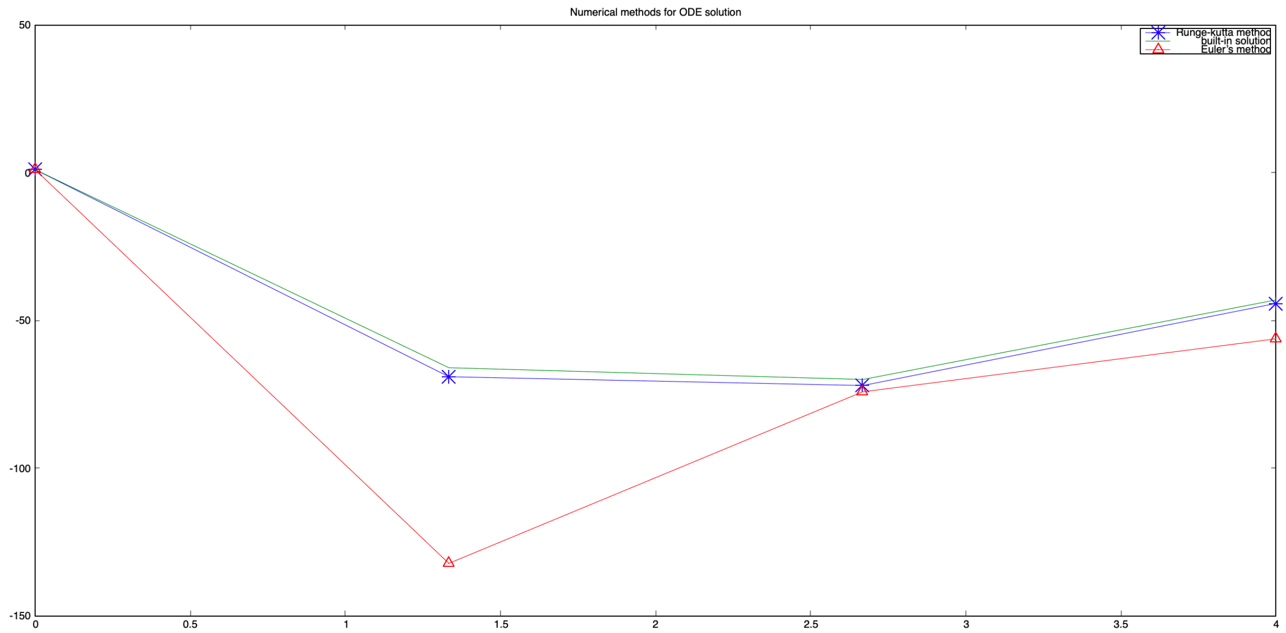
Runge Kutta and Euler’s methods for 10 steps



