Posted on 23.10.2025 @ 2:30 pm and due on 23.10.2025 @ 6:00 pm

1. Use Runge-Kutta-4 method to solve and the following differential equation and compare with analytical form over the range $x \in [0, \pi/5]$. Use step sizes 0.1, 0.25, 0.45.

 $\frac{dy}{dx} = (x+y)^2$ with y(0) = 1 \to $\tan^{-1}(x+y) = x + \frac{\pi}{4}$

2. Use RK4 to solve the damped simple harmonic oscillator using the following initial values and parameters over a time range [0, 40]. Plot variation of x, v and total energy E with time t.

 $\ddot{x} + \mu \dot{x} + \omega^2 x = 0$, with x(0) = 1.0, v(0) = 0.0 and k = 1.0, m = 1.0, $\mu = 0.15$