Assignment-7

Problem-1: Solve the following differential equation using the Euler's, mid-point and Heun's method separately and compare your results with the exact results using gnuplot.

$$y' = 4e^{0.8x} - 0.5y \tag{1}$$
$$\tag{2}$$

for $x = 0$ to $x = 4$ with the initial condition $y(x = 0) = 2$.

Exact solution is

$$y = \frac{4}{1.3}\left(e^{0.8x} - e^{-0.5x}\right) + 2e^{-0.5x} \tag{3}$$
$$\tag{4}$$

Problem-1: Use the same proceedure to solve the problem for a spring-mass system along the X-axis to obtain the position of the mass as a function of time and plot the x-position in Y-axis and time in the X-axis for different methods and compare them with the exact result.

The equation for the spring-mass system is given by

$$m\frac{d^2x}{dt^2} = -kx \tag{5}$$
$$\tag{6}$$

where symbols have their usual meaning. The initial conditions are $x(t = 0) = x_0$ and $v(t = 0) = 0$. To simplify the calculation let's assume that $k/m = 1$ and $x_0 = 1$.

Exact reuslt for this problem is $x = x_0 cos\left(t\frac{k}{m}\right)$.