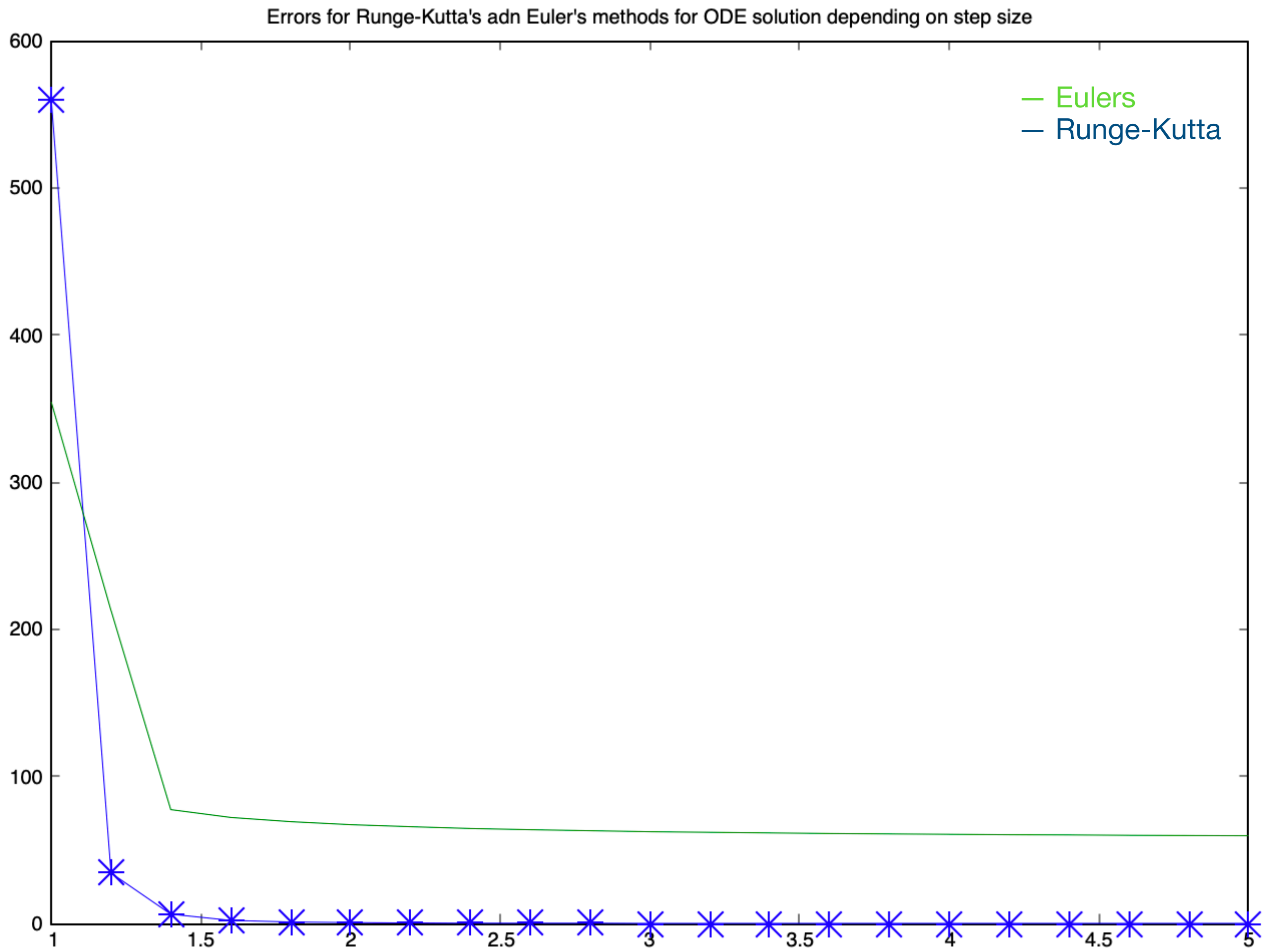
Runge Kutta and Euler’s methods for 5 steps

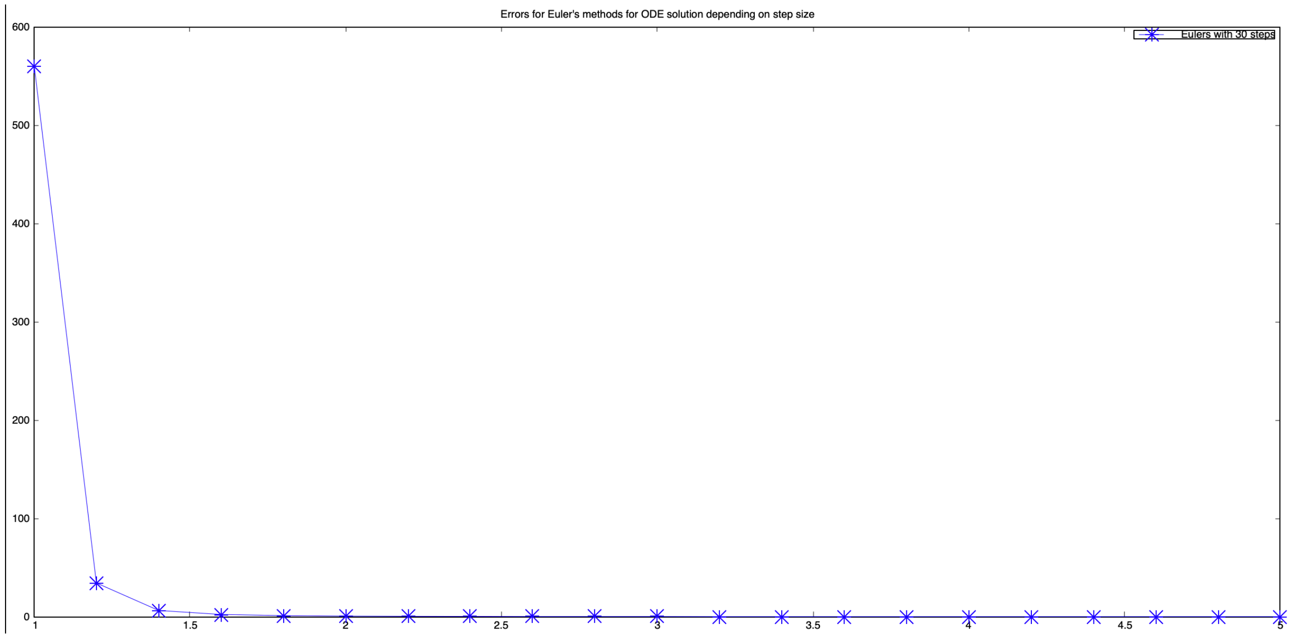


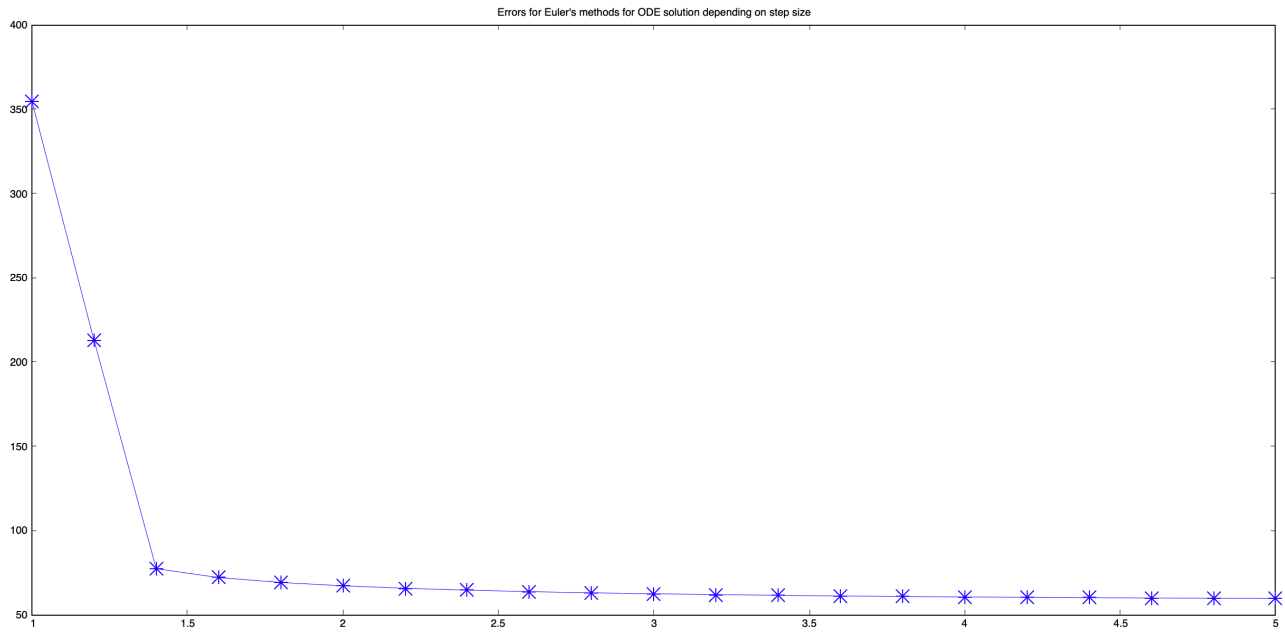
Runge Kutta and Euler’s methods for 3 steps



Graphs for error for Runge-Kutta and Euler’s method depending on a step size




Errors for Euler's methods for ODE solution depending on step size
Eulers with 30 steps
600
500
400
300
200
100
0
1
1.5
2
2.5
3
3.5
4
4.5
5


Errors for Euler's methods for ODE solution depending on step size
400
350
300
250
200
150
100
50
1
1.5
2
2.5
3
3.5
4
4.5
